

Sixth High-Lift Prediction Workshop (HLPW-6)

RANS Technical Focus Group (TFG)

Boris Diskin and Mike Park

July 1, 2026

Schedules and Deadlines

June 11, 2026:

Mini-workshop 1: Preliminary RANS solutions for TC1;
comparison with SRS TC1 solutions

January 2027:

Mini-workshop 2: Updated RANS solutions for TC1;

Comparison with experiment

Geometric variations of TC1, first application of lessons learned to TC2,
RANS model modifications

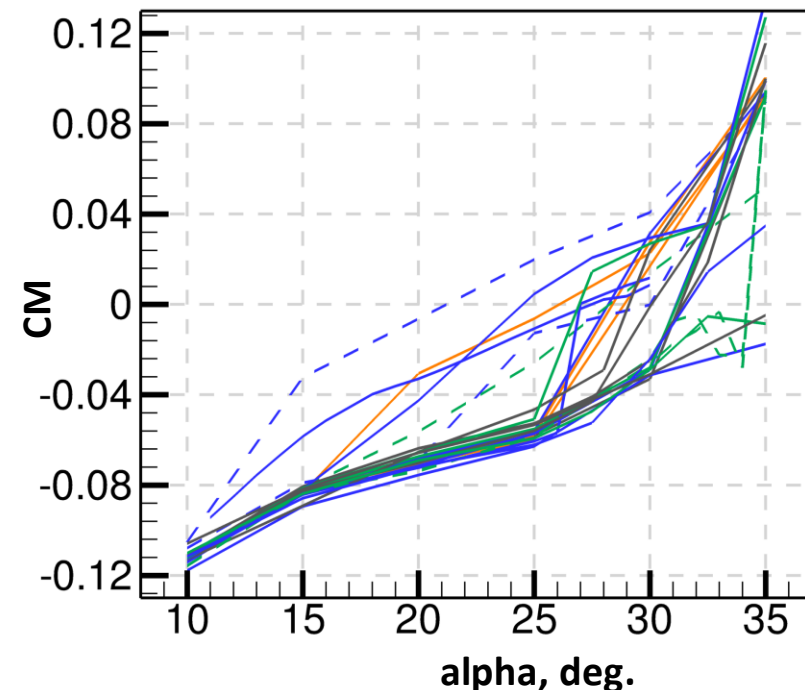
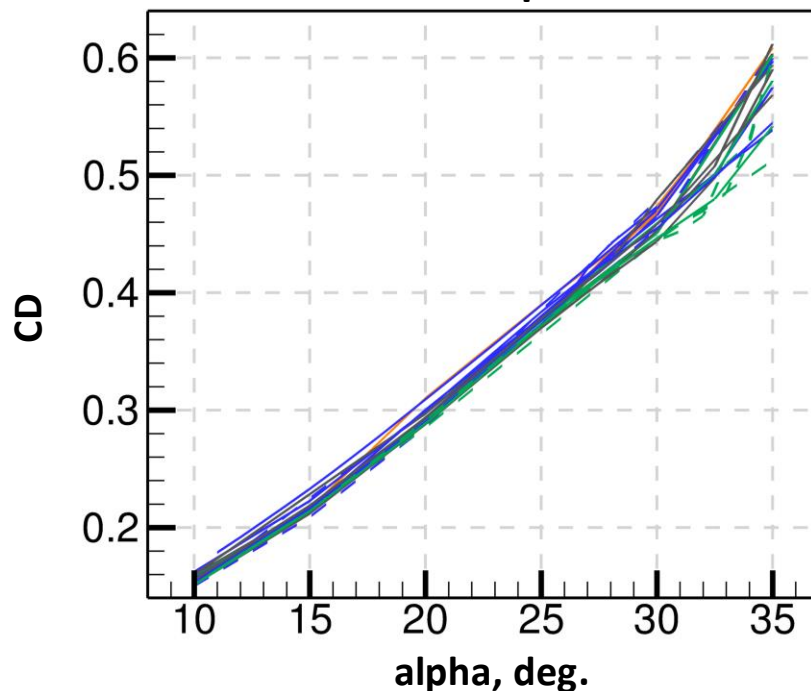
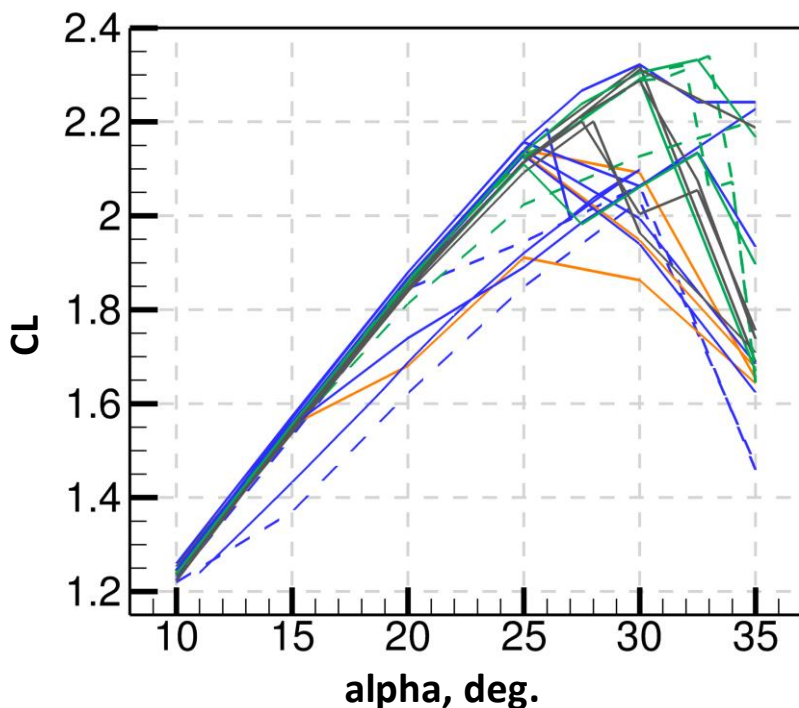
June 2027:

HLPW-6: RANS solutions for TC2 (Config 2.4); single Re,
limited number of angles of attack. Final report

January 2028:

HLPW-6 special sessions at SciTech-28

Forces and Moments – Nominal Grid All Participants



- 23** curves

All data sets uploaded by June 9th included

- Line style by turbulence model

[SA, SA-neg] = solid lines

[SST2003, SSTV2003, kw88, SA-R, SA-R23] = dashed lines

- Color by grid family:

R.1.TC1.01 = blue

R.1.TC1.02 = red

R.1.TC1.03 = green

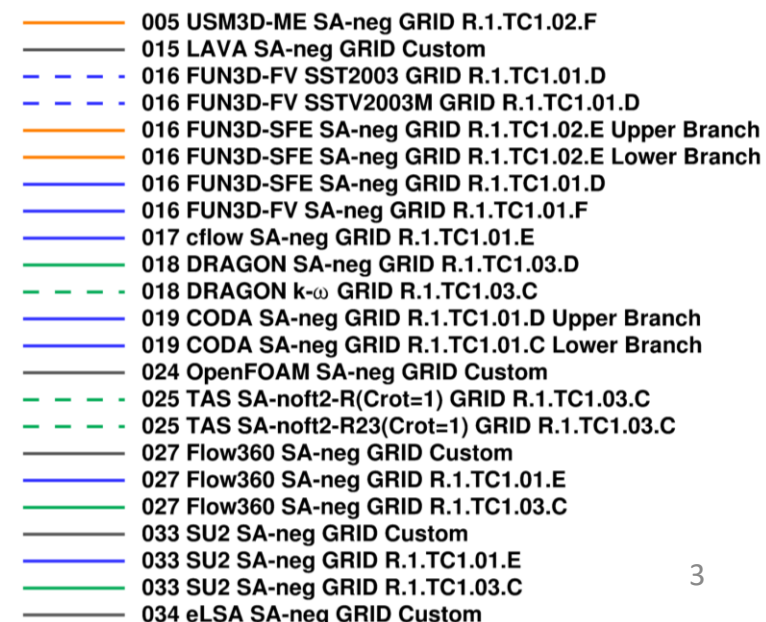
Custom = black

Large spread may reflect multiple solutions

Without outliers:

