High AoA Working Group AePW-3 Telecon

January 26, 2021

https://nescacademy.nasa.gov/workshops/AePW3/public

Next AePW-3 Telecon: February 4, 2021 (Thursday)

Next High AoA Working Group Telecon: February 25, 2021 (Thursday)

AePW-3 Organizing Committee Telecon: January 28, 2021 (Thursday)

High AoA Working Group, January 26, 2021

- BSCW Results: Antoine De Blois
- General discussion: common mesh analysis, experimental data, IFASD 2021, SciTech 2022

- Next Meeting: February 25, 2021

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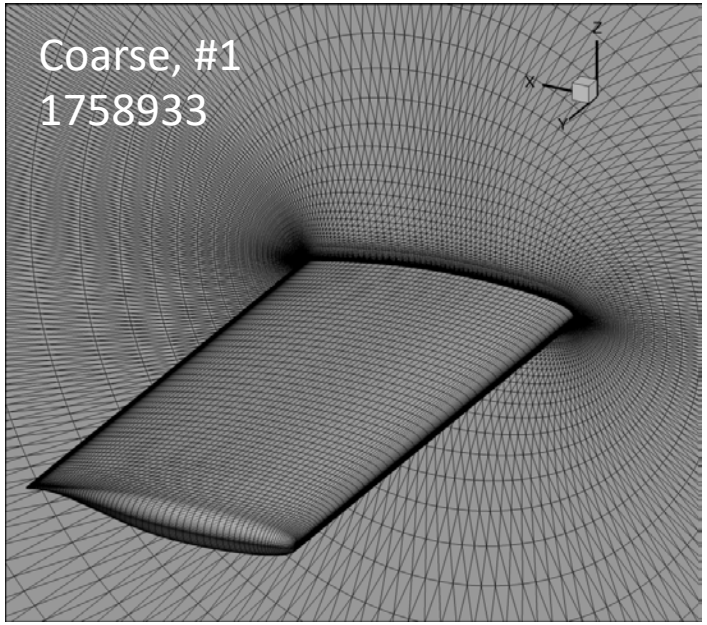
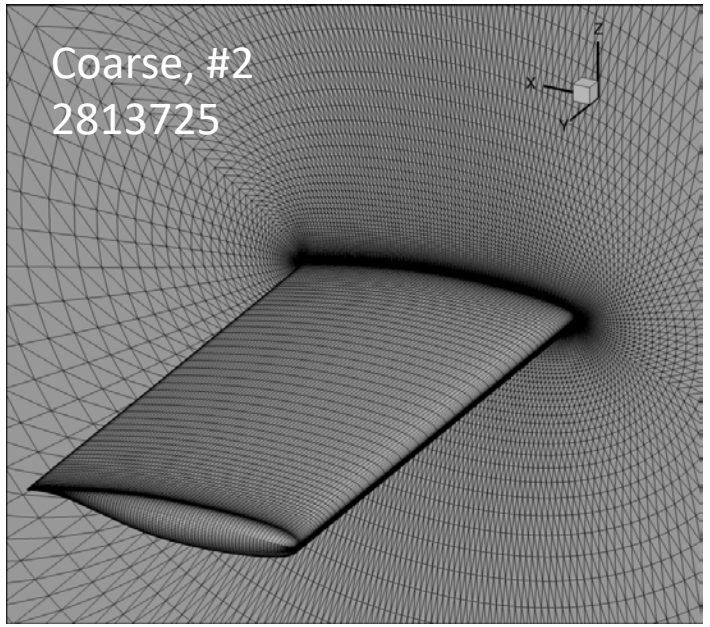
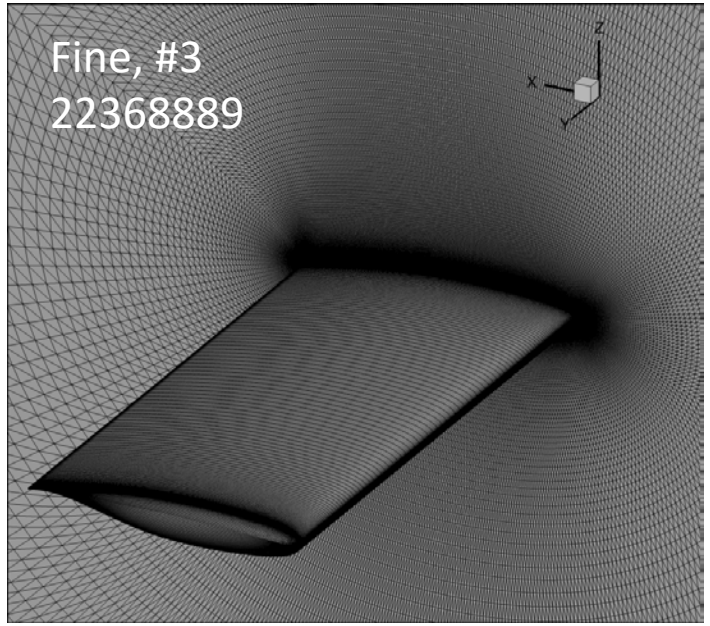
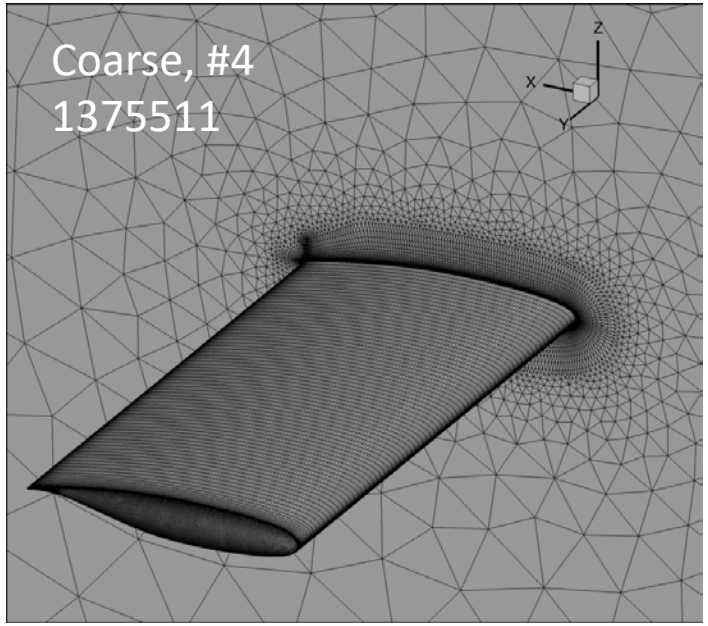
AePW-2 Case2 FUN3D study using 8 grids