$$2.13 \leq CL_{\max} \leq 2.35;$$

$$25^\circ \leq \alpha \leq 35^\circ$$



Branch Map

High-Lift Branch

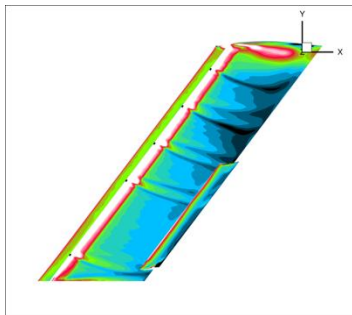
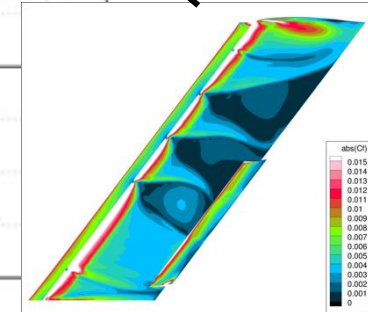
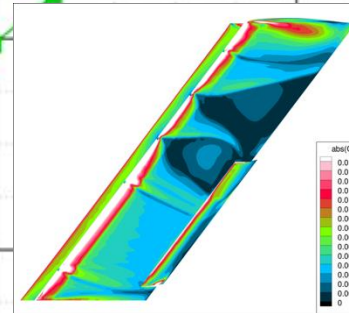
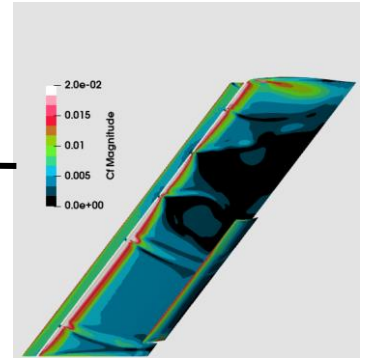
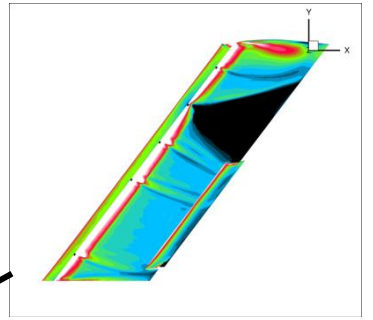
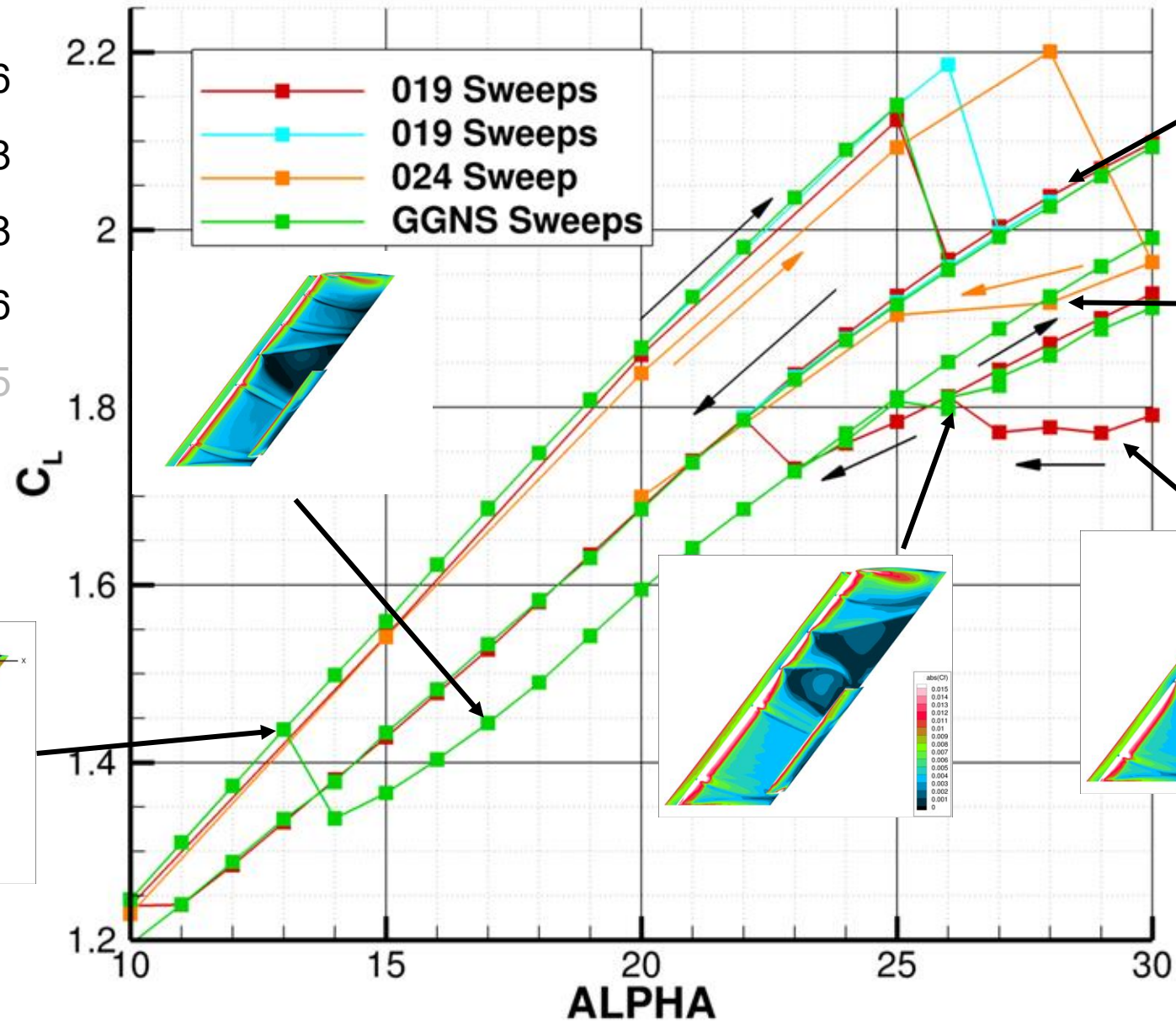
$\alpha = 10^\circ$ $1.22 < CL < 1.26$

$\alpha = 15^\circ$ $1.54 < CL < 1.58$

$\alpha = 20^\circ$ $1.83 < CL < 1.88$

$\alpha = 25^\circ$ $2.07 < CL < 2.16$

$\alpha = 30^\circ$ $2.25 < CL < 2.35$



Selected RANS Solution from High-Lift Branch

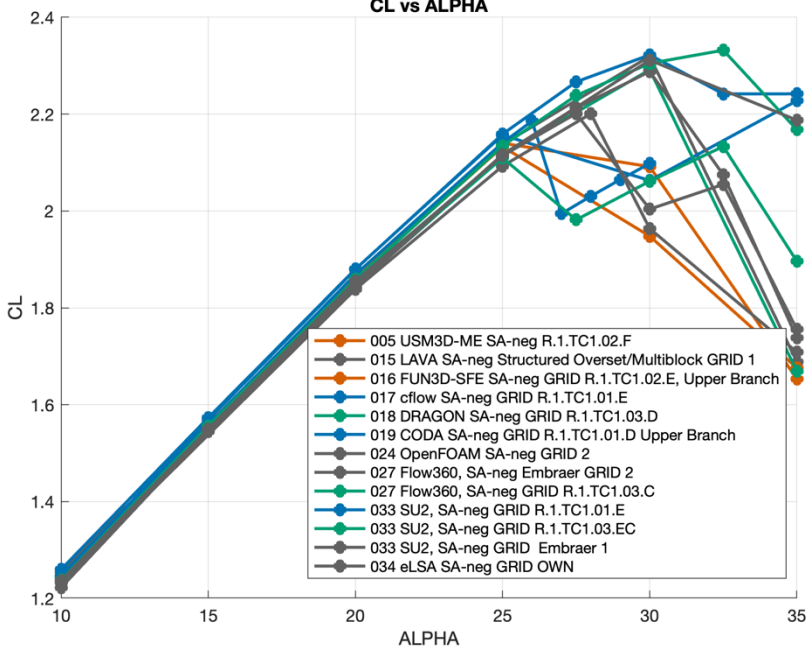
- **Selection Criteria**

- Submitted TC1 solution set
- SA turbulence model
- High-lift branch for $\alpha = 10^\circ, 15^\circ, 20^\circ$, and 25°
- Established grid convergence for each angle of attack
 - ✓ At least 3 grids in a family
 - ✓ Nominal grid with at least 30M dofs
- Iterative convergence on each grid

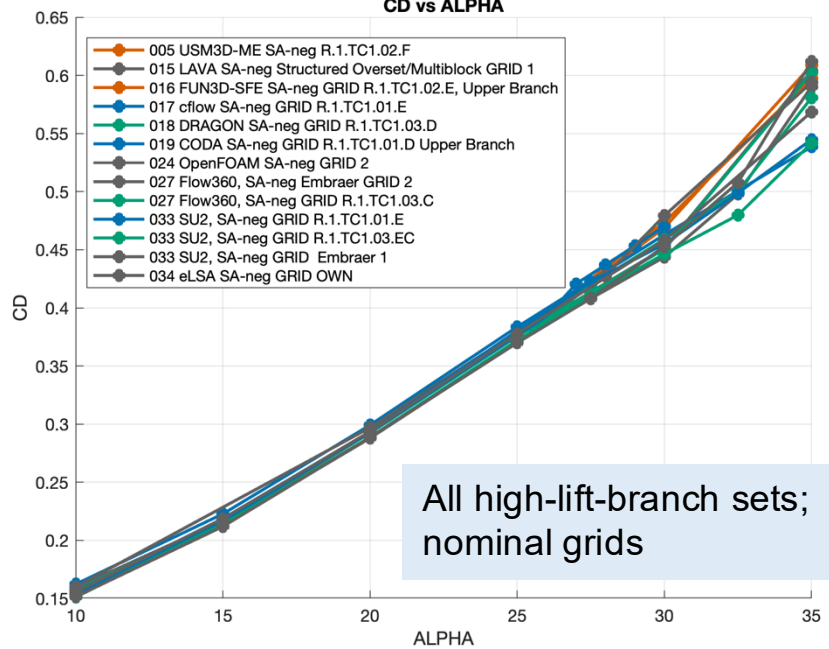
- **Selected Sets**

- 005 USM3D-ME, CC-FV, Nominal Grid: 1.R.TC1.02.F (323M cells)
- 016 FUN3D-SFE, NC-FE, Nominal Grid: 1.R.TC1.02.E (31M points)
- 018 DRAGON, CC-FV, Nominal Grid: R.1.TC1.03.D (237M cells)
- 019 CODA, CC-FV, Nominal Grid: R.1.TC1.01.D (38M cells)

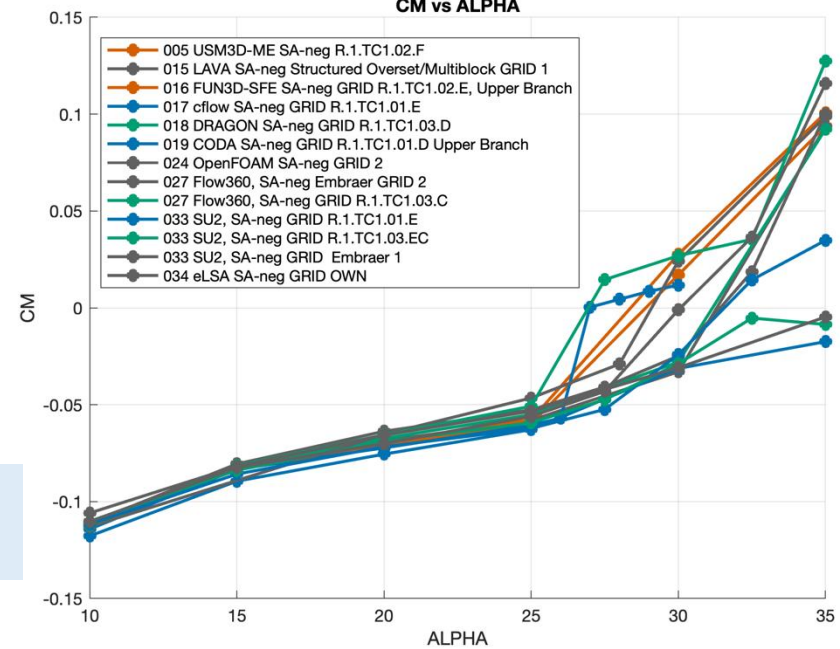
CL vs ALPHA



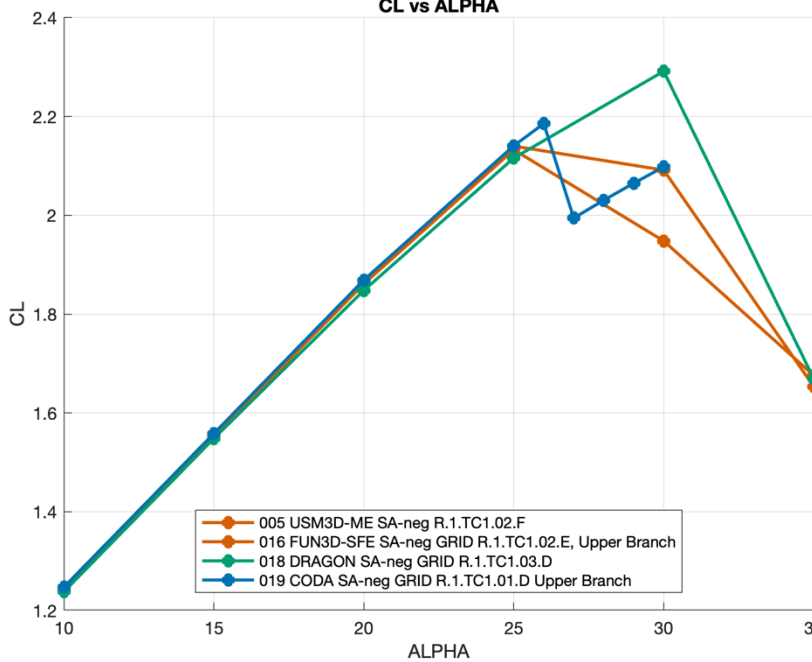
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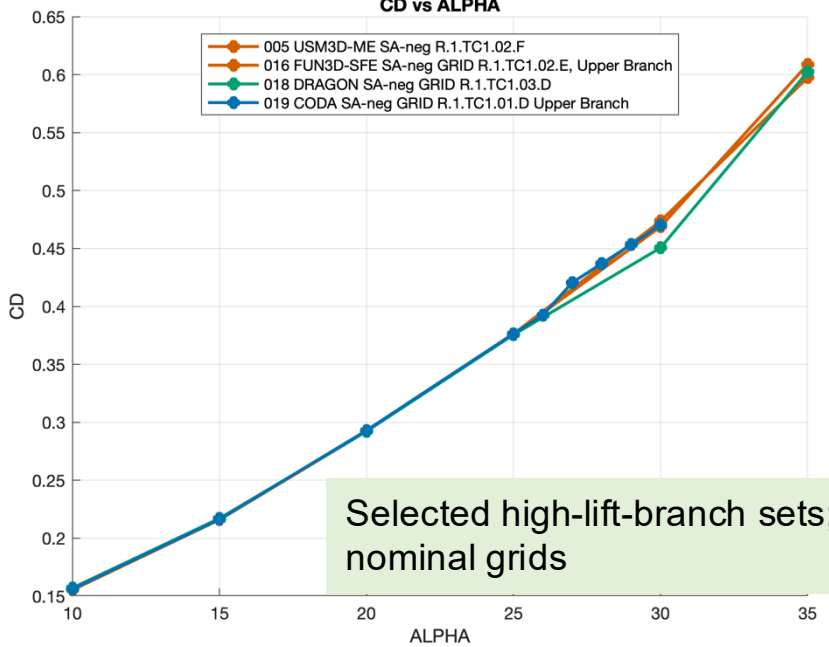
CM vs ALPHA



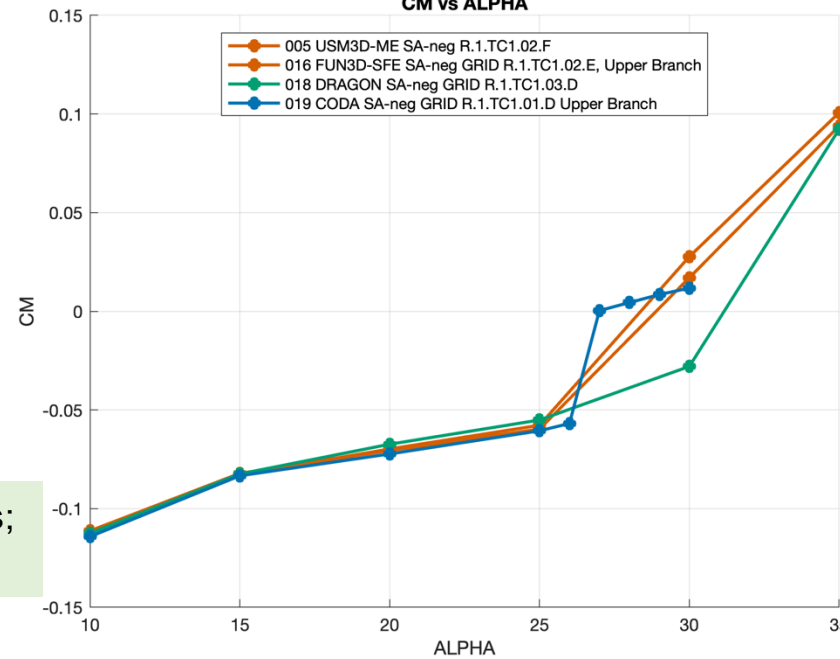
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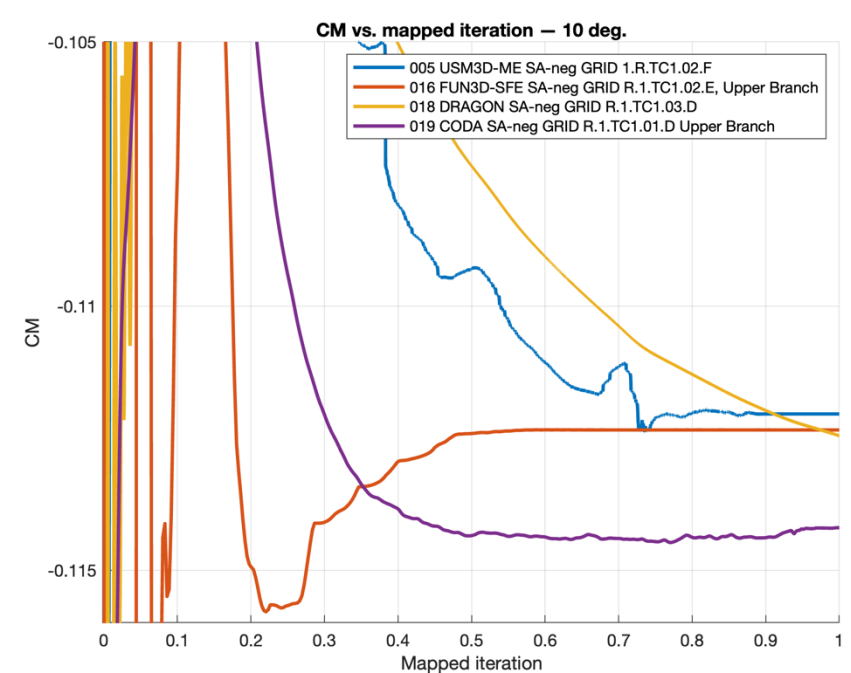
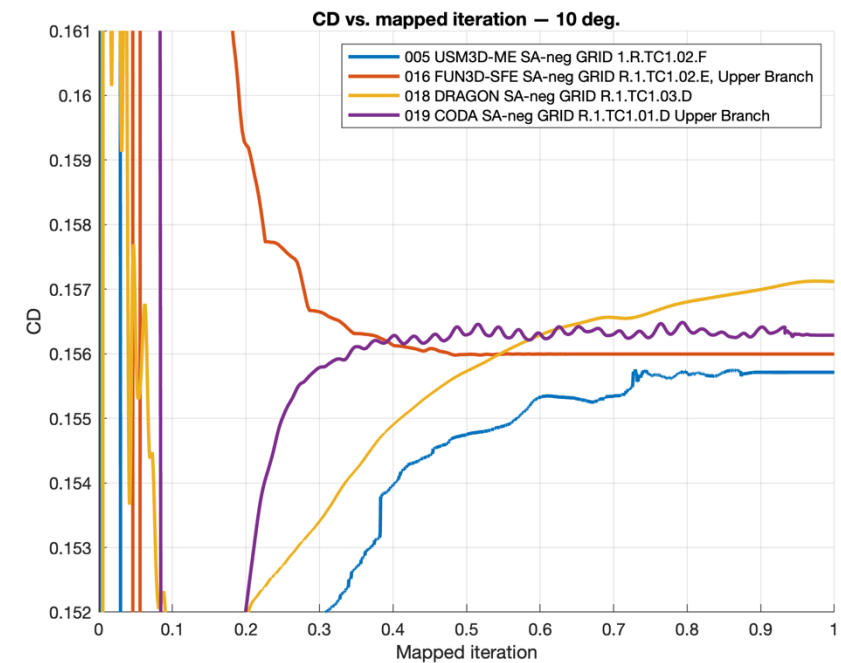
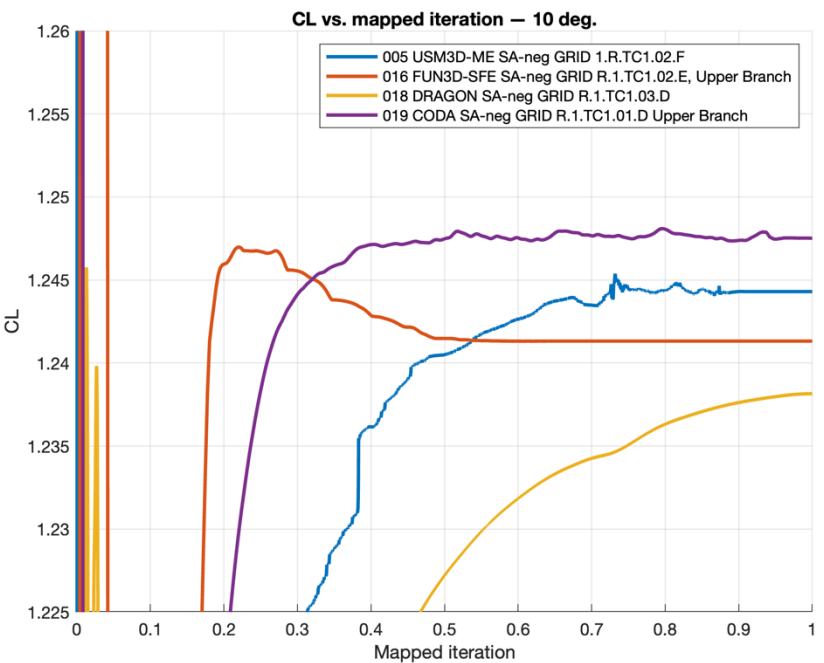
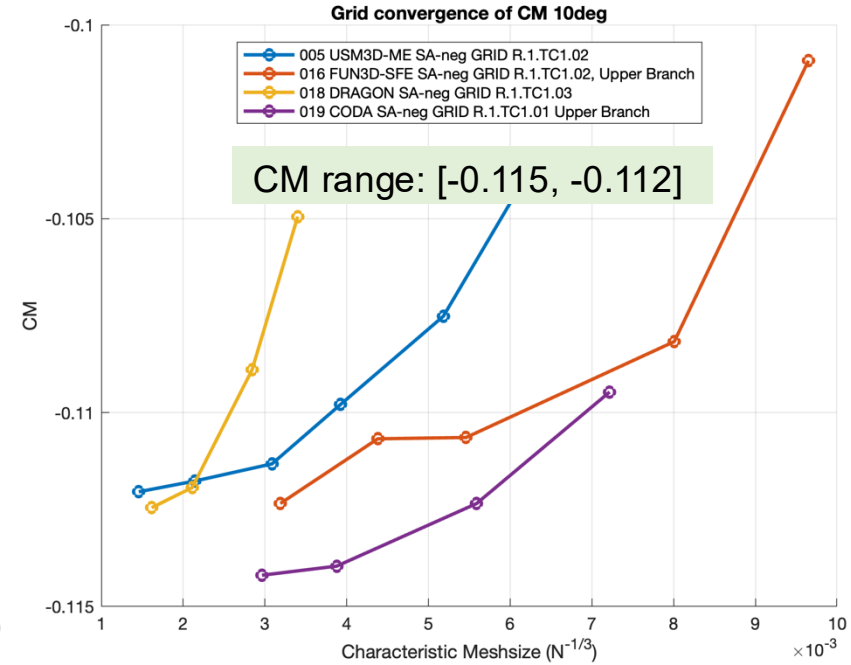
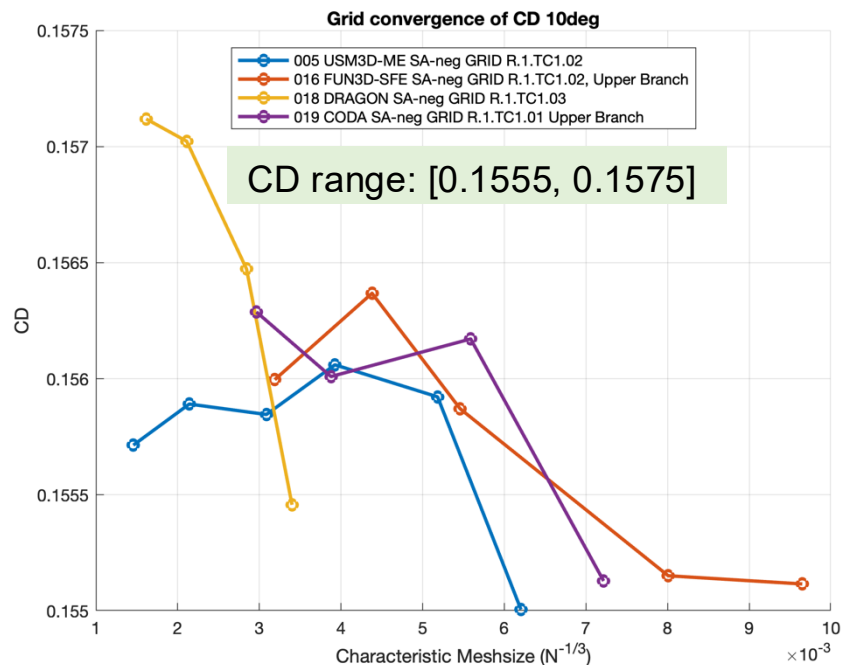
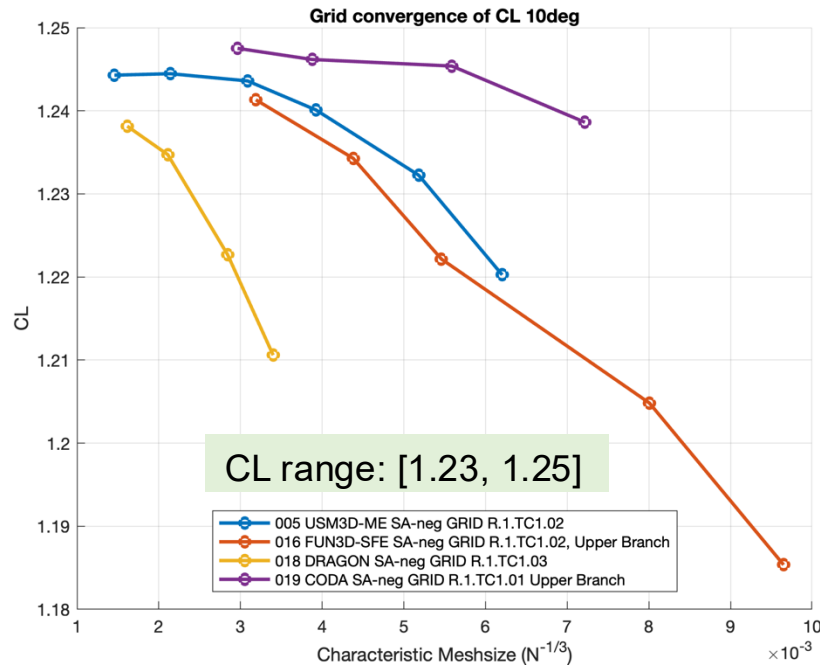
CD vs ALPHA