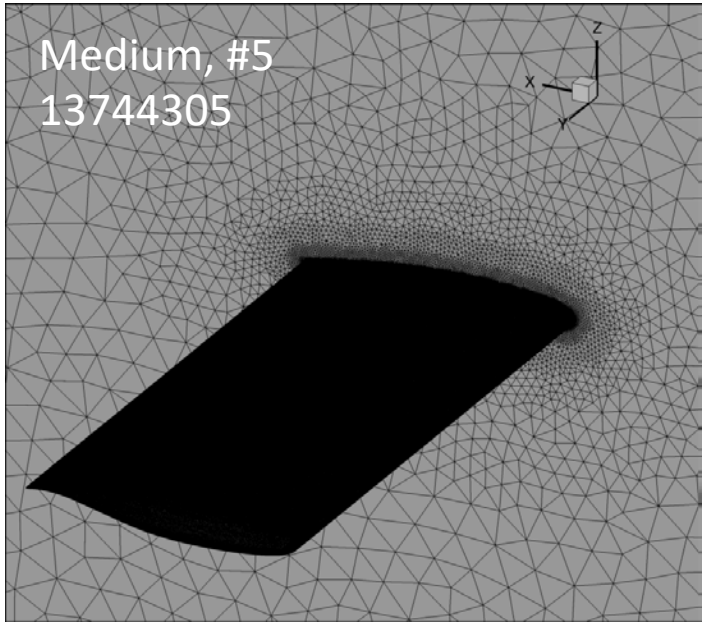


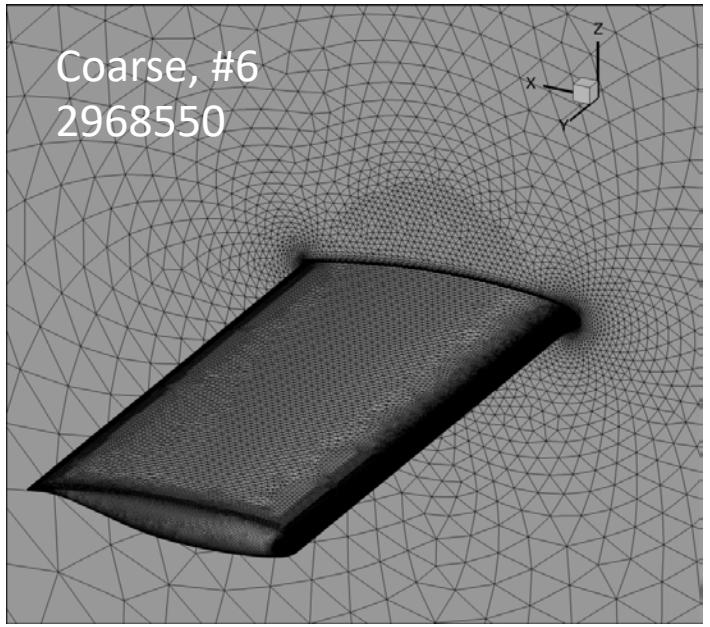


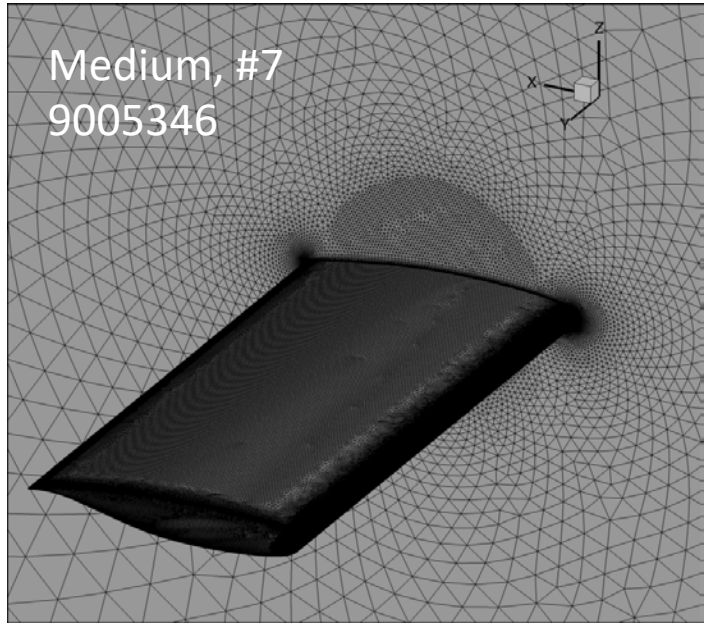


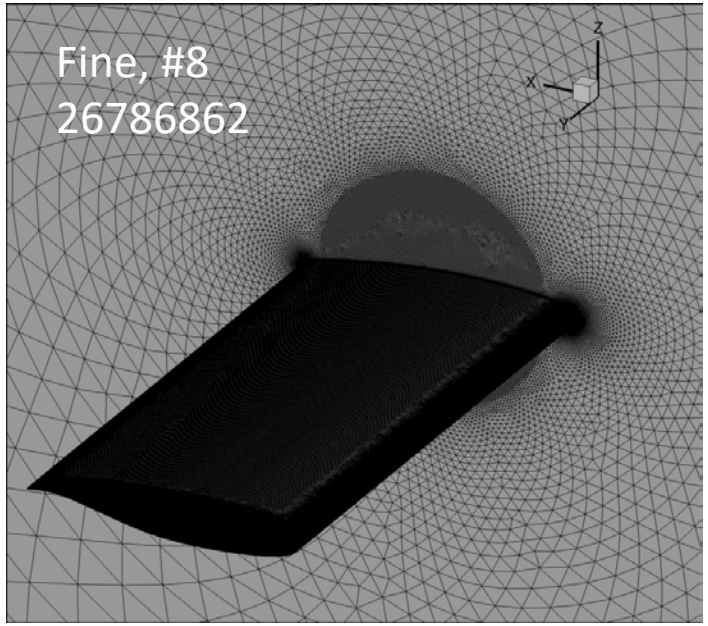


AePW-2 Case2 (Mach 0.74) FUN3D study using 8 grids

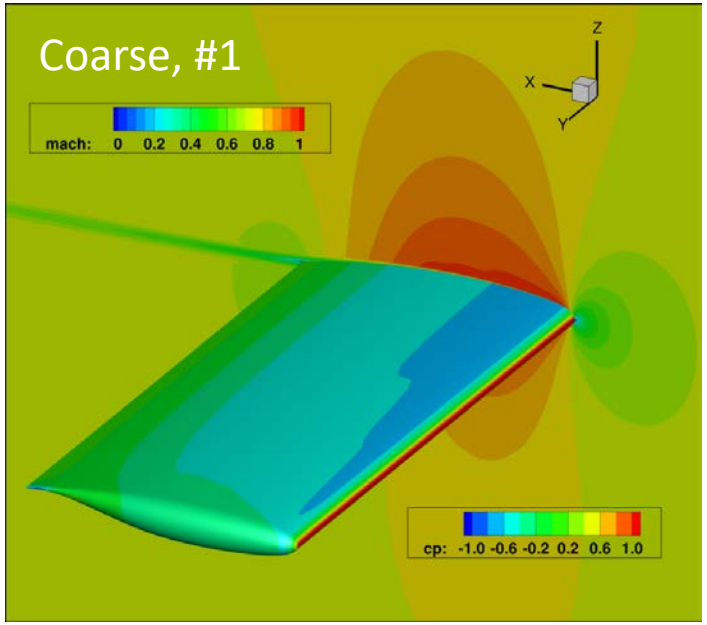


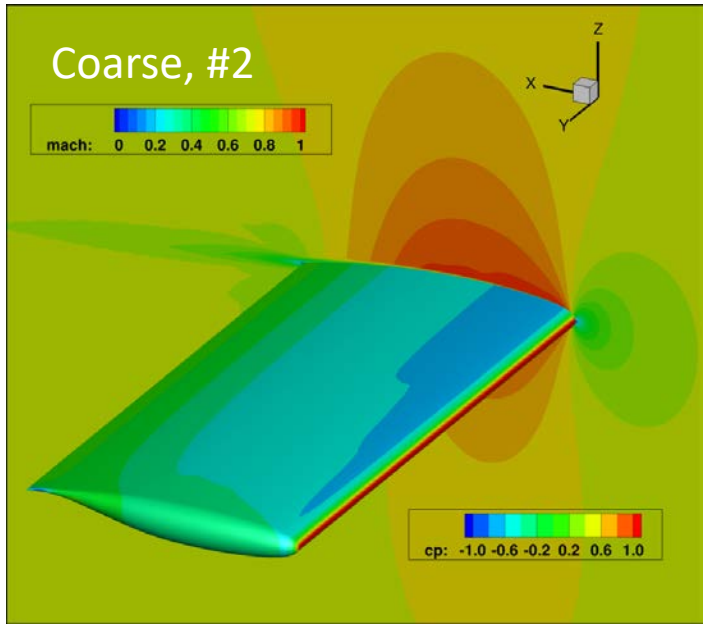


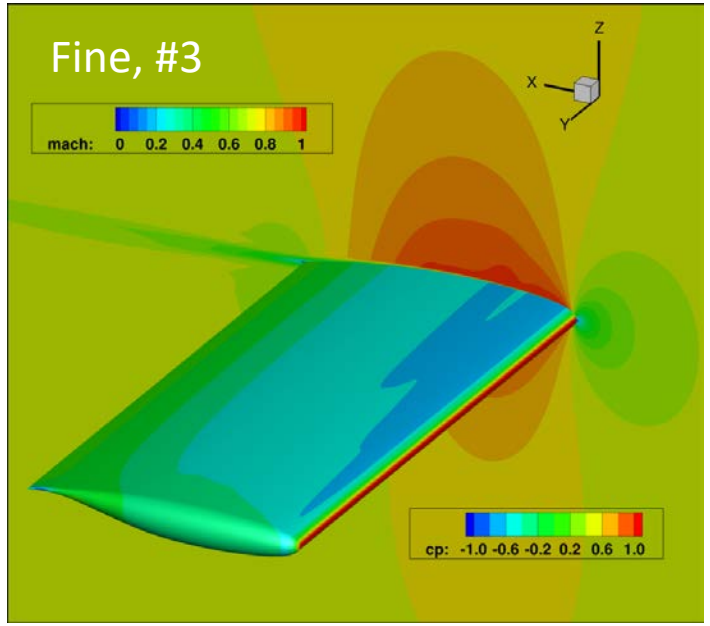


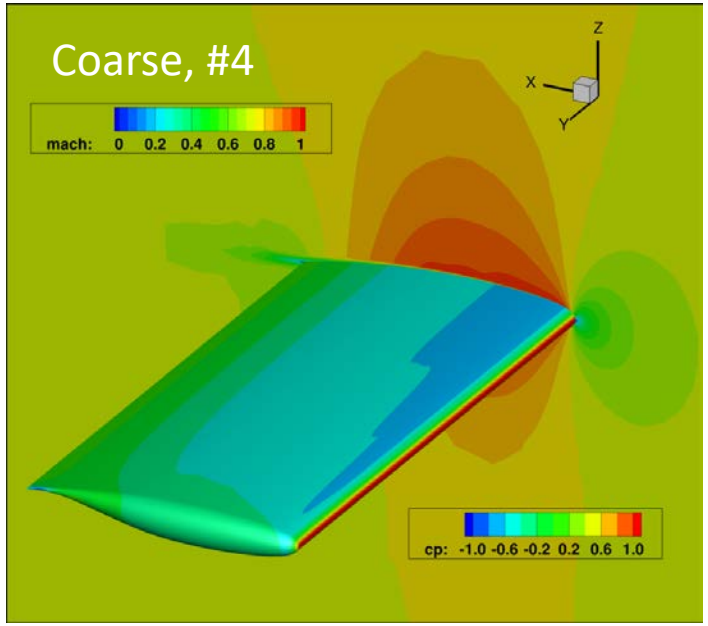


Unforced Steady Solution









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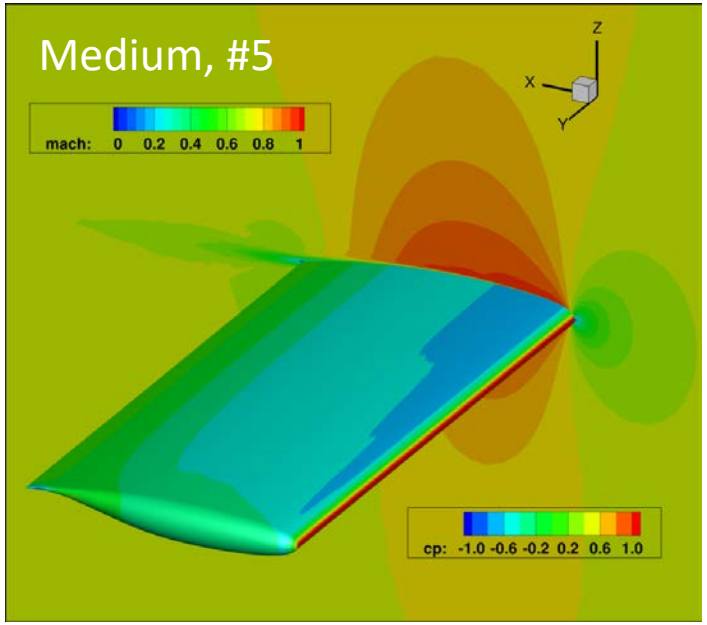
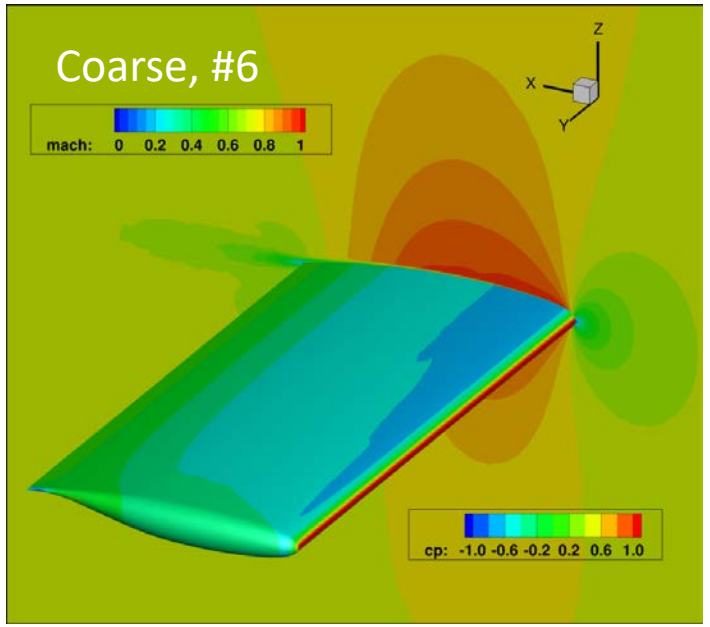
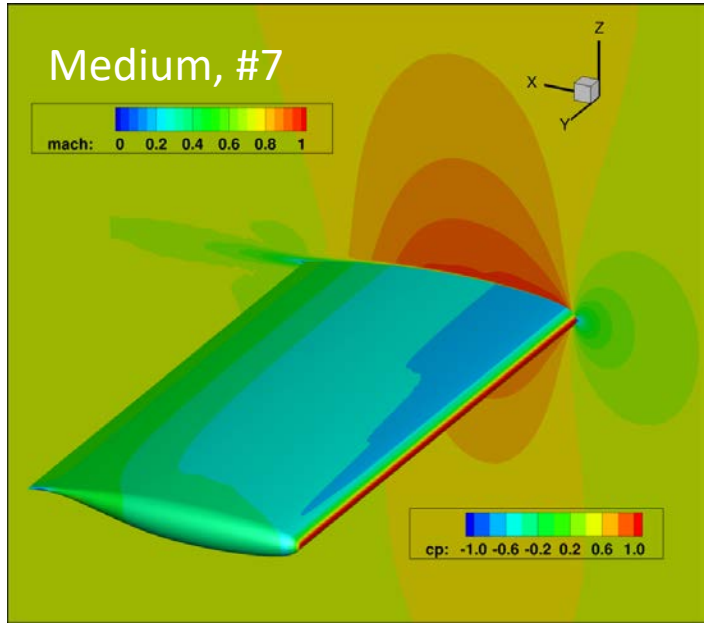
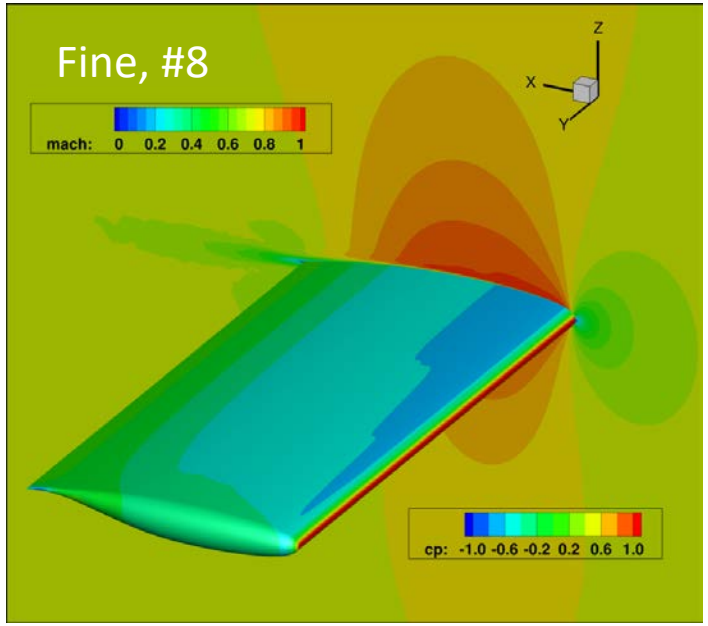
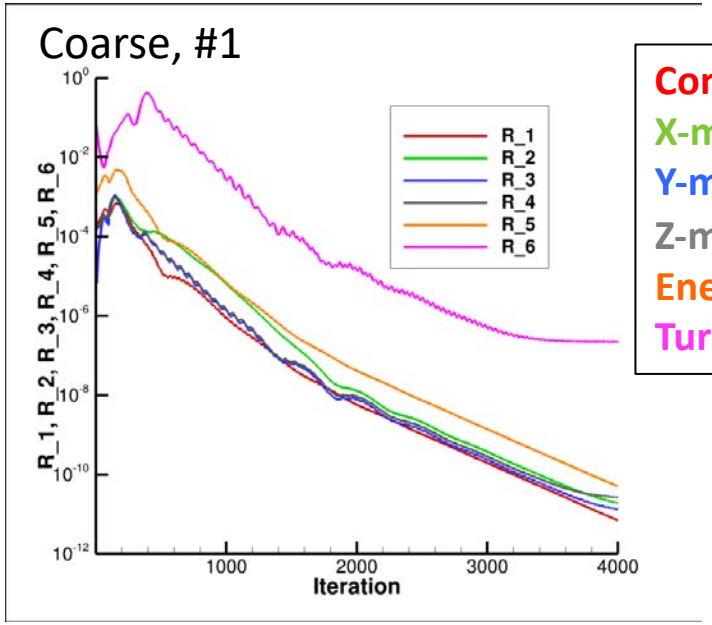




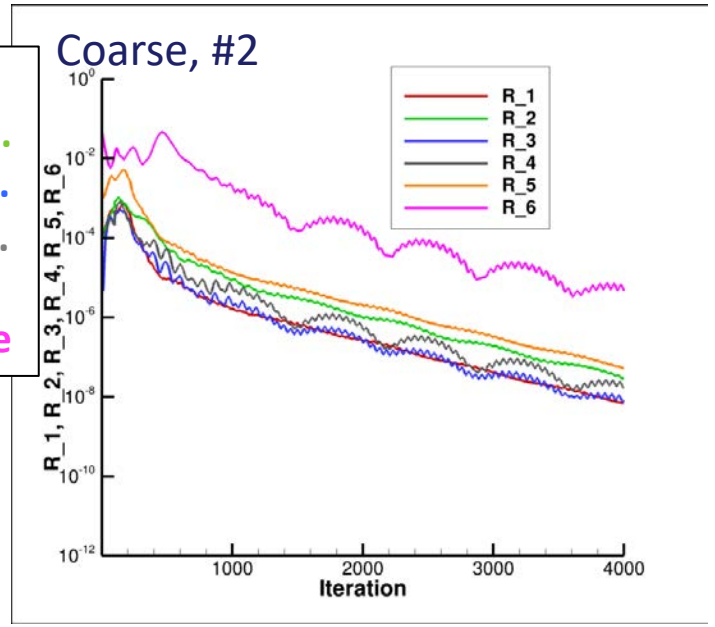


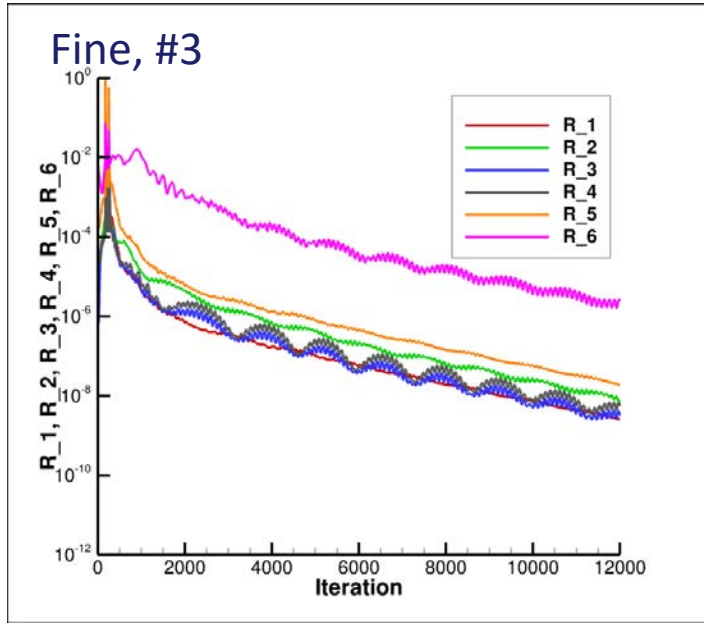


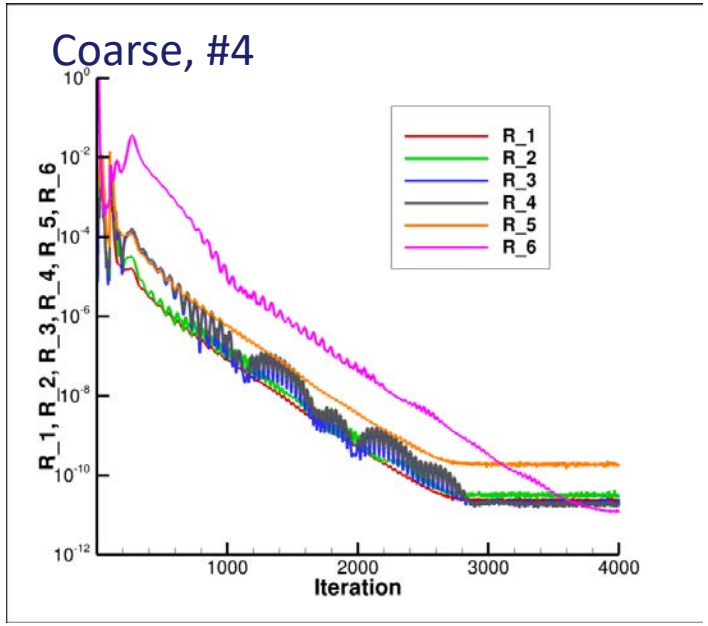
Convergence Rates: Unforced Steady



Continuity
X-moment.
Y-moment.
Z-moment.
Energy
Turbulence







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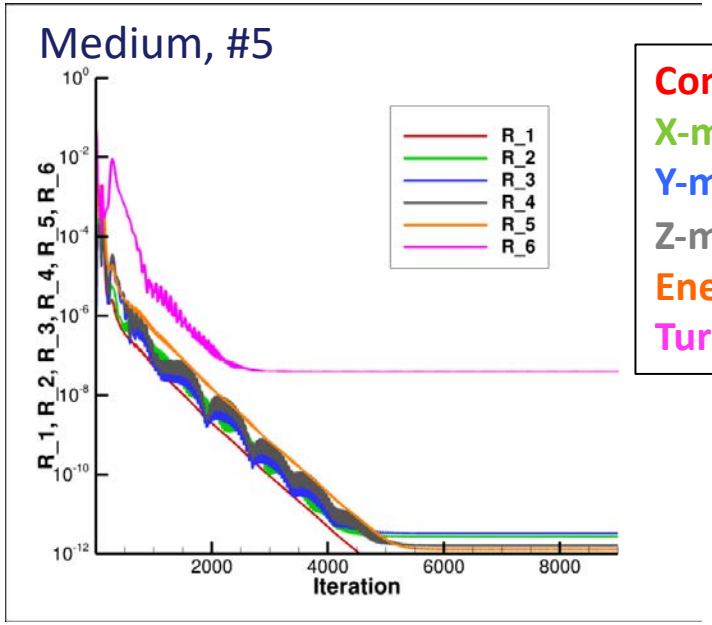