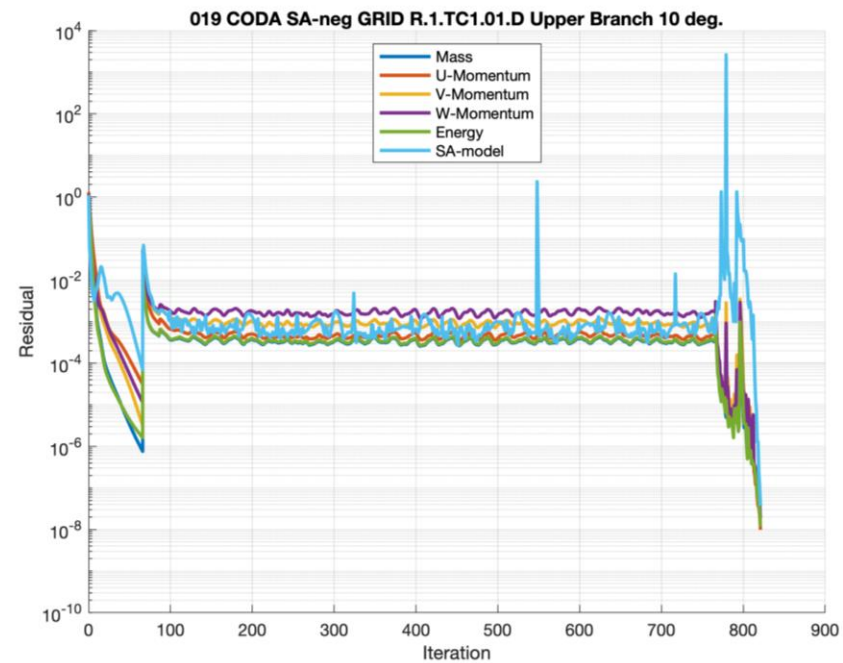
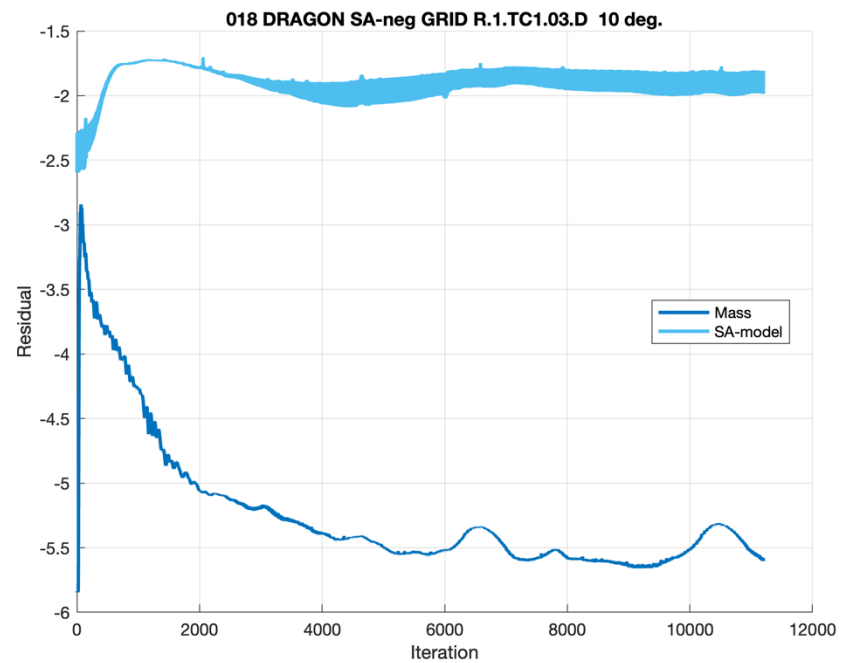
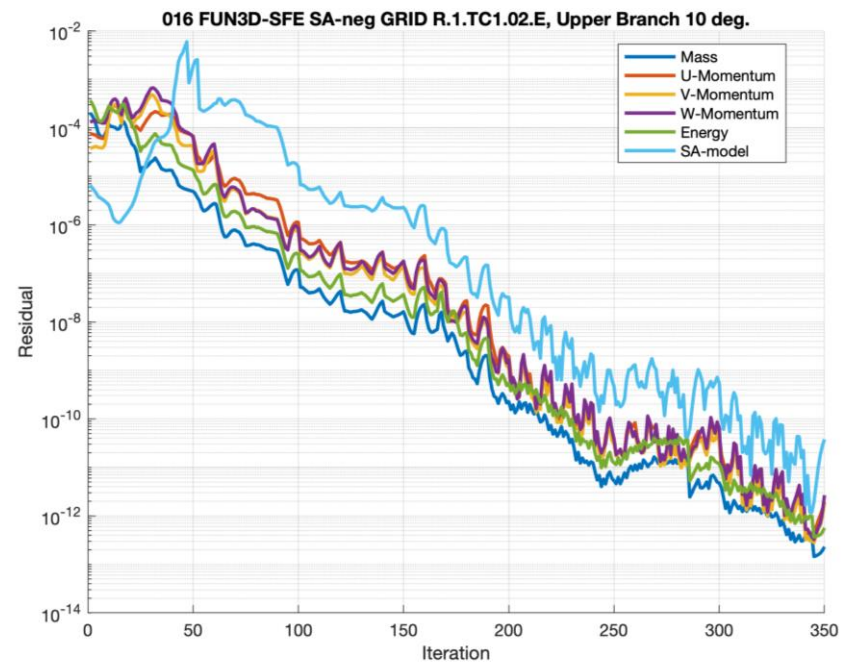
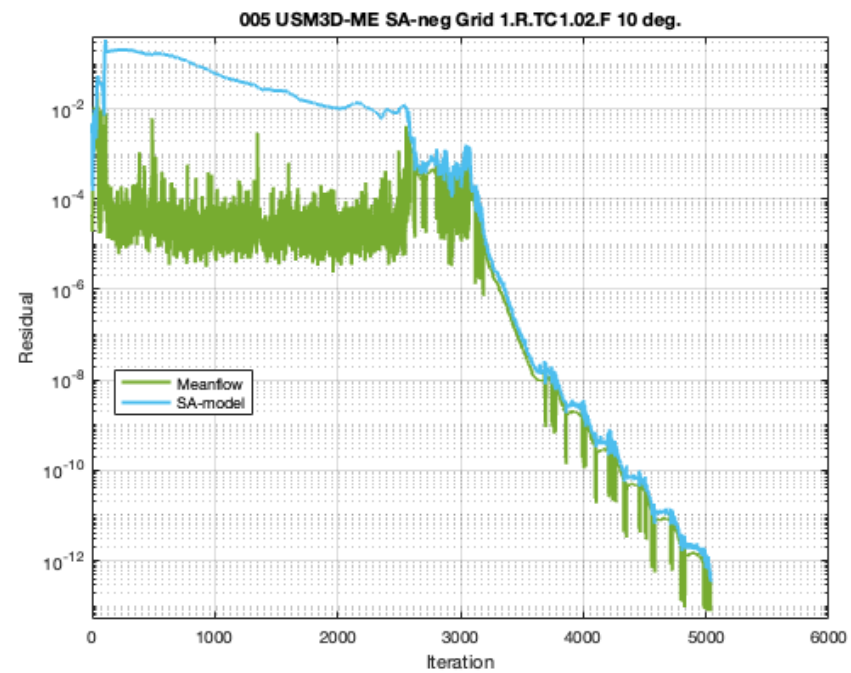