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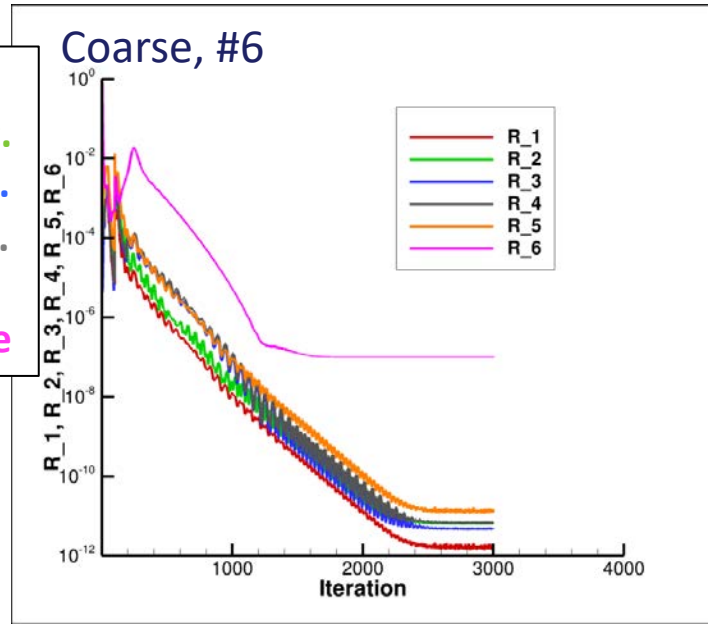
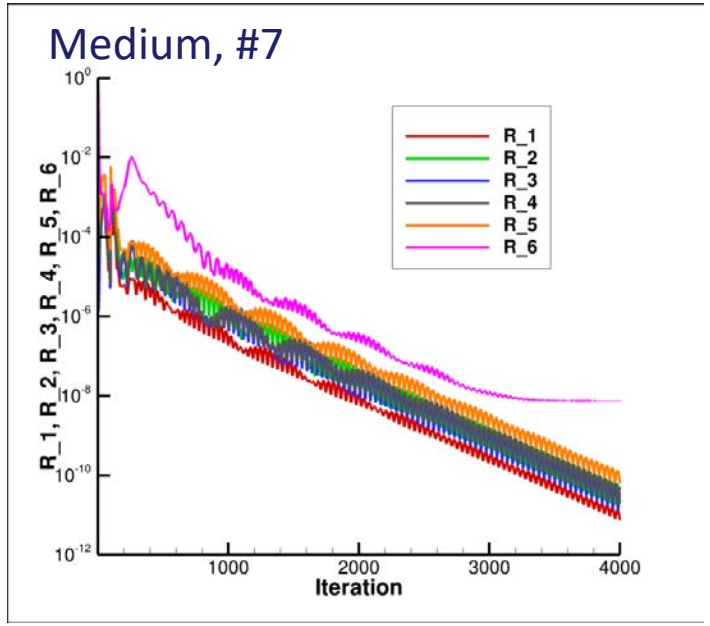
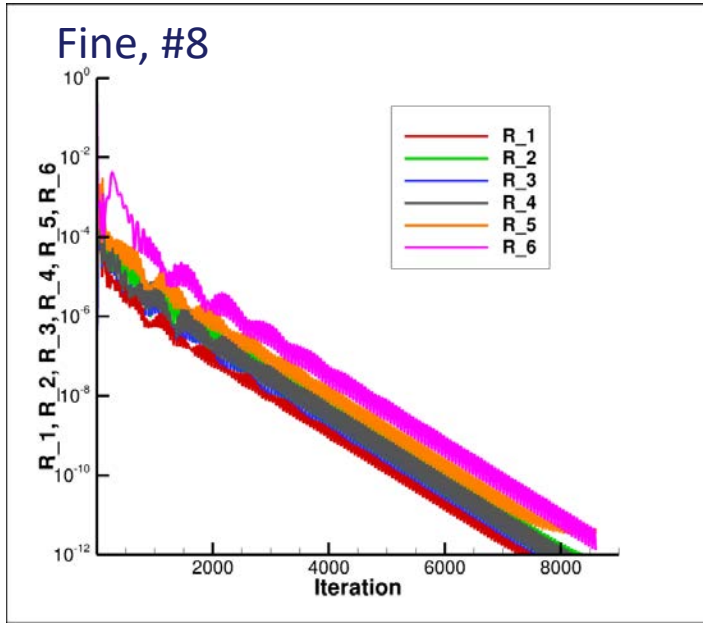
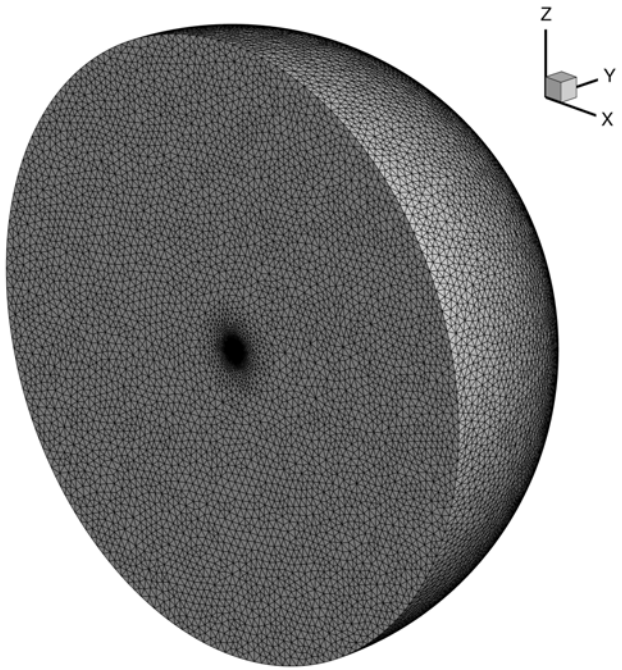
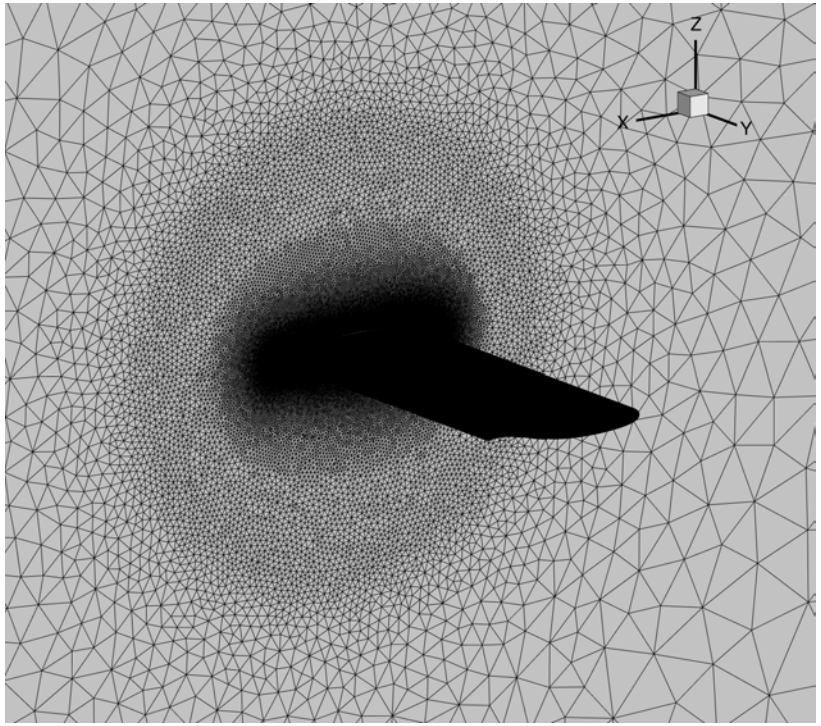







Z
Y
X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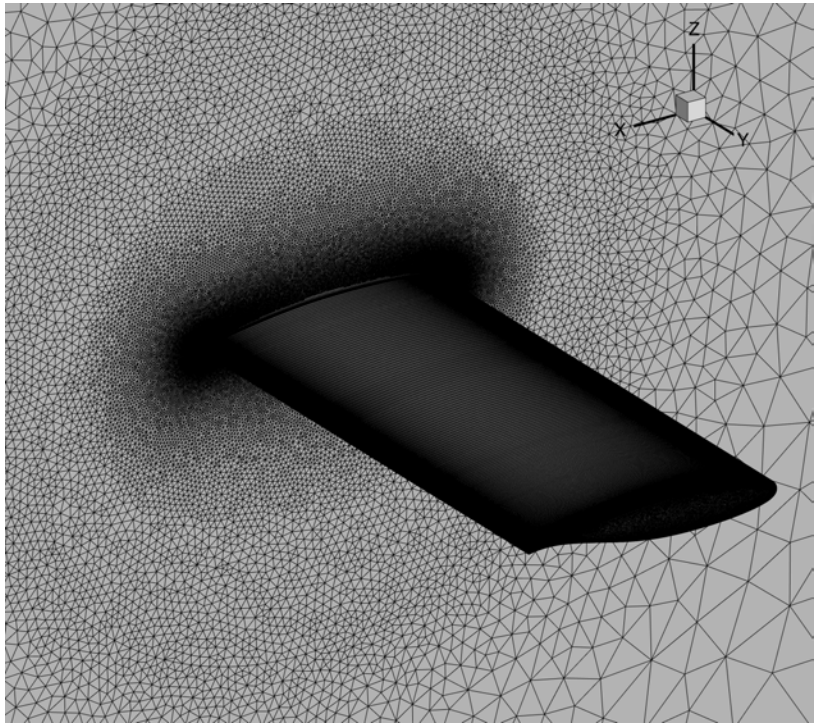
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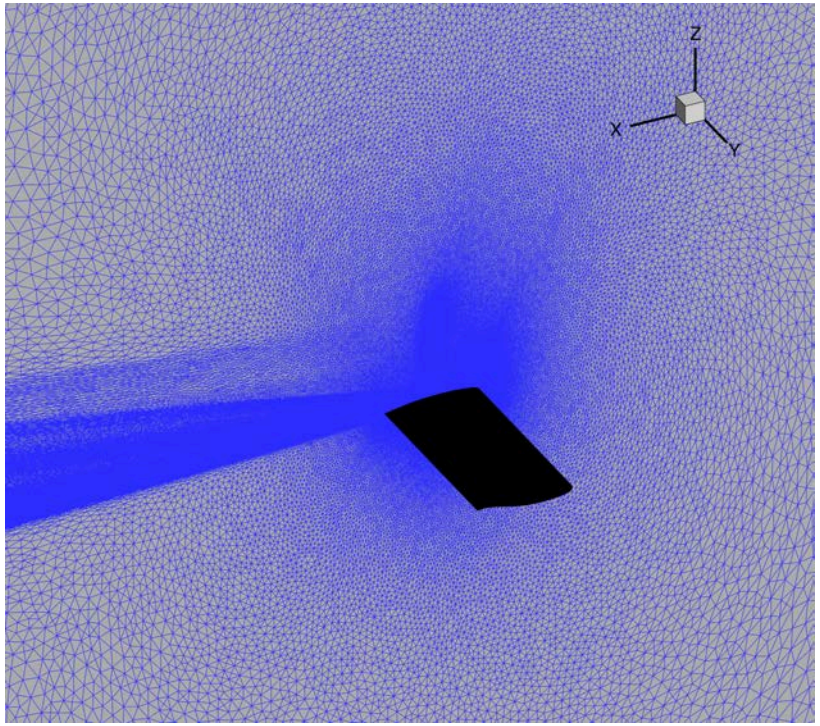
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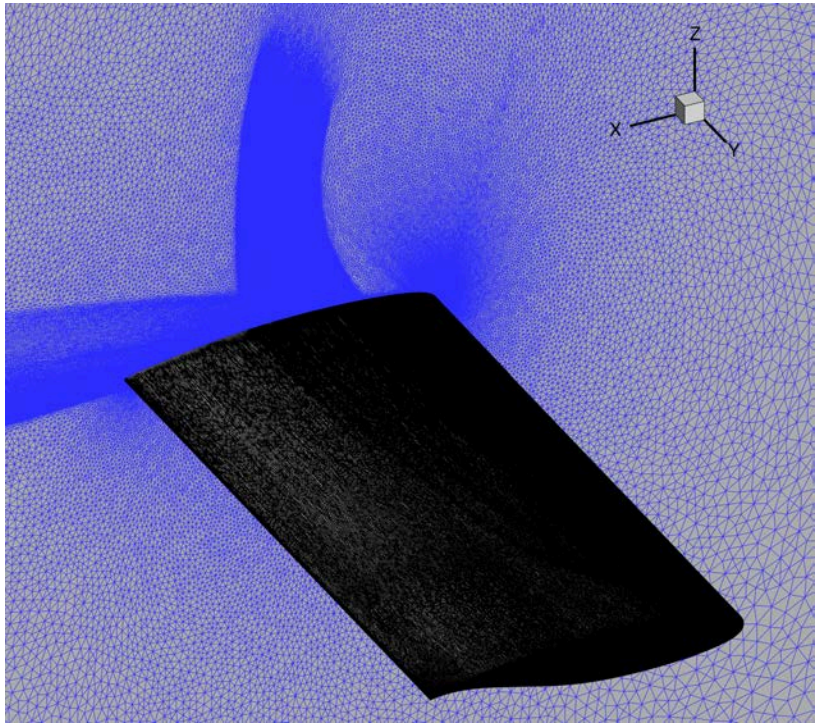
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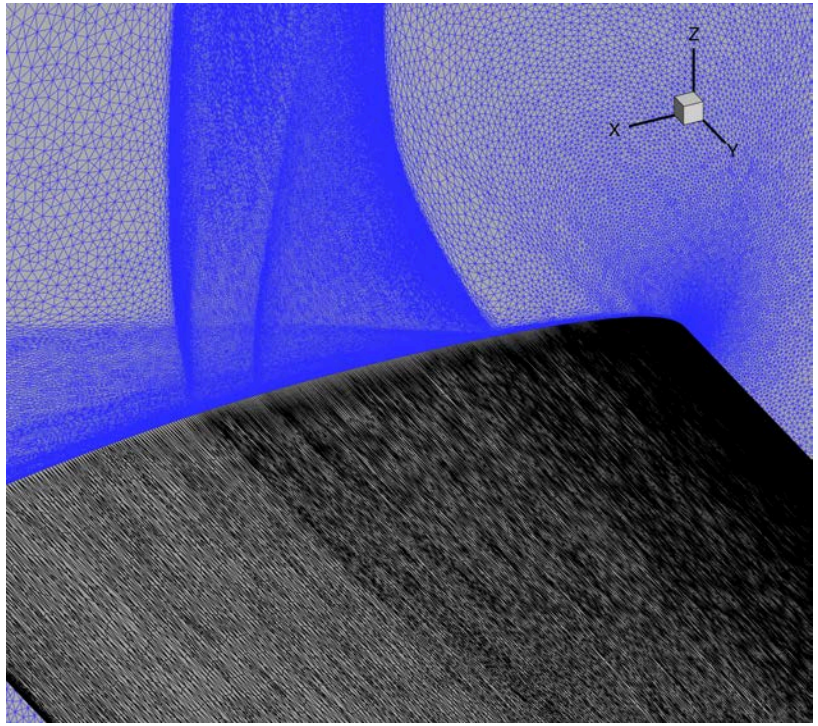
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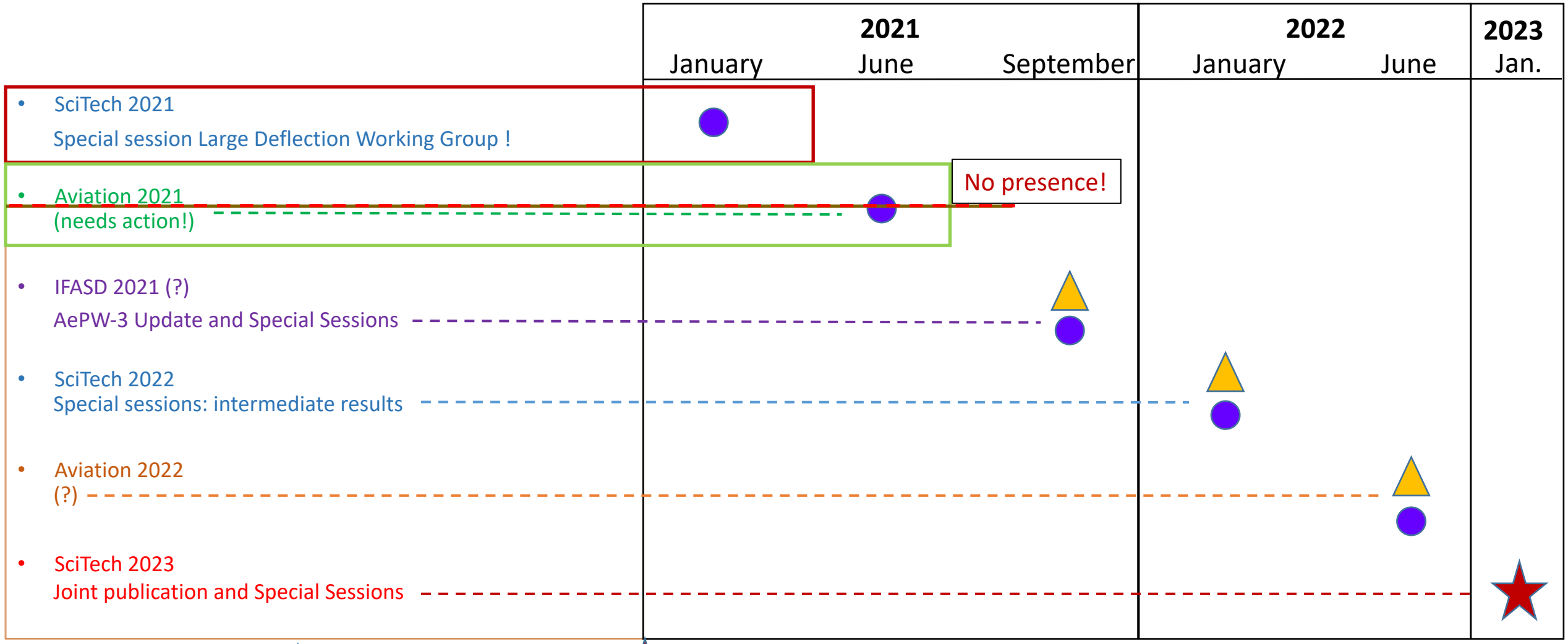
- BSCW Results: Antoine De Blois
- General discussion: common mesh analysis, experimental data, IFASD 2021, SciTech 2022

- Next Meeting: February 25, 2021

Forced excitation experimental data at Mach 0.8 – still working on that!!!

Toward the next Aeroelastic Prediction Workshop (AePW-3): Requesting Conference-Associated Support



Publications; In-person meetings; Workshop / Joint publication

High AoA Working Group, January 26, 2021

IFASD 2021

Abstracts due February 28, 2021

Giampaolo Pagliuce !

Wrik Mallik !

Pawel Chwalowski !

Antoine ?

SciTech 2022

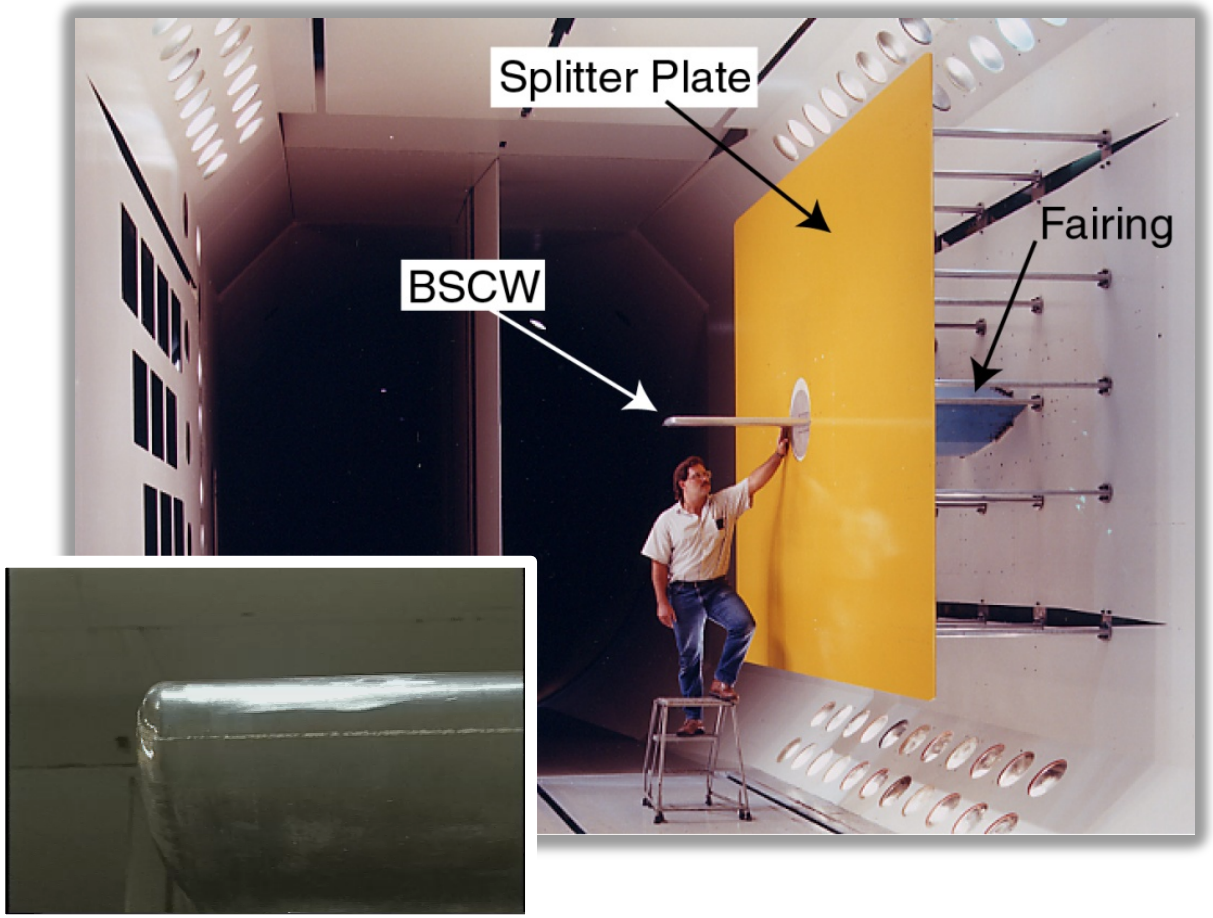
Abstracts due June 2021

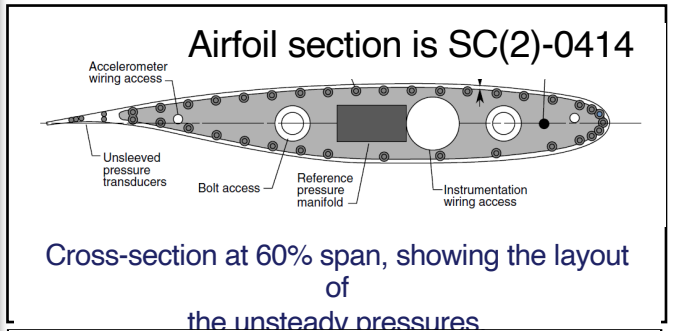
Pawel Chwalowski

Wrik Mallik

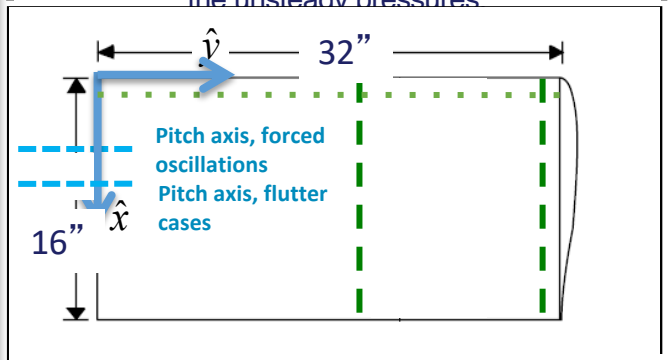
Adam Jirasek

Benchmark Supercritical Wing (BSCW) Model





Cross-section at 60% span, showing the layout of the unsteady pressures



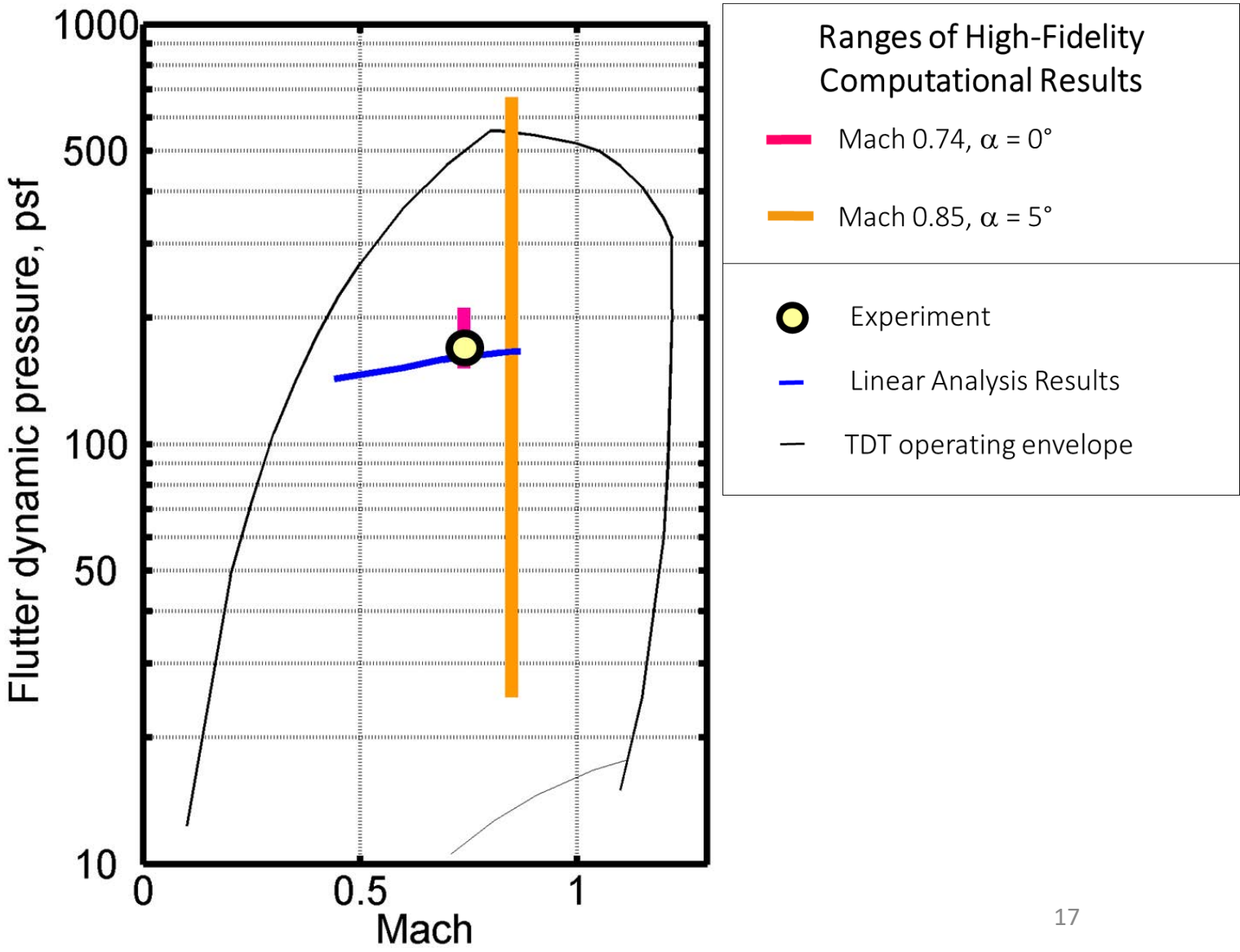
Model planform. Dimensions are in inches.

AePW-2 Configurations for Flutter Computation

Config	Mach	α	Re_c, millions	
BSCW	0.7	3	4.56	
BSCW	0.74	0	4.45	Experimental data
BSCW	0.85	5	4.49	Blind computational test

AePW-2 Summary of Results

- At Mach 0.74, α = 0°
  - Small variation in computational results
  - Match the experimental results well
  - Match the linear results well
- At Mach 0.85, α = 5°
  - Significant variation in predictions
  - No experimental data for comparison



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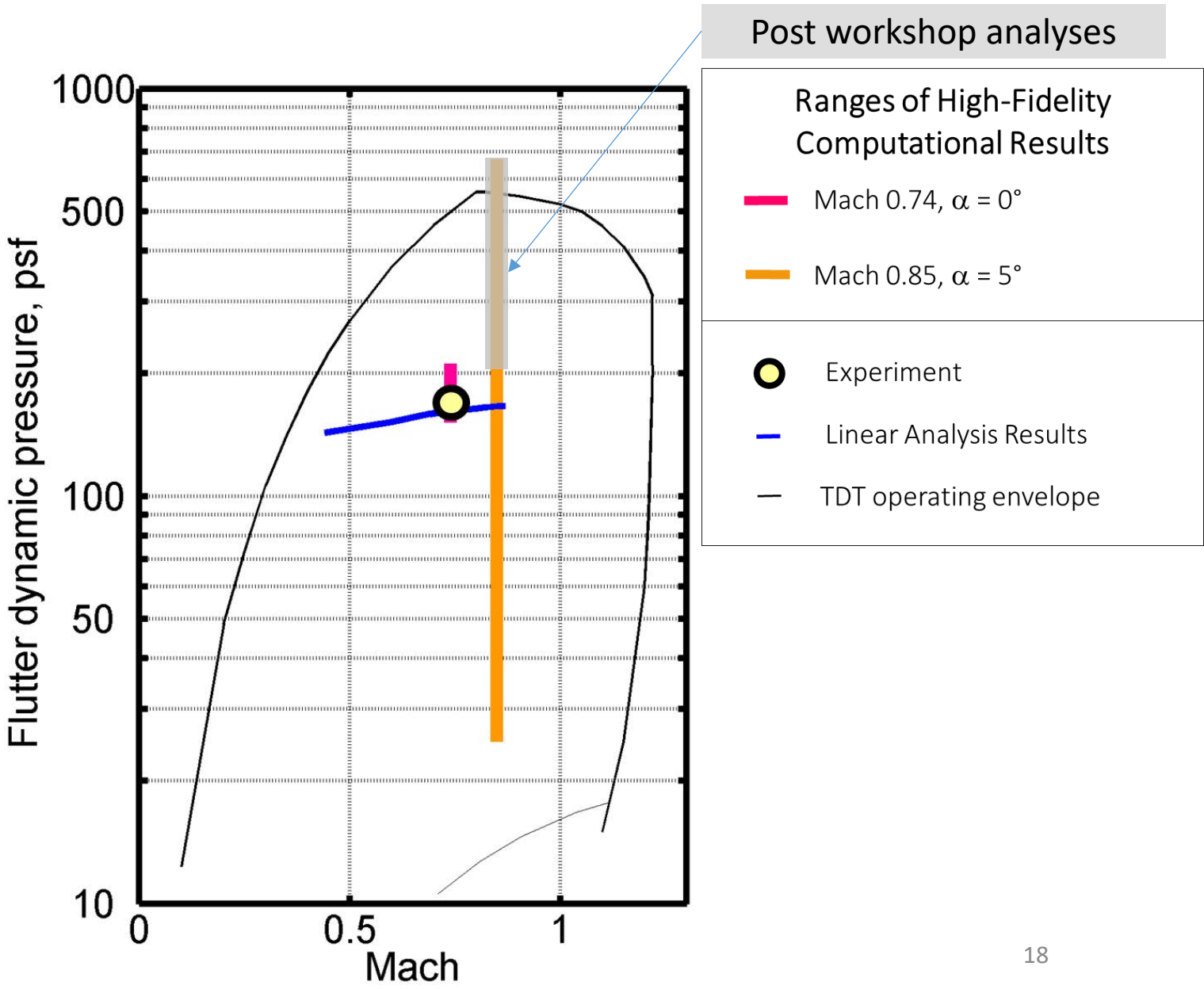
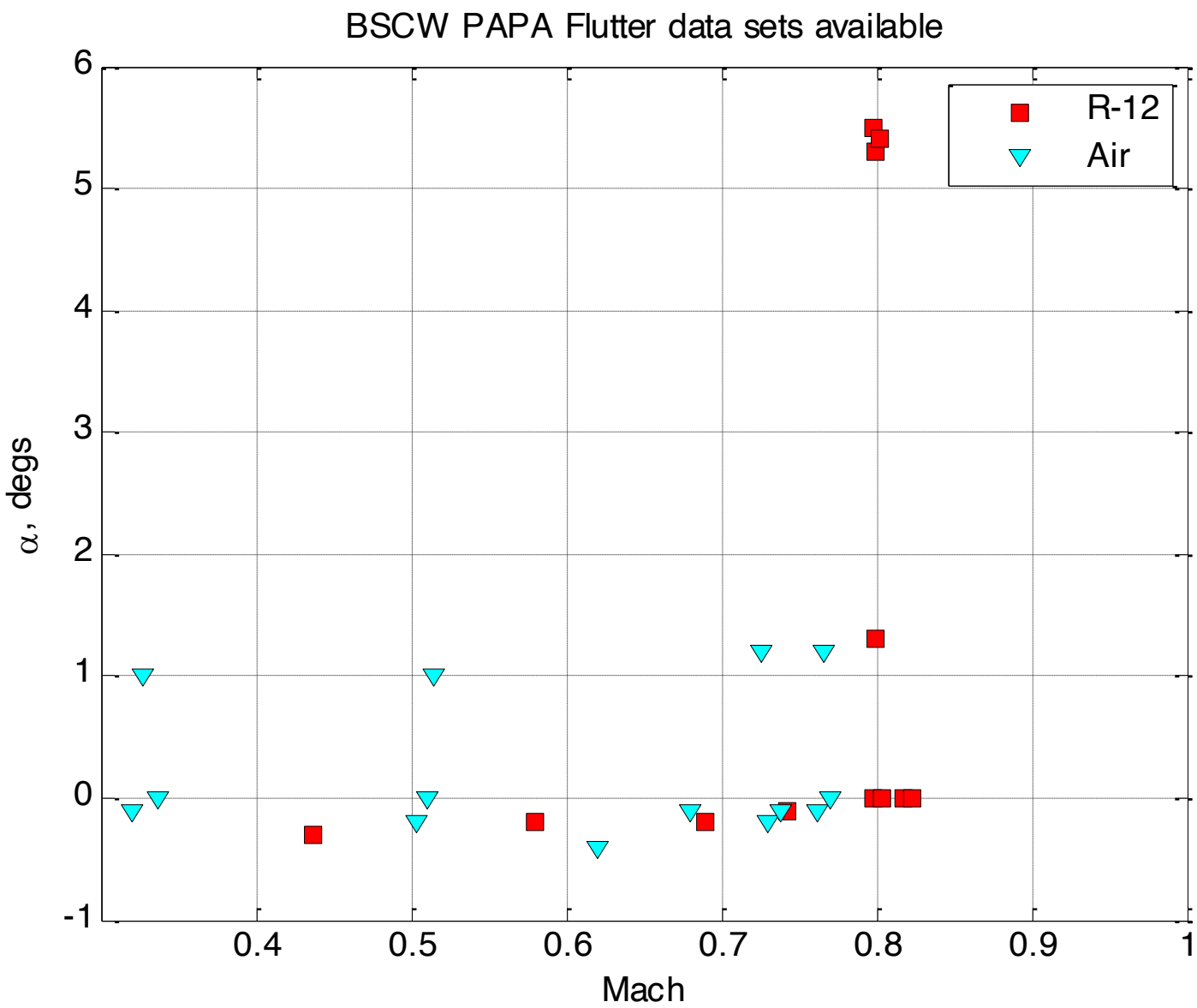


Experimental flutter points



Transition strip information
Is not separated out in this plot.

EXPERIMENTAL UNSTEADY PRESSURES AT FLUTTER ON THE SUPERCRITICAL WING BENCHMARK MODEL

AIAA-93-1592-CP

Bryan E. Dansberry, Michael H. Durham*, Robert M. Bennett**, José A. Rivera*, Walter A. Silva*, and Carol D. Wieseman*; Structural Dynamics Division, NASA Langley Research Center, Hampton, VA 23681-0001
and David L. Turnock*
Lockheed Engineering and Sciences Corporation

Stall Flutter: Additional flutter points were acquired at non-zero angles of attack at a constant Mach number of 0.8. These data, acquired in 11-12 with fixed transition, are presented in figure 9 as flutter dynamic pressure versus *a. The test conditions and flutter parameters for* these stall flutter points are included in table 6. Due to load limits of the PAPA mount only three points could be acquired at angles of attack greater than two degrees. The data acquired, however, shows trends consistent with those of models previously tested on the PAPA mount. Results for models previously tested on the PAPA mount show that the flutter dynamic pressure varies only slightly as *a is increased to some critical angle* (above four degrees in reference 4). At this point, a rapid decrease in flutter dynamic pressure with increasing angle of attack and a rise in the flutter frequency to very near the wind-off torsion frequency is seen. This rapid change in character from equal participation in the flutter mechanism of pitch and plunge to a pitch dominated flutter mechanism is associated with wing stall conditions during a portion of the pitch oscillation cycle.