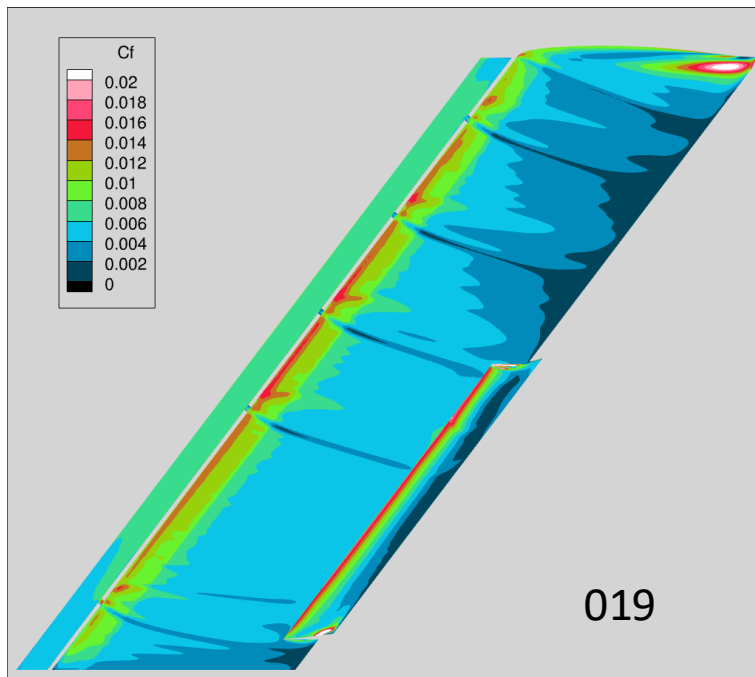
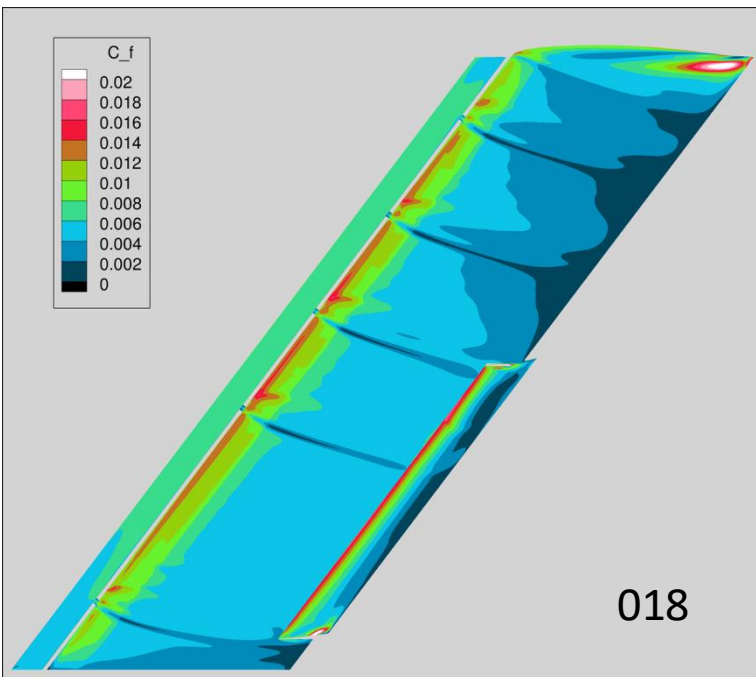
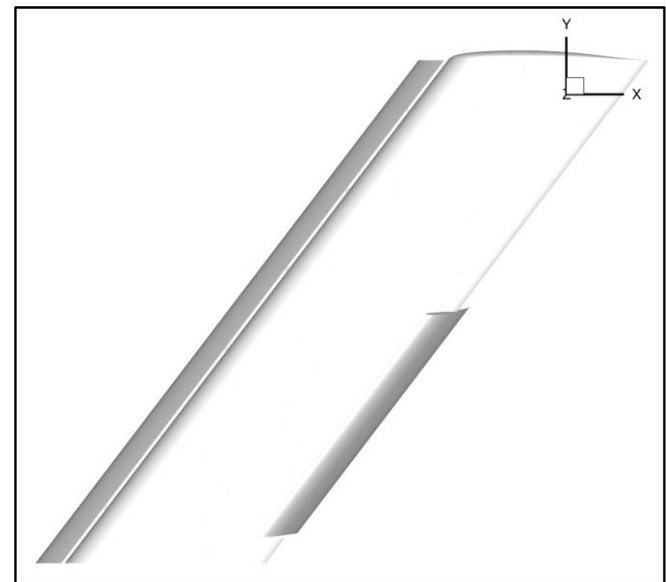
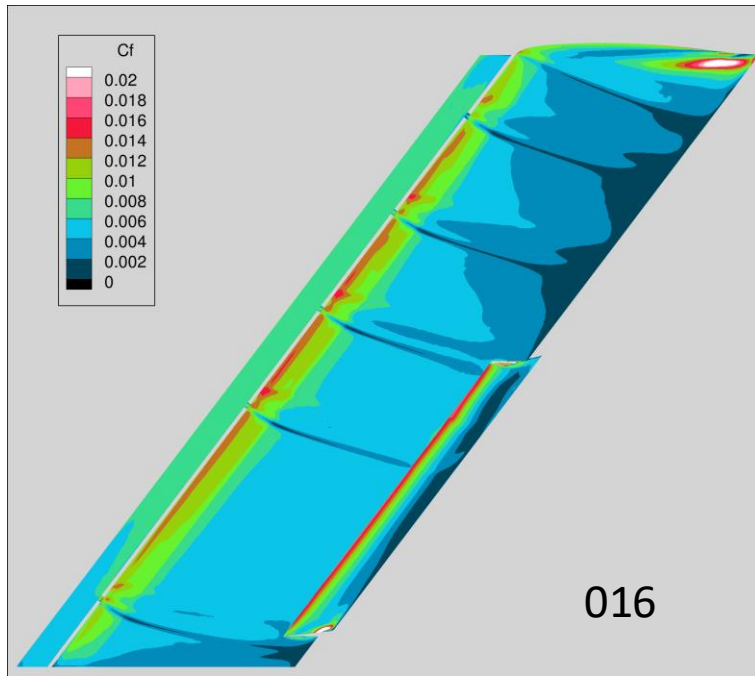
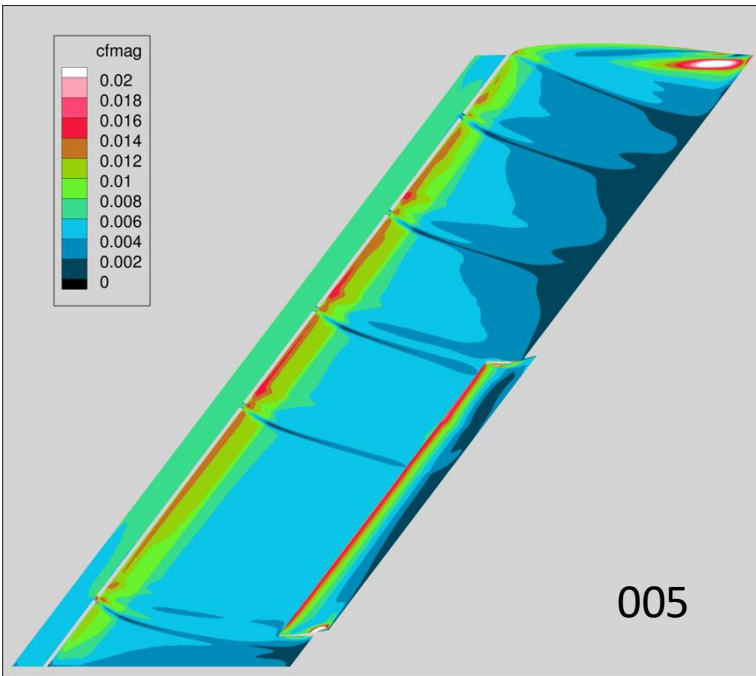
CM vs ALPHA

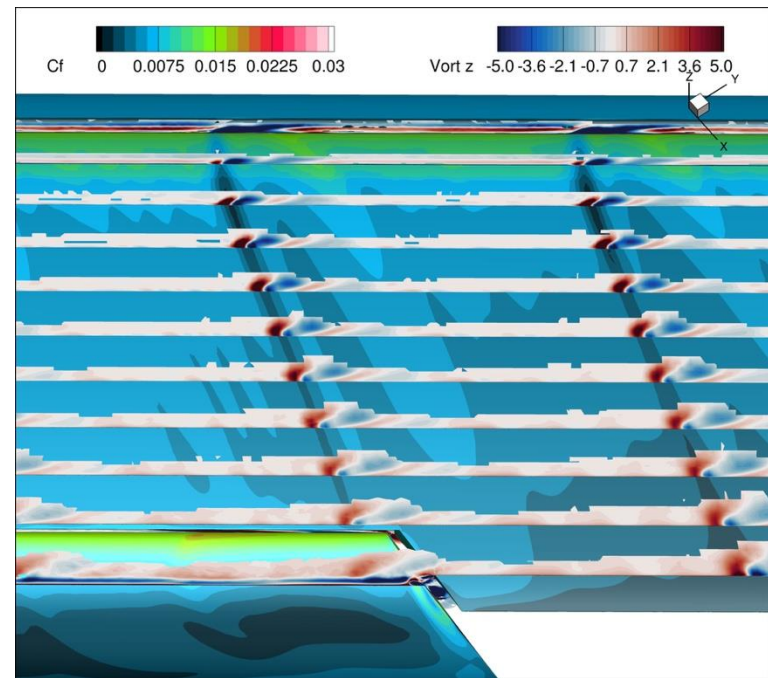
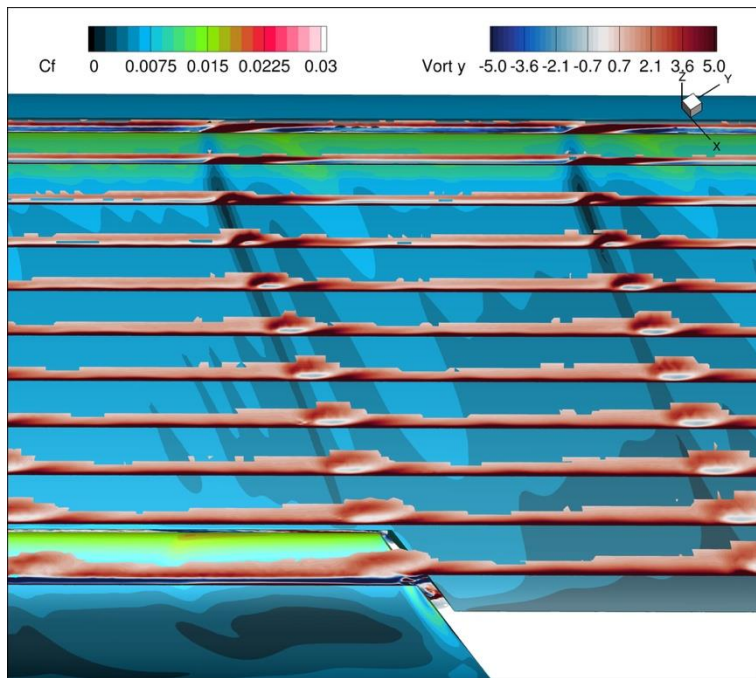
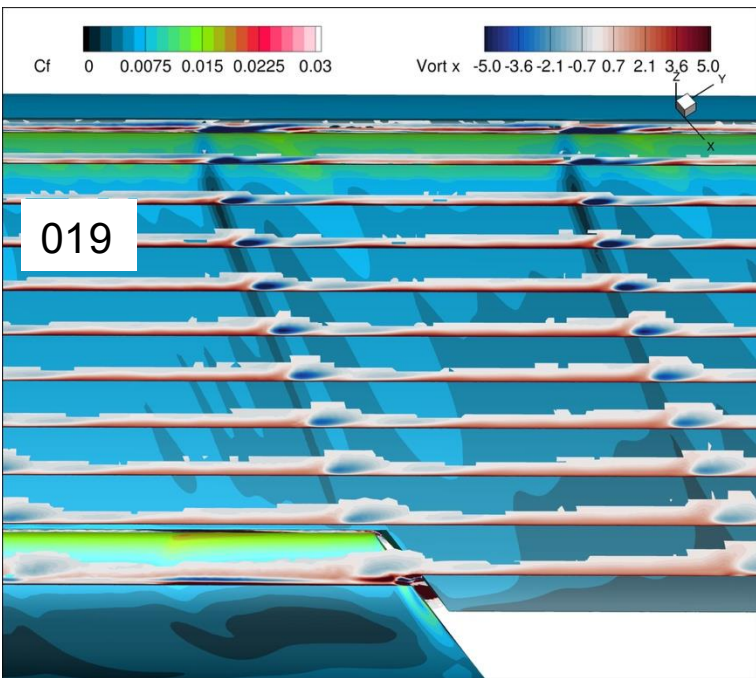
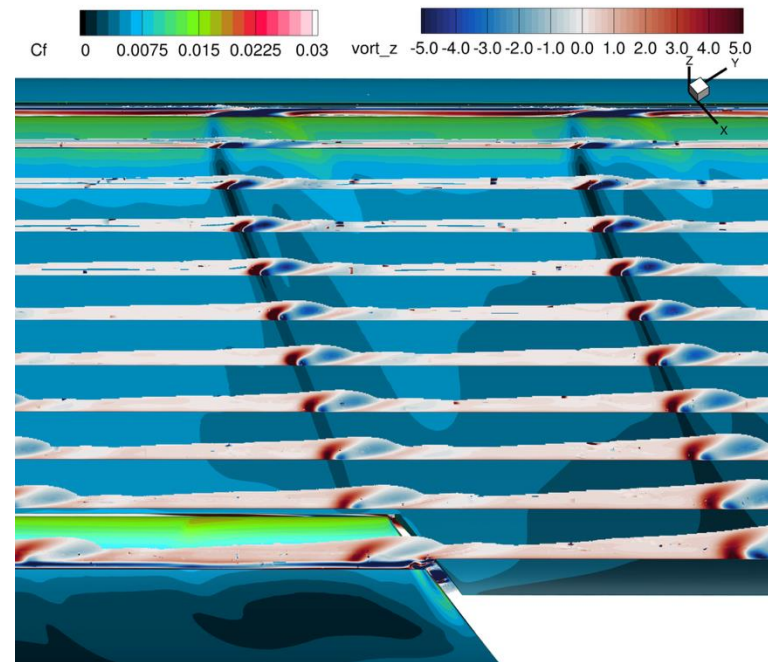
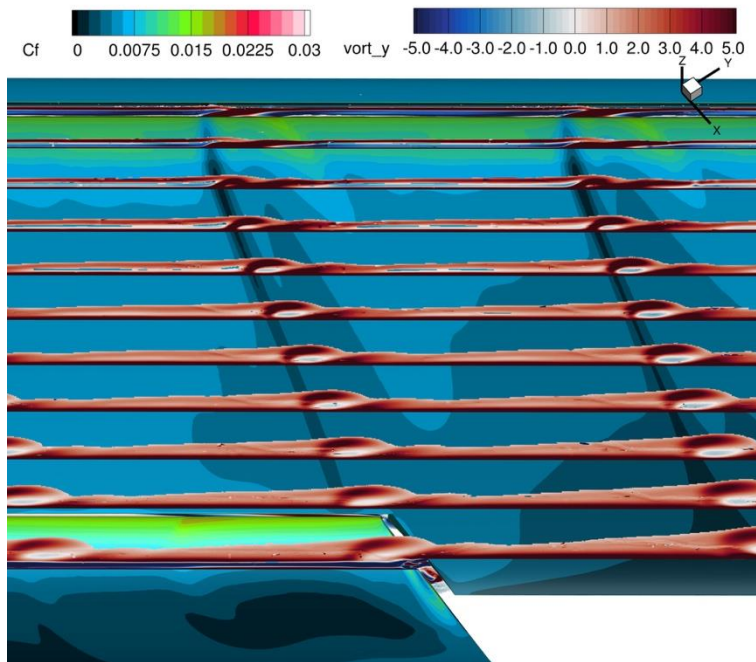
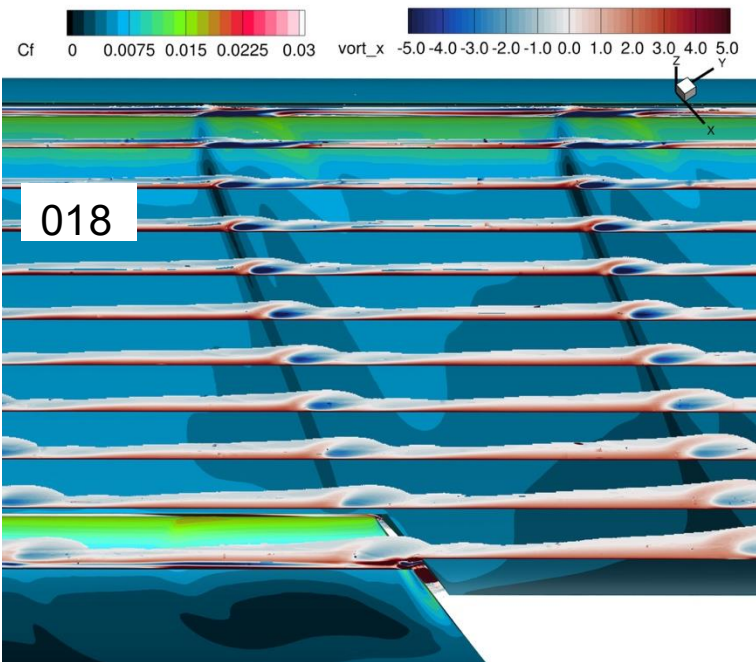