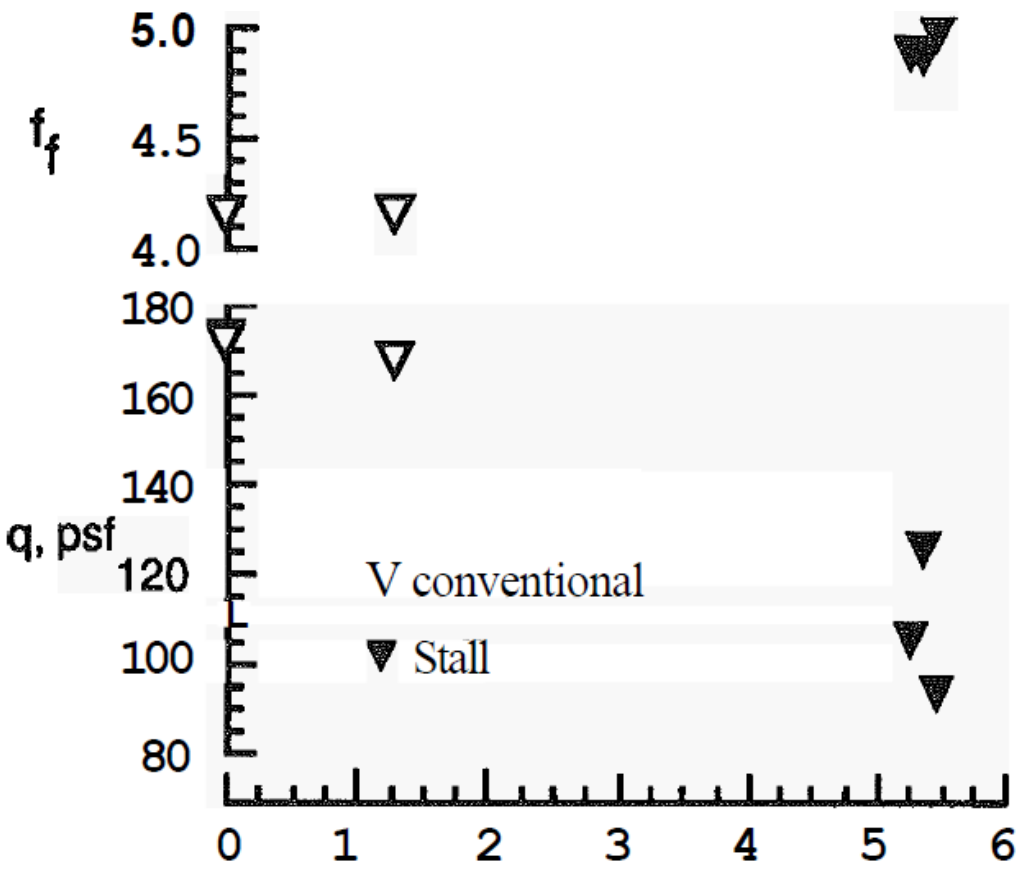


Figure 9. Stall flutter boundary in R-12 at M = 0.80.

What they have termed “stall flutter” corresponds to the test conditions where separated flow is first observed for the unforced system. For the oscillated system, the time histories from the OTT test indicate that the wing goes in and out of separated flow as the wing is Pitched nose up and nose down.

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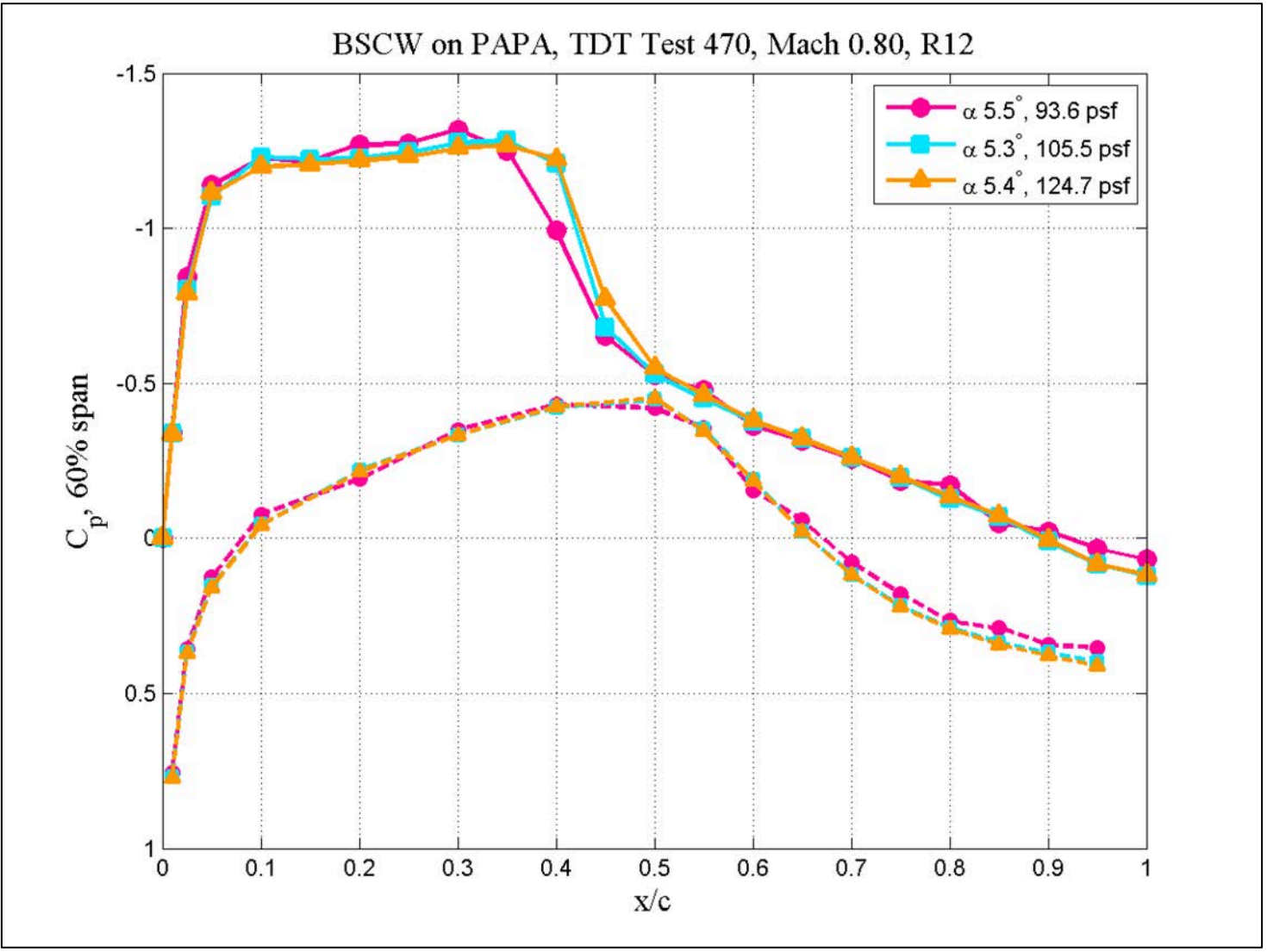


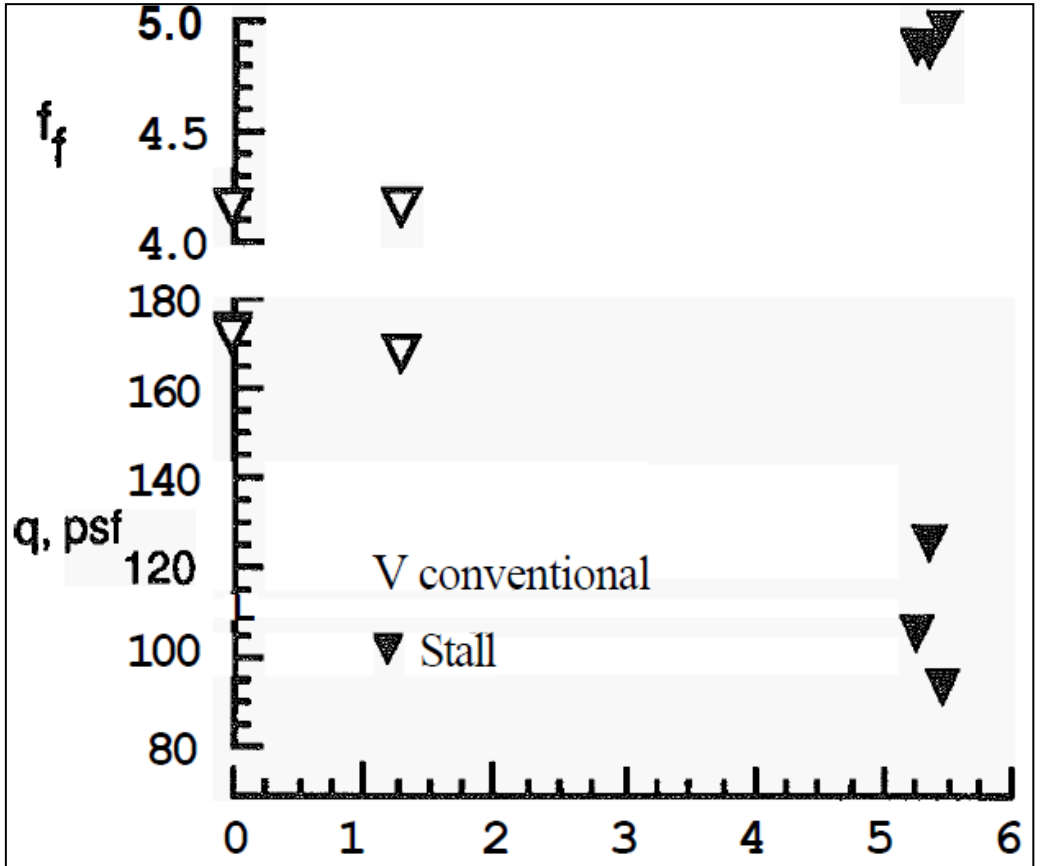
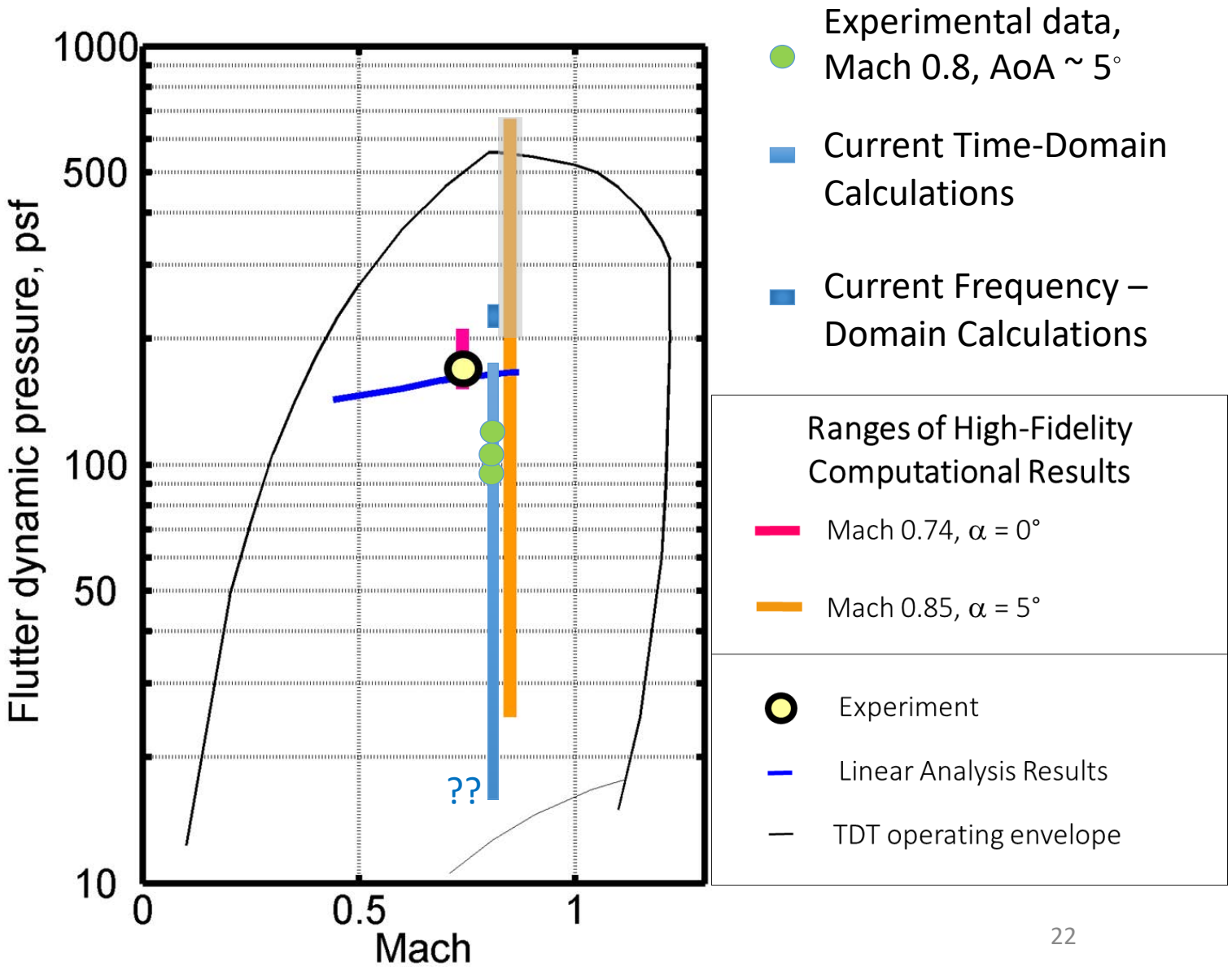


Figure 9. Stall flutter boundary in R-12 at M = 0.80.

AePW-2 Summary of Results

- At Mach 0.8, α = 5°, R-134a



BSCW, Mach 0.8, AoA = 5deg Results

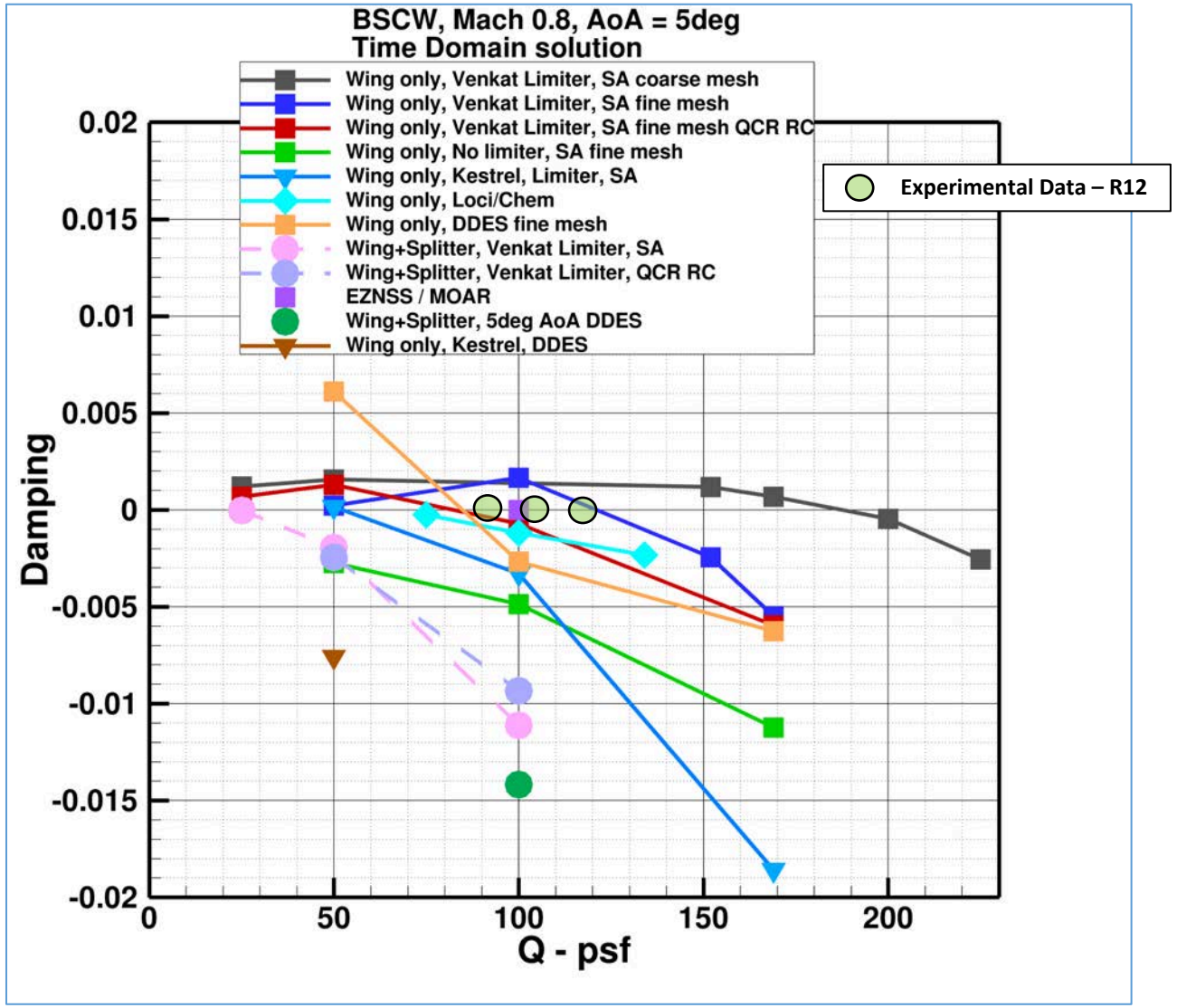
BSCW Current Analysis:

FUN3D

Loci/Chem

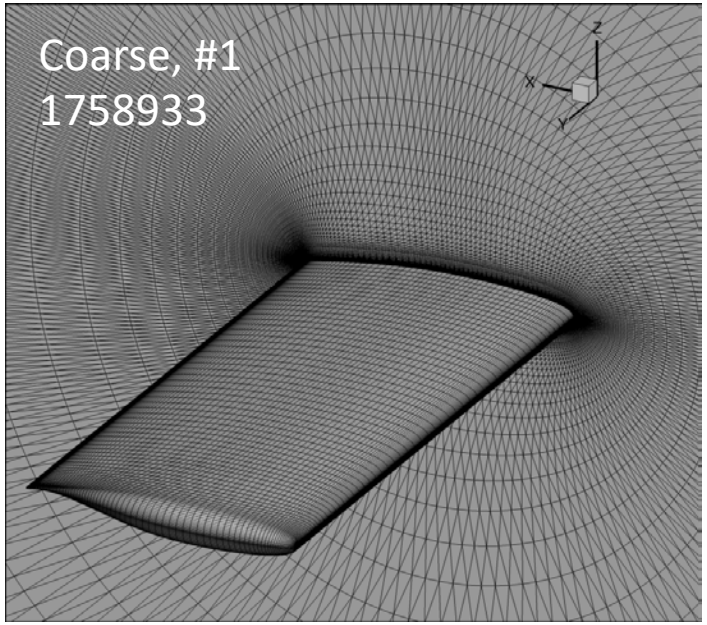
Kestrel

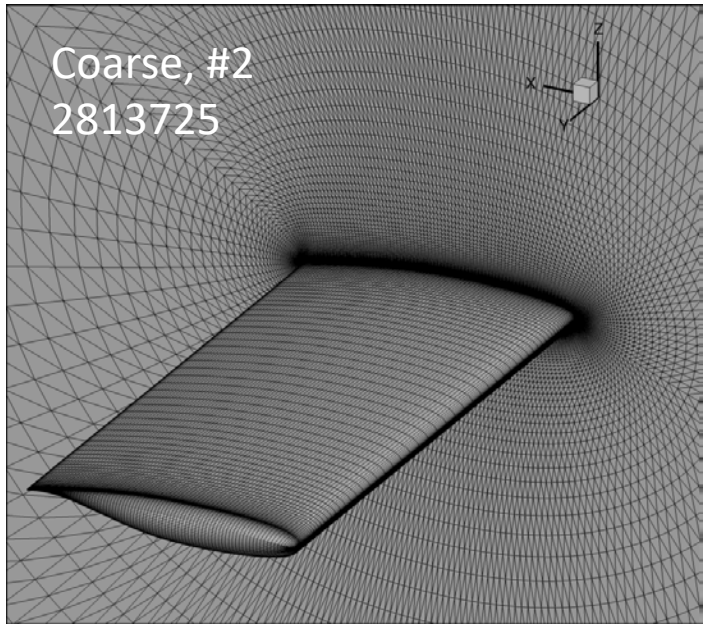
EZNSS / MOAR

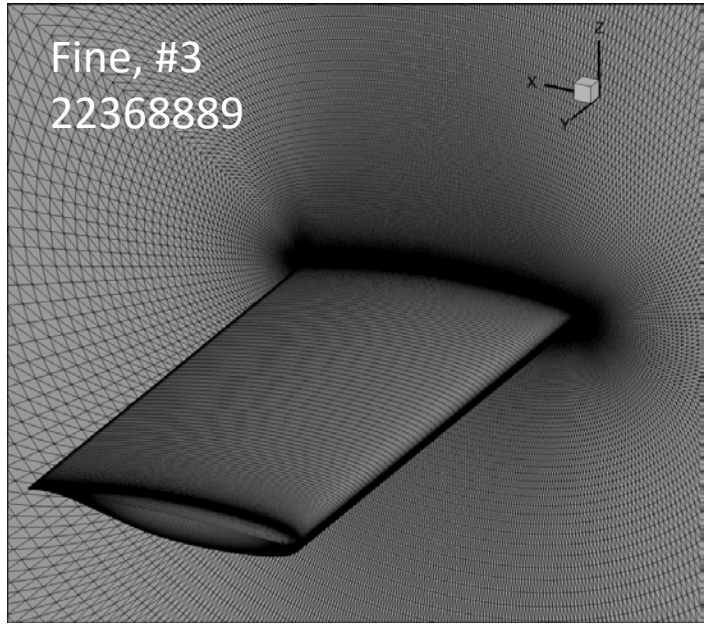


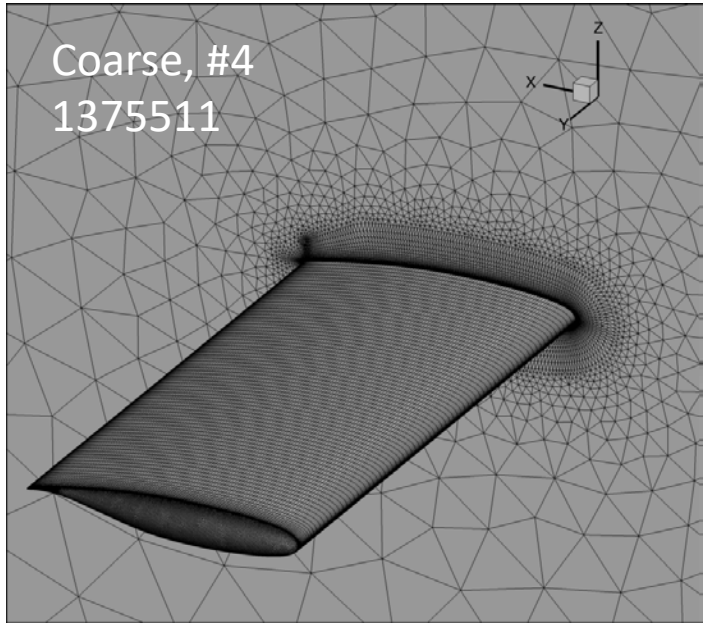
SA – Spalart-Allmaras model
QCR - Quadratic Constitutive Relationship
RC - rotation/curvature correction
Venkat - Venkatakrishnan limiter
DDES – Delayed Detached Eddy Simulation