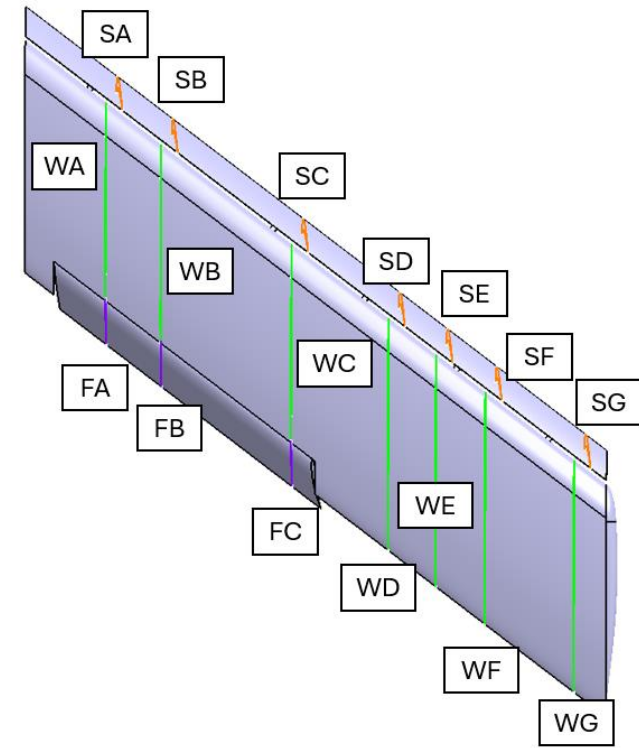
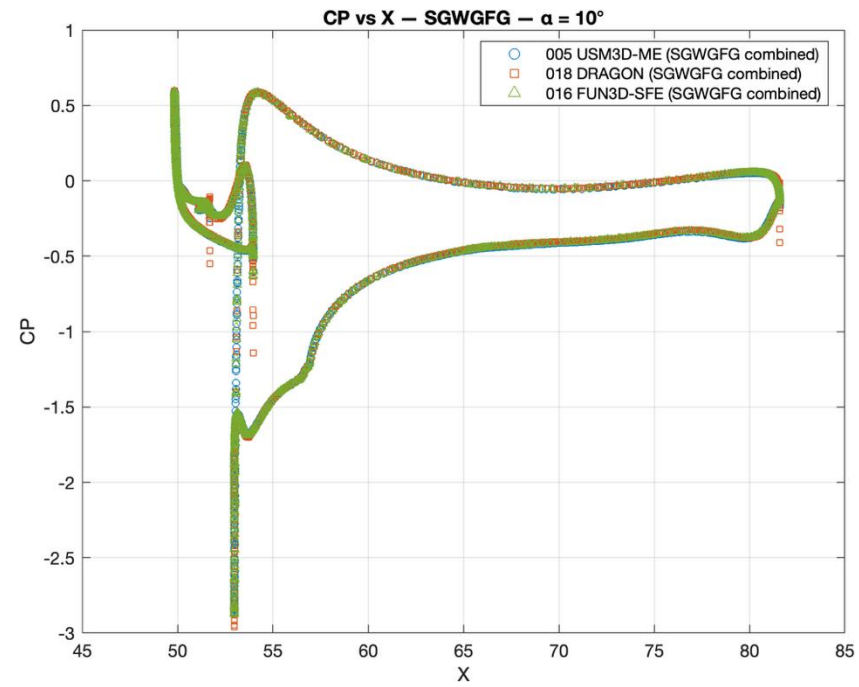
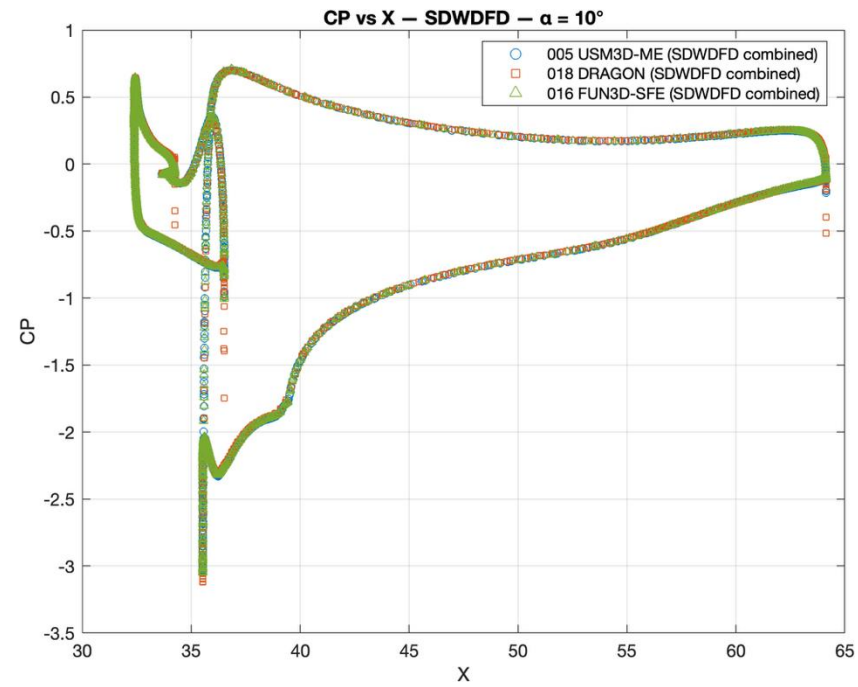
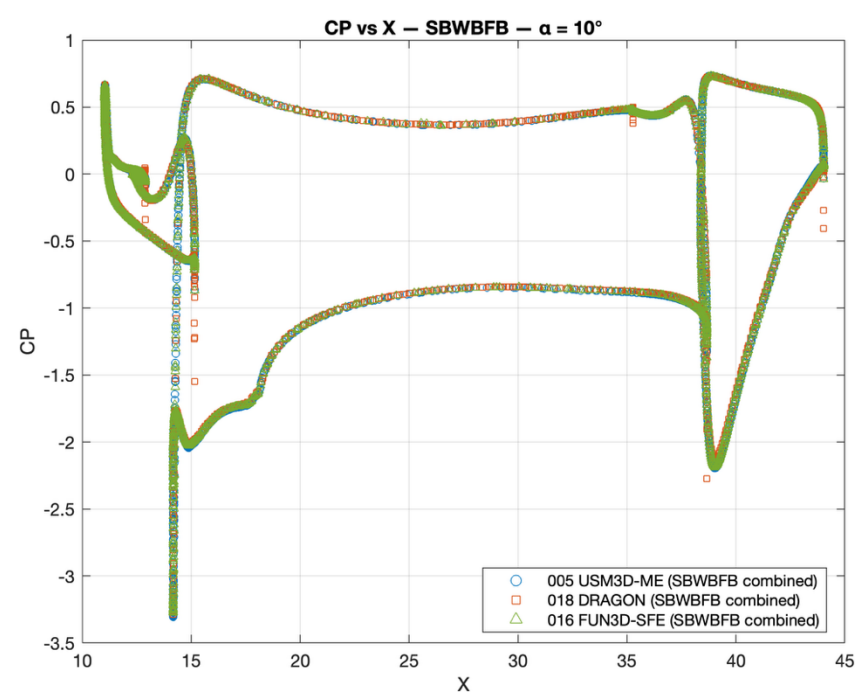
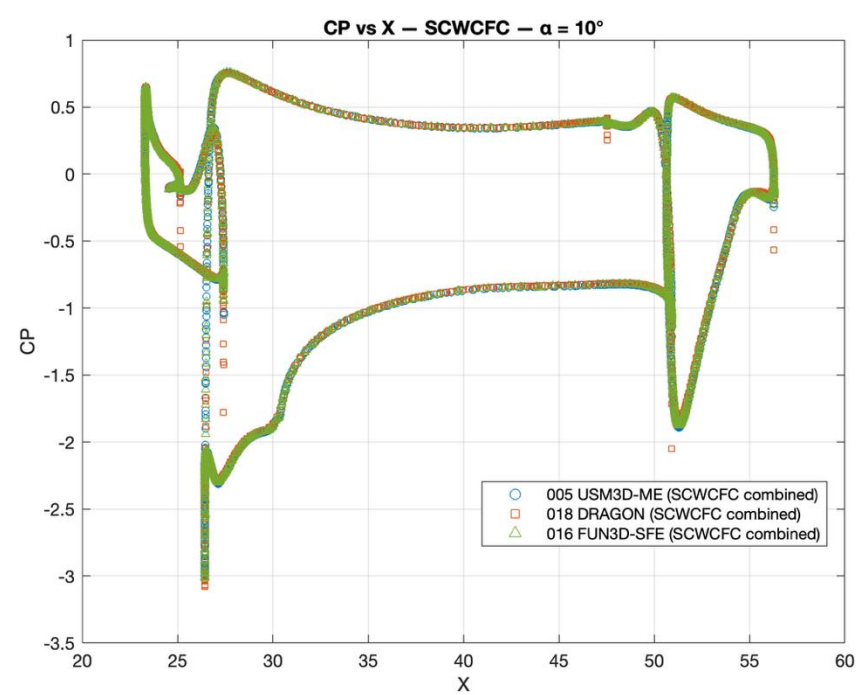
$$\alpha = 10^\circ$$