AePW-2 Case2 FUN3D study using 8 grids

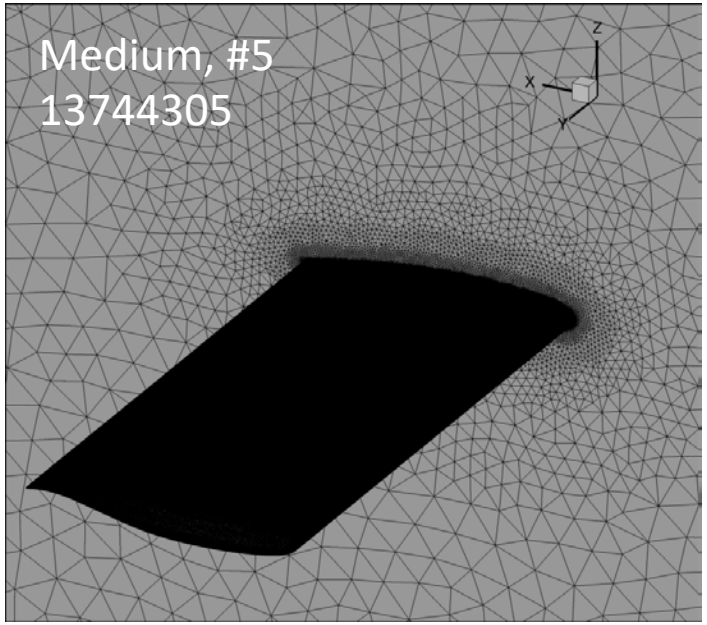


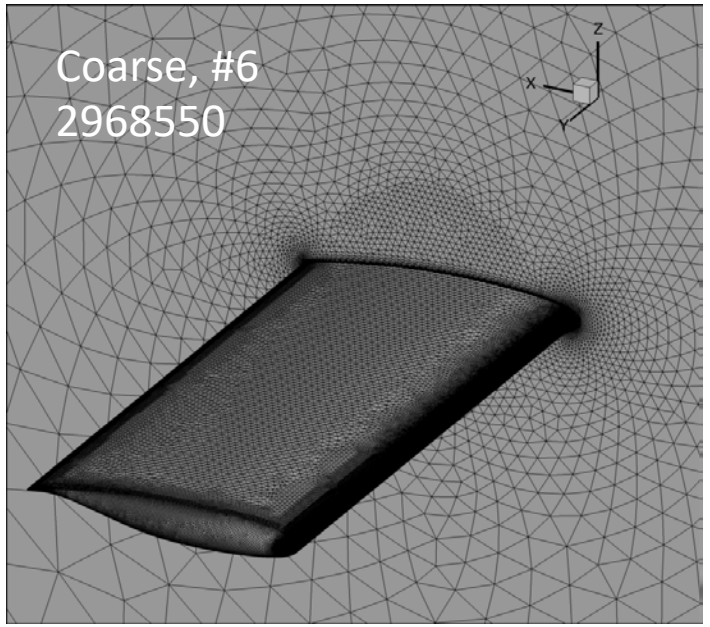


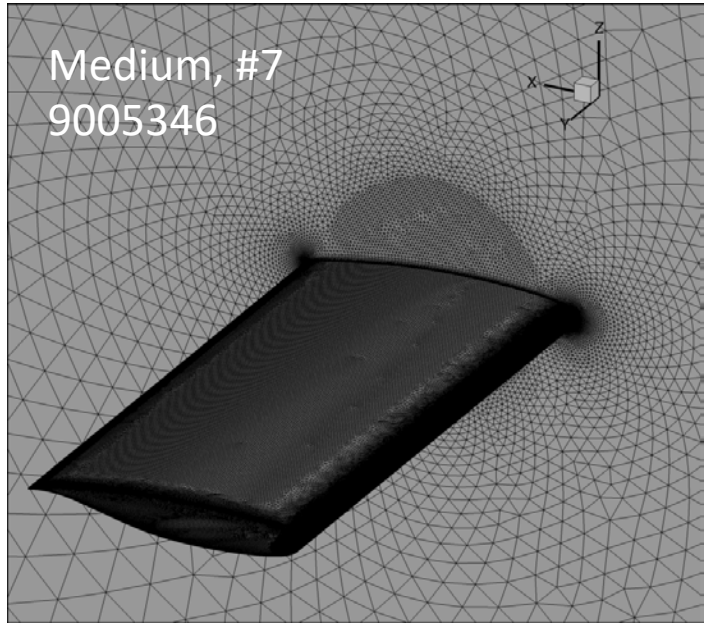


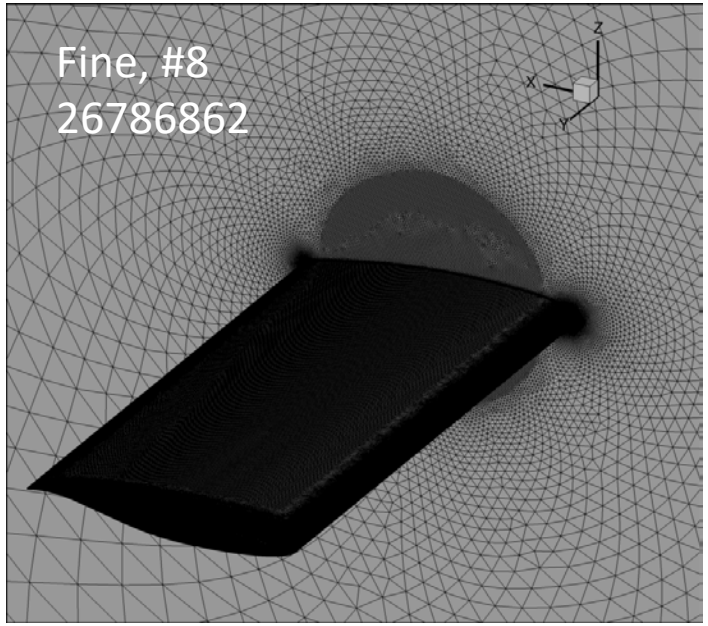


AePW-2 Case2 (Mach 0.74) FUN3D study using 8 grids

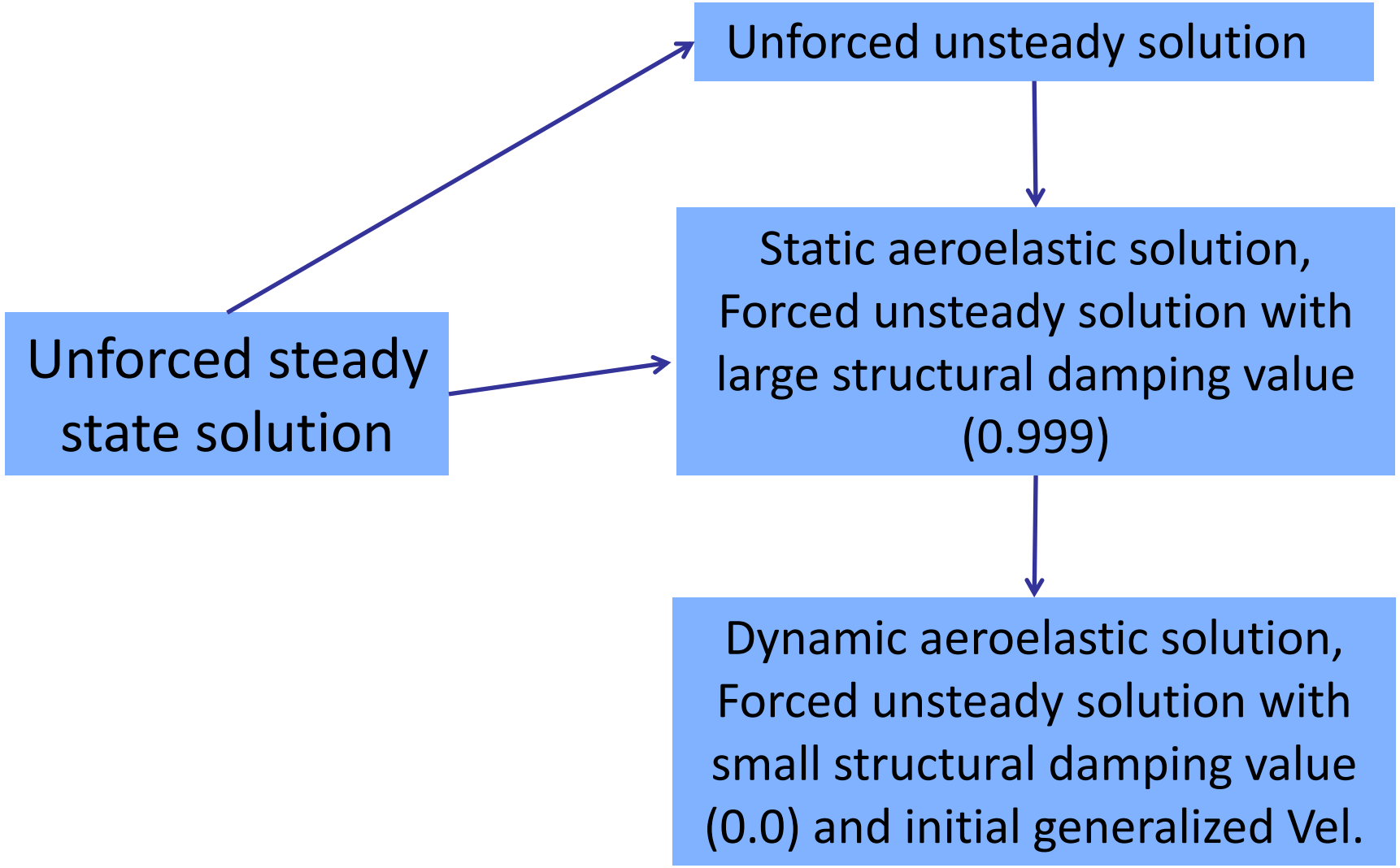




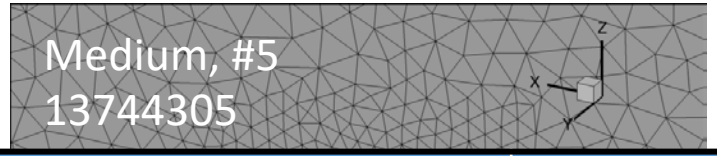


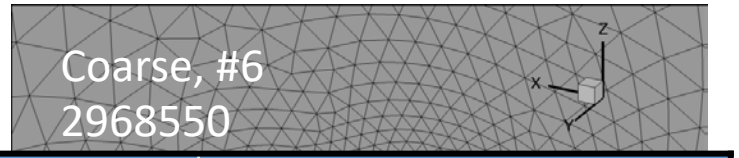


FUN3D Analysis Process

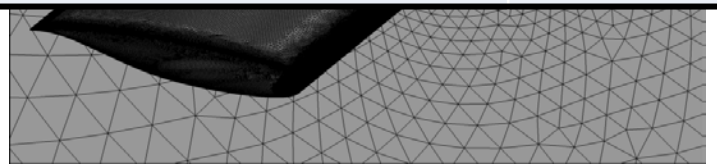


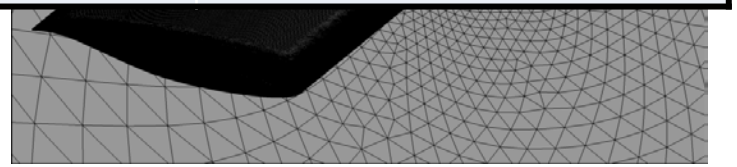
AePW-2 Case2 FUN3D study using 8 grids



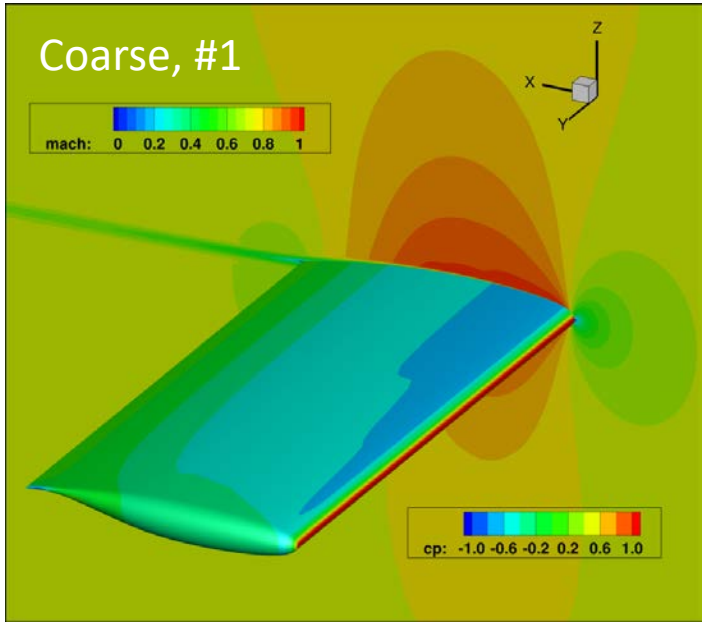


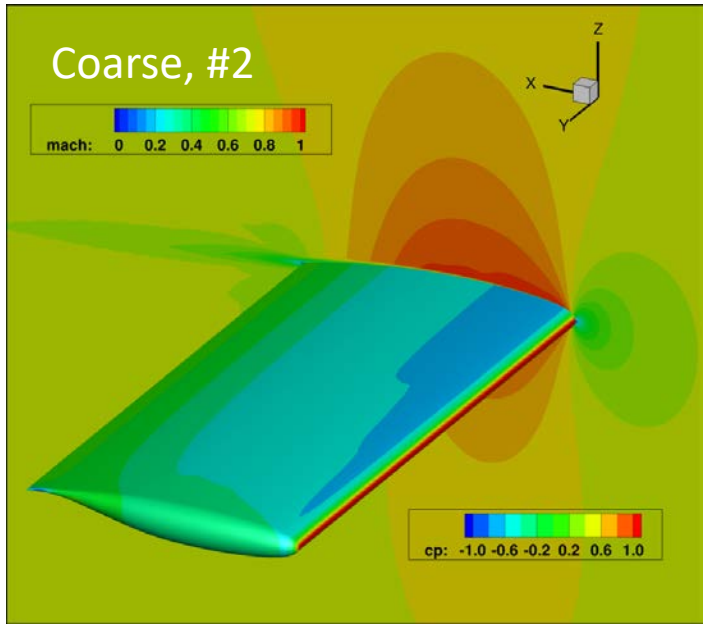
Grid #	# nodes	Resolution
1	1758933	Coarse
2	2813725	Coarse
3	22368889	Fine
4	1375511	Coarse
5	13744305	Medium
6	2968550	Coarse
7	9005346	Medium
8	26786862	Fine

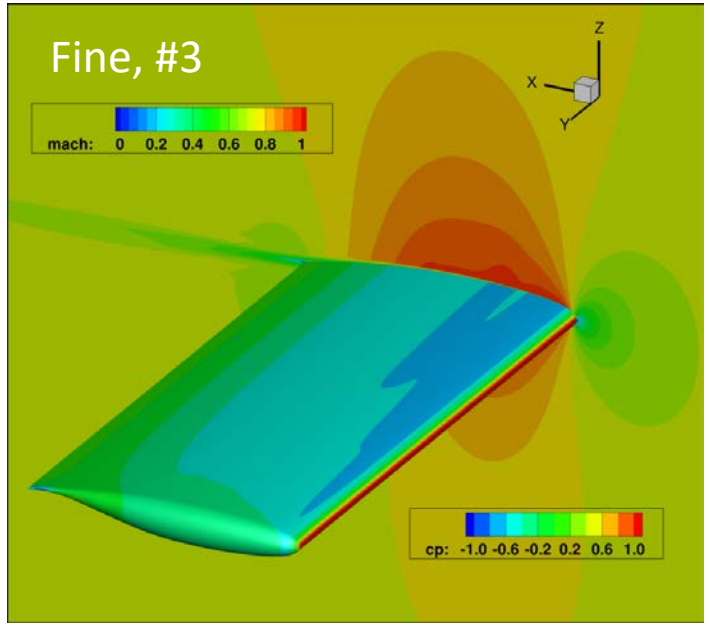


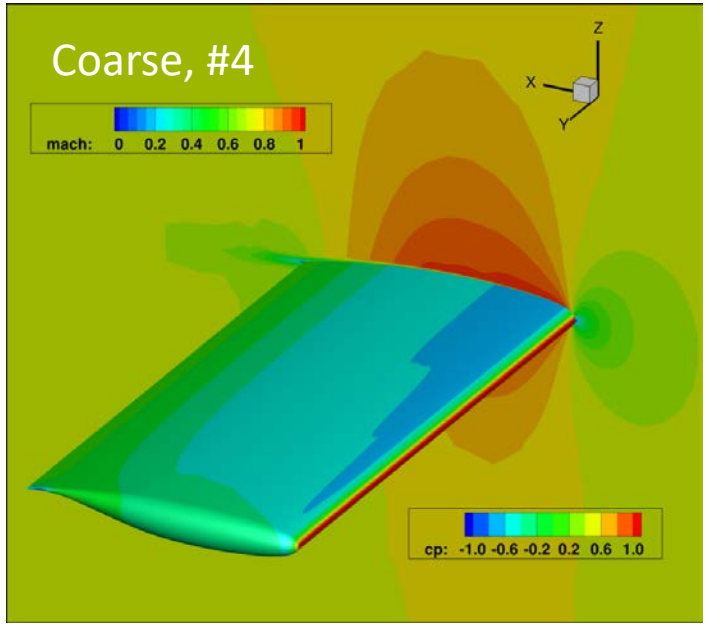


Unforced Steady Solution

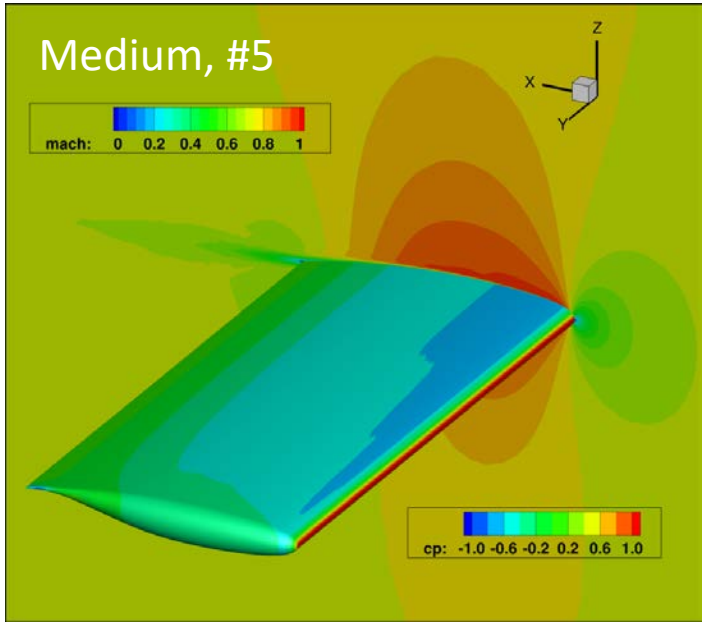


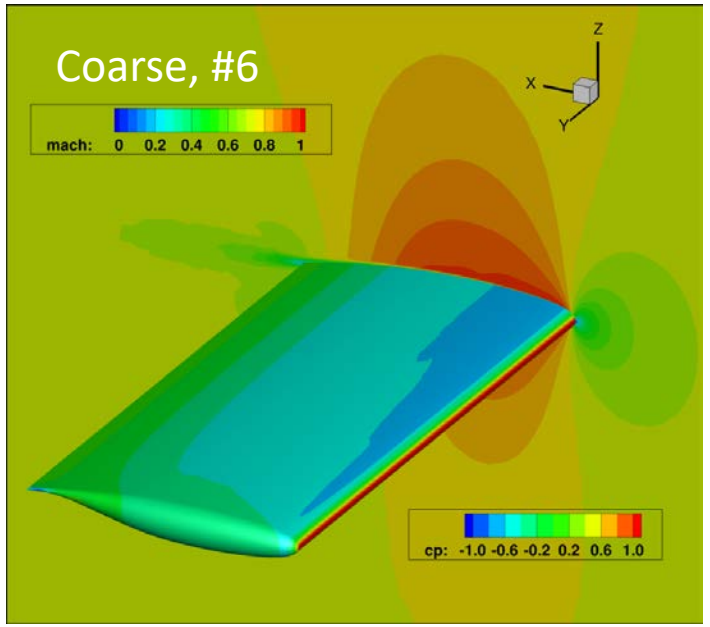


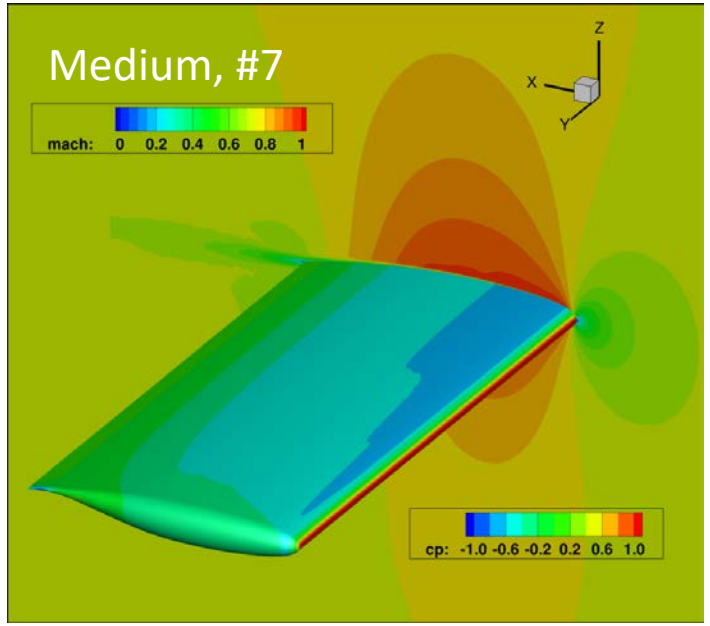


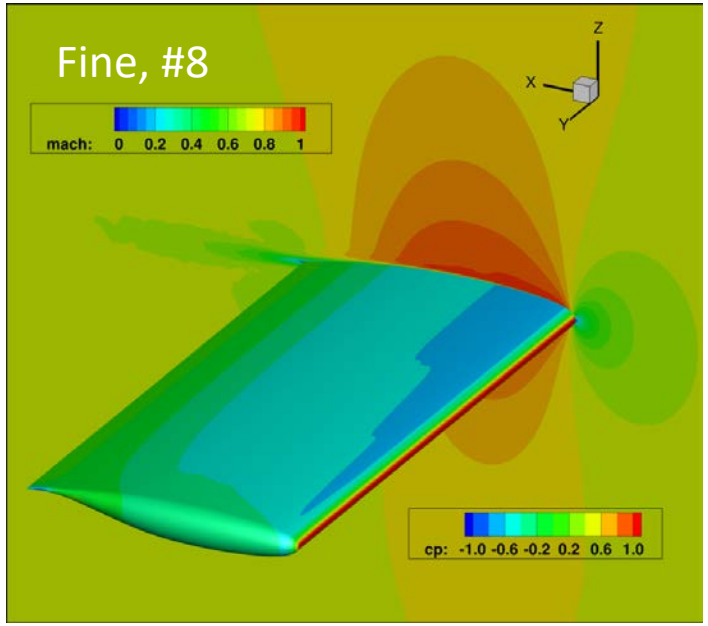


Unforced Steady Solution

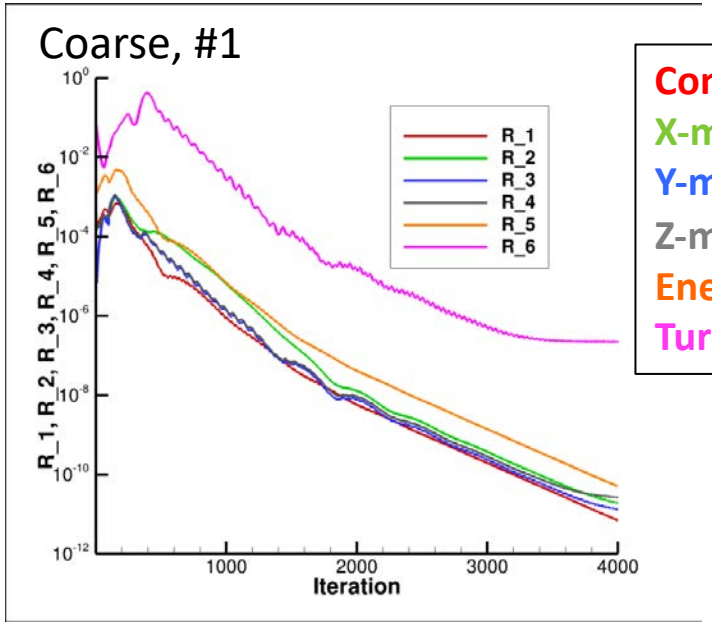




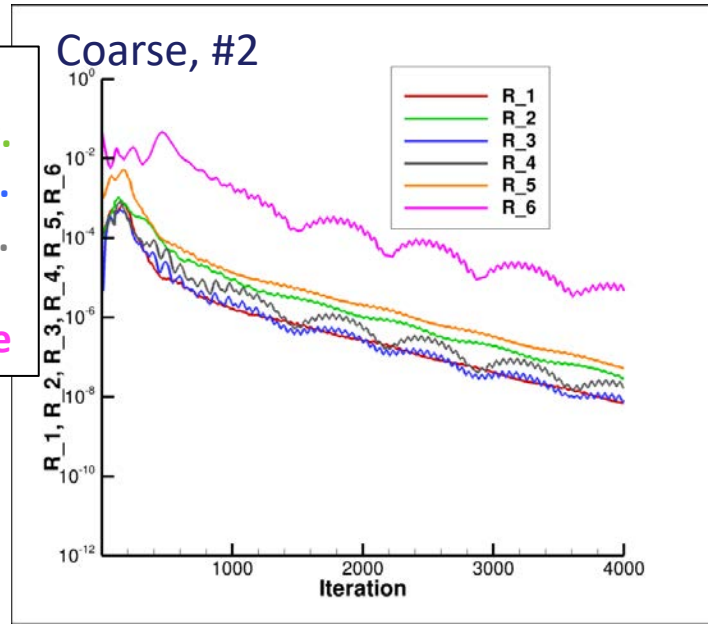


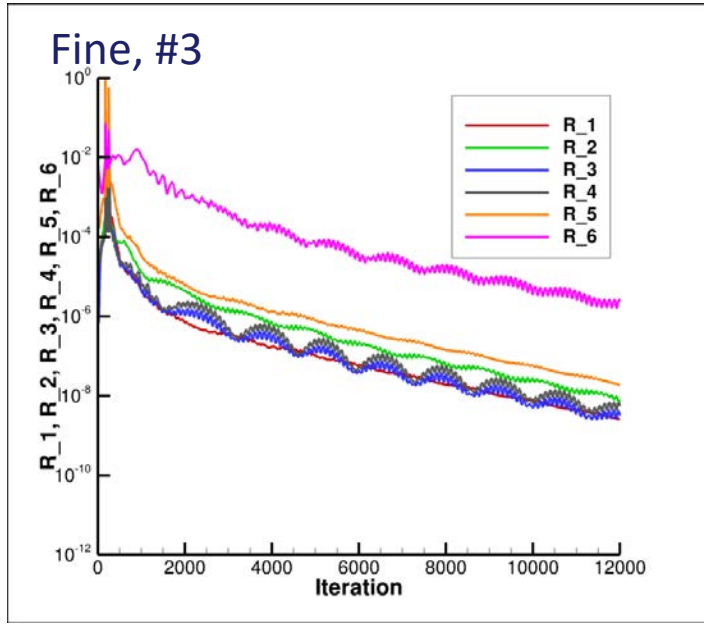


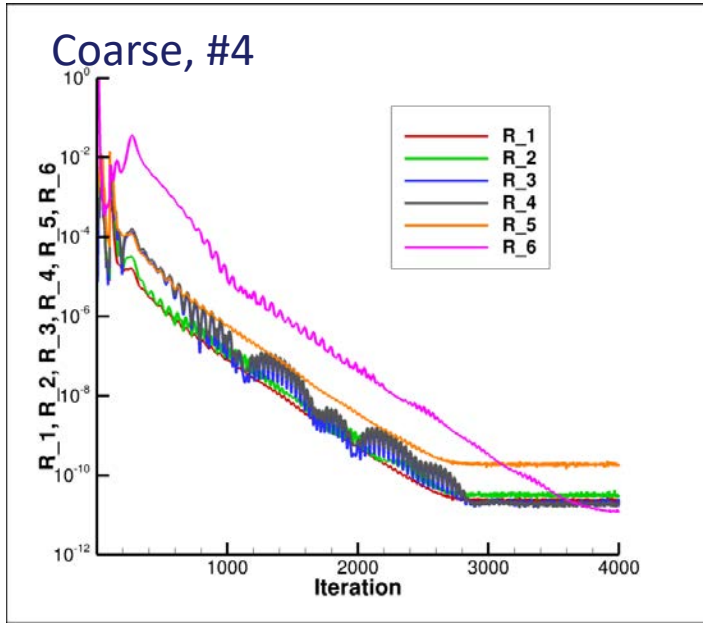
Convergence Rates: Unforced Steady



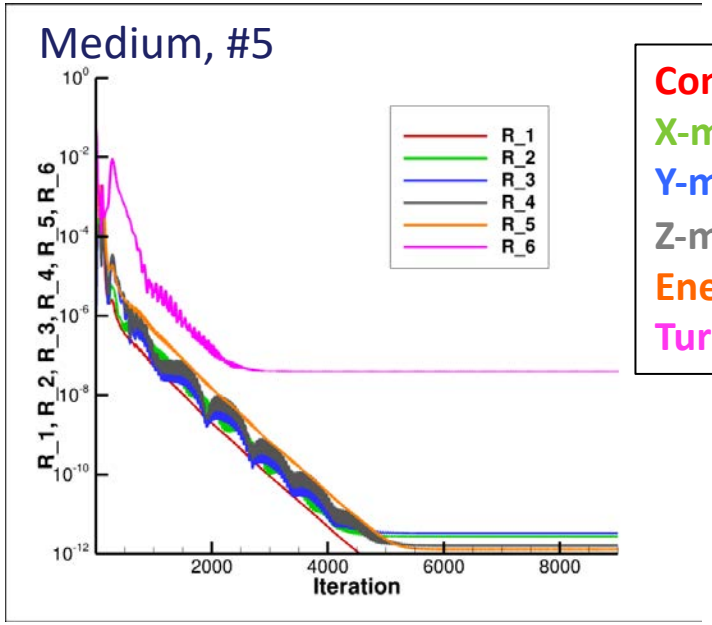
Continuity
X-moment.
Y-moment.
Z-moment.
Energy
Turbulence