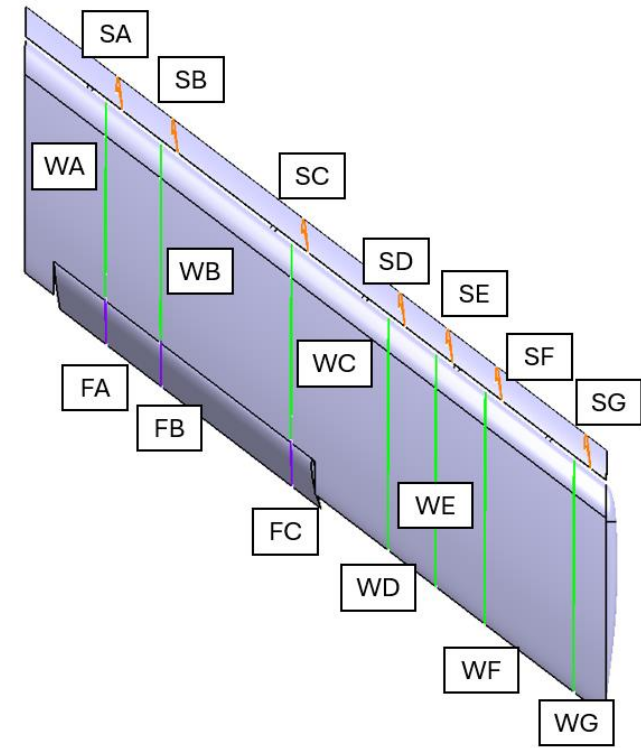
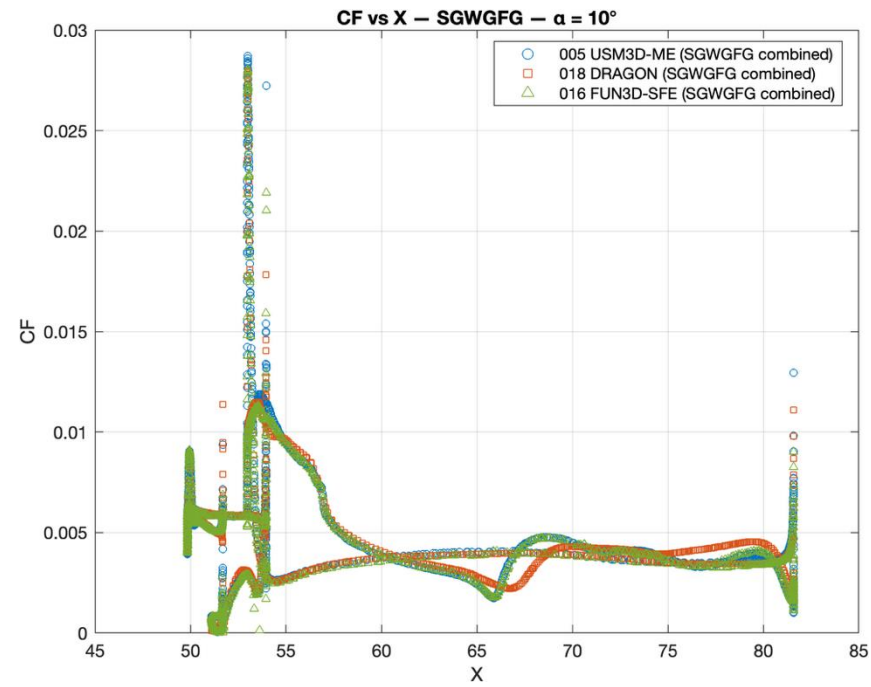
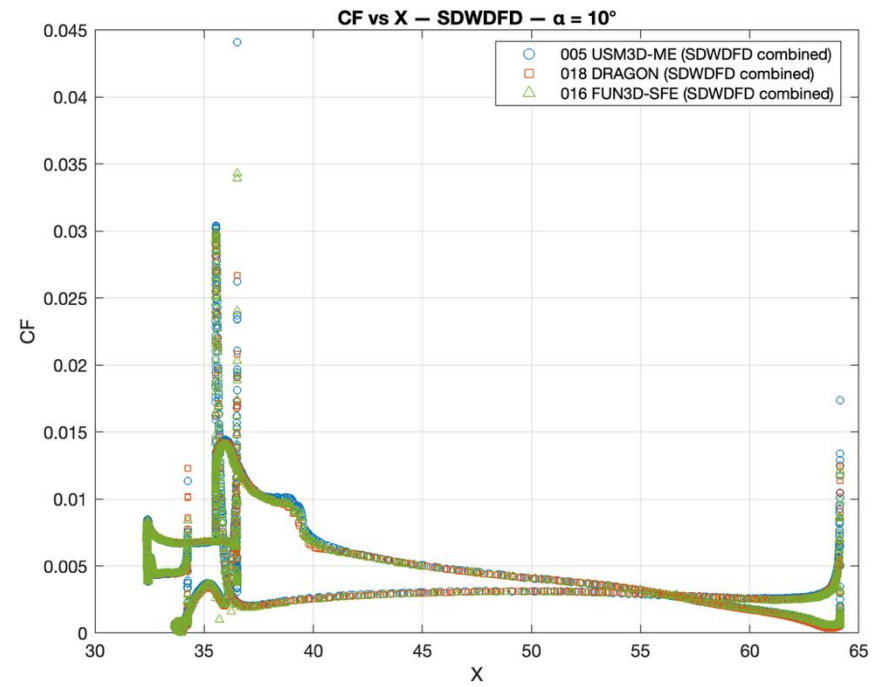
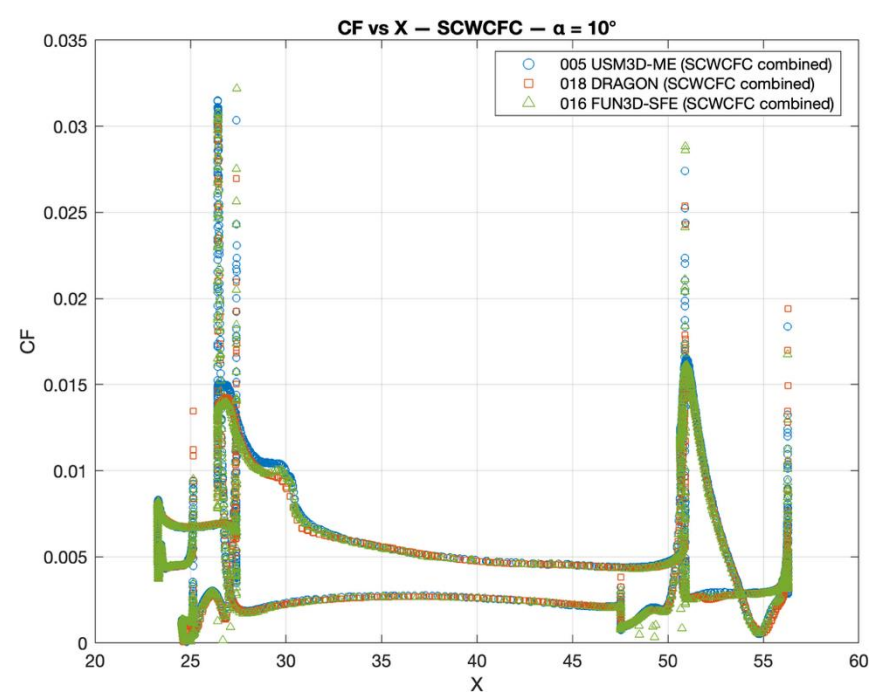
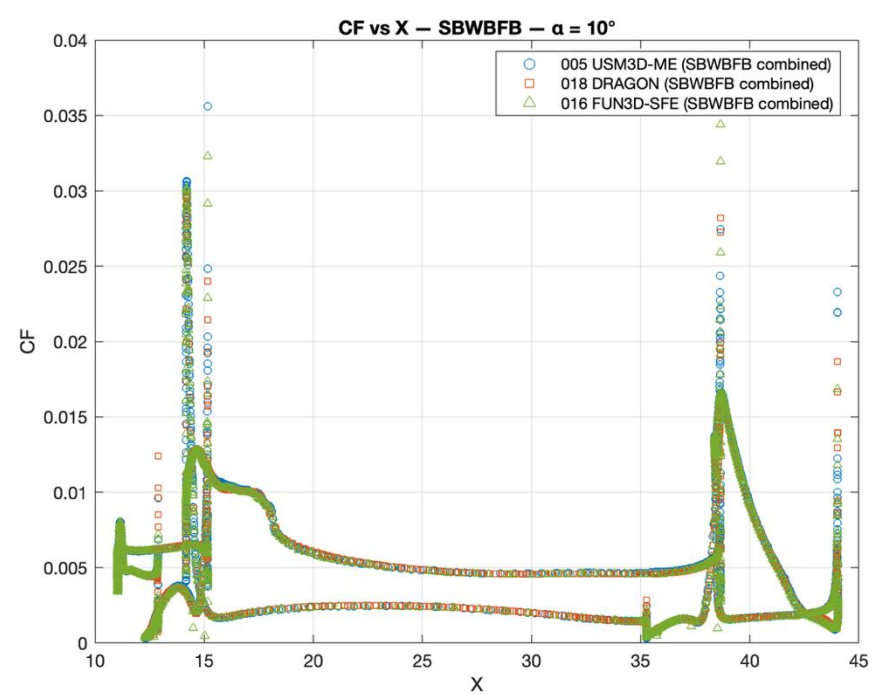


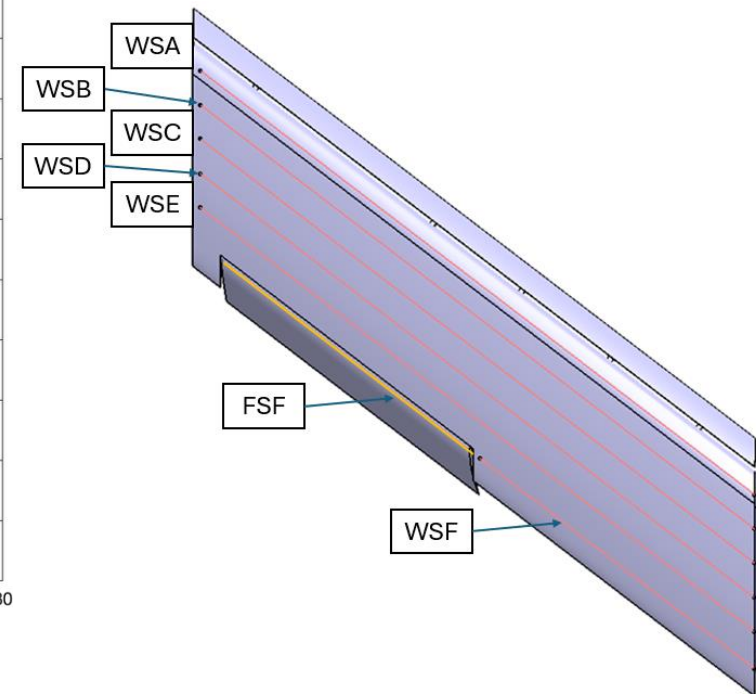
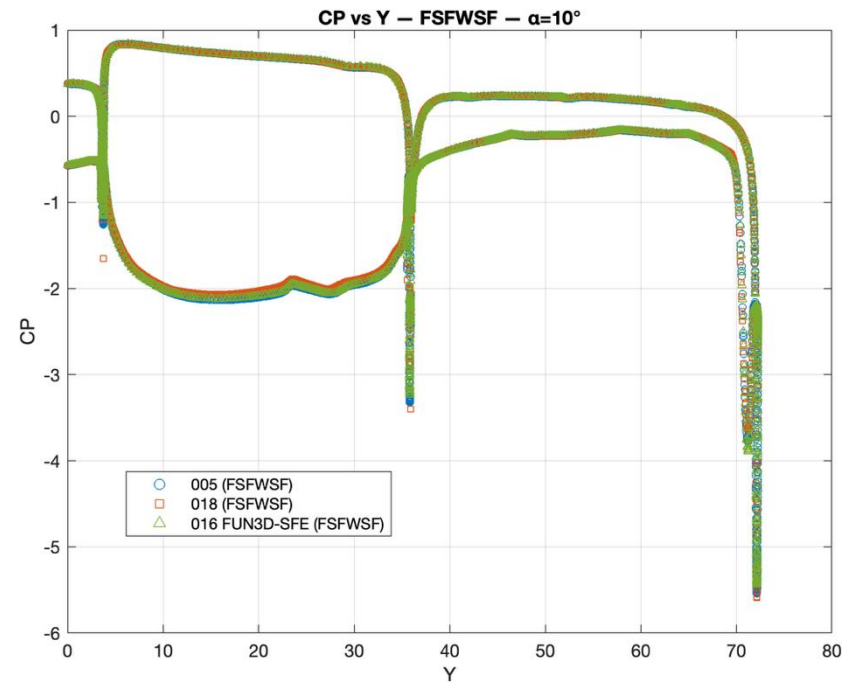
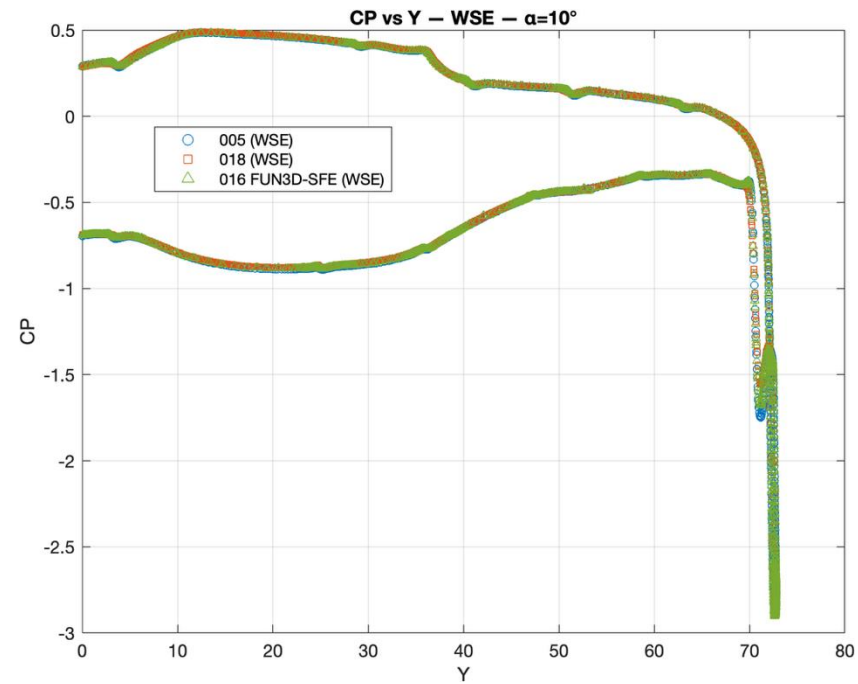