Convergence Rates



Continuity
X-moment.
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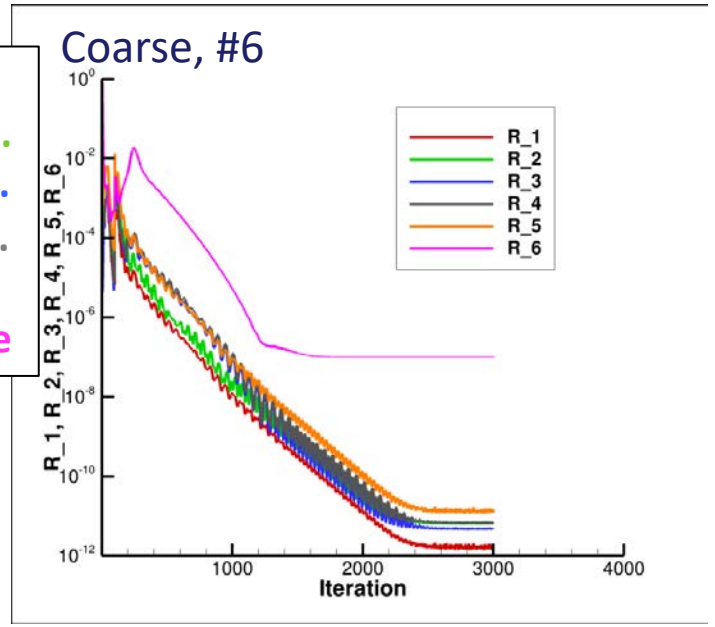
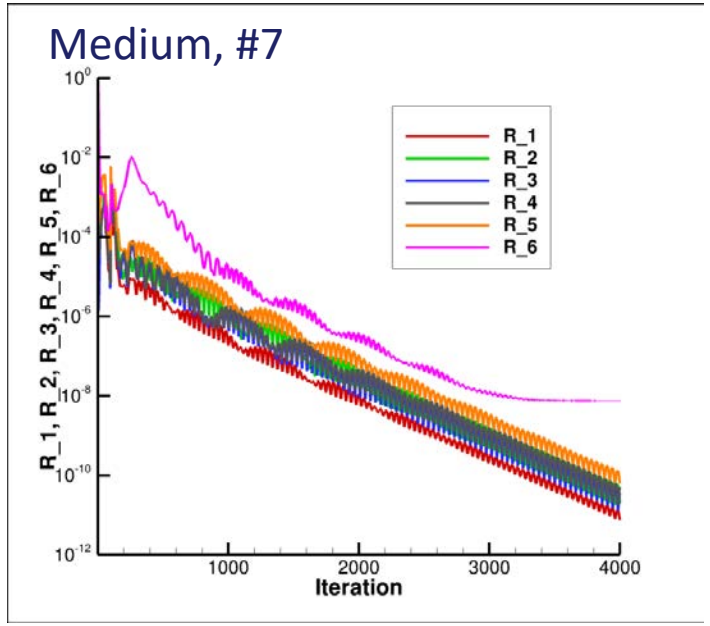
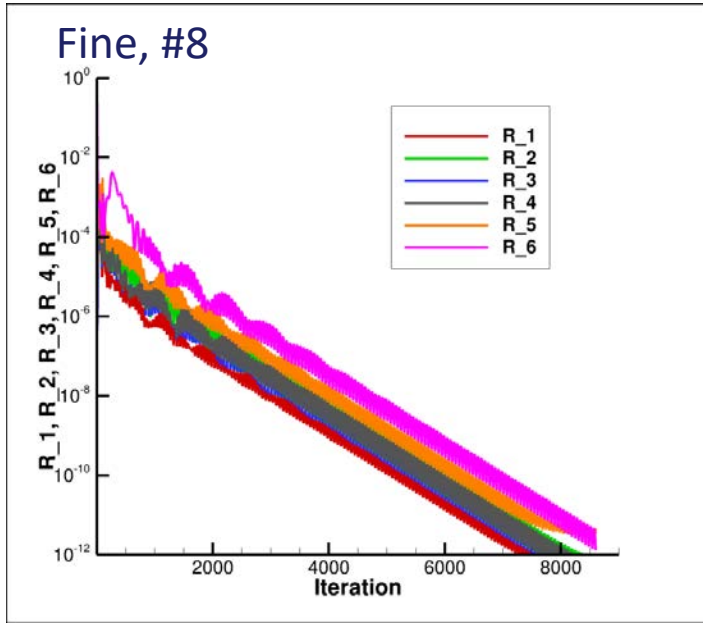
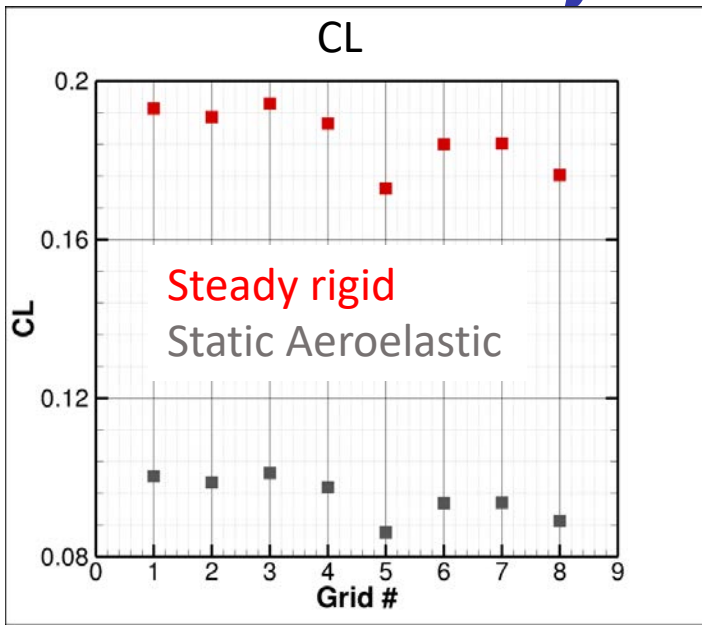
Energy
Turbulence

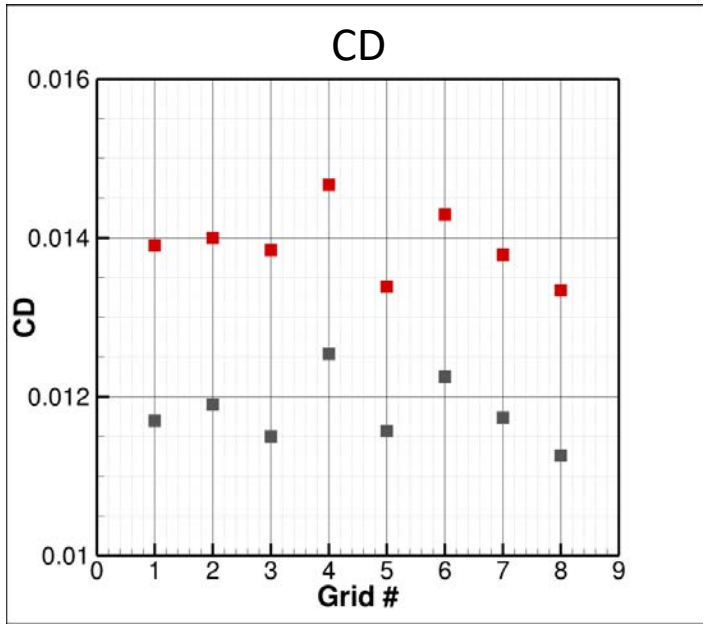


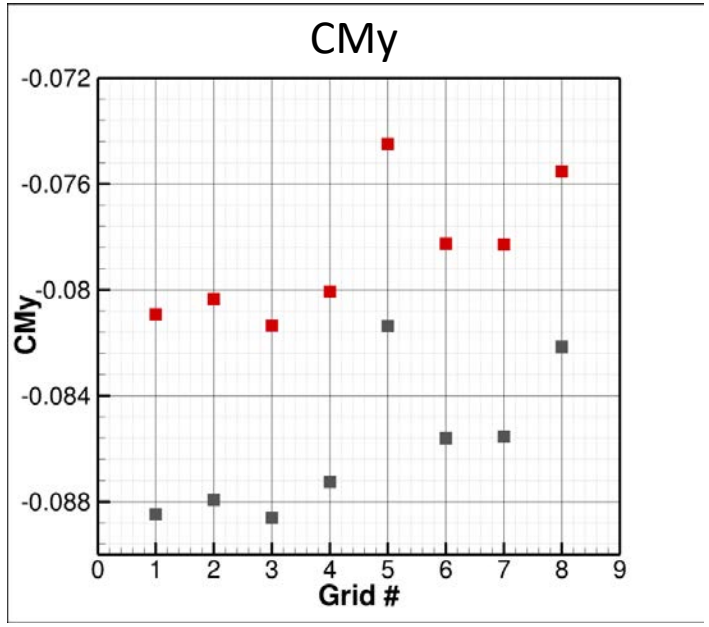


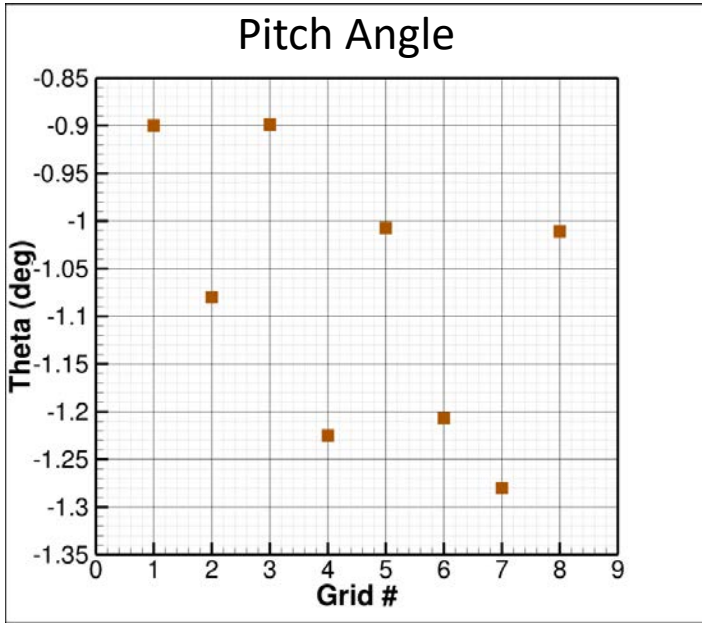
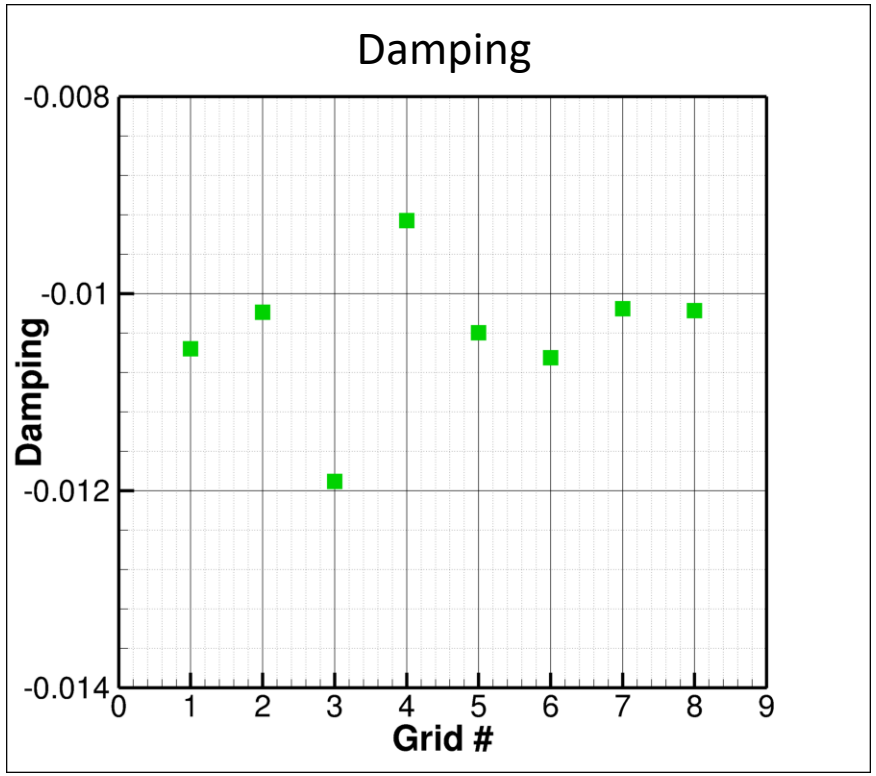
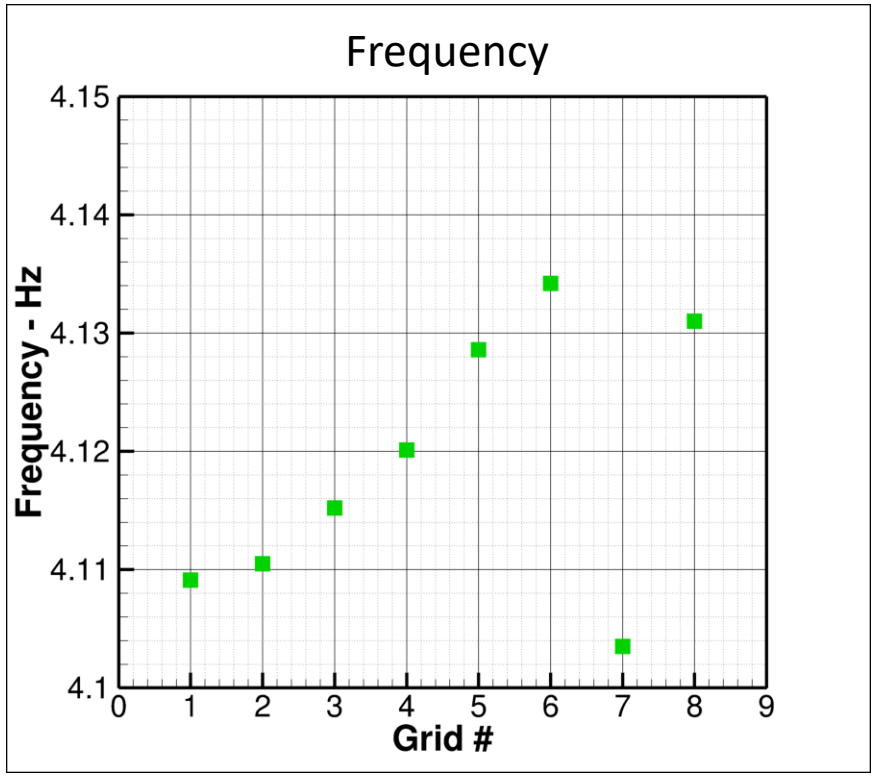


Unforced Steady and Static Aeroelastic Aerodynamic Coefficients









Dynamic Aeroelastic Results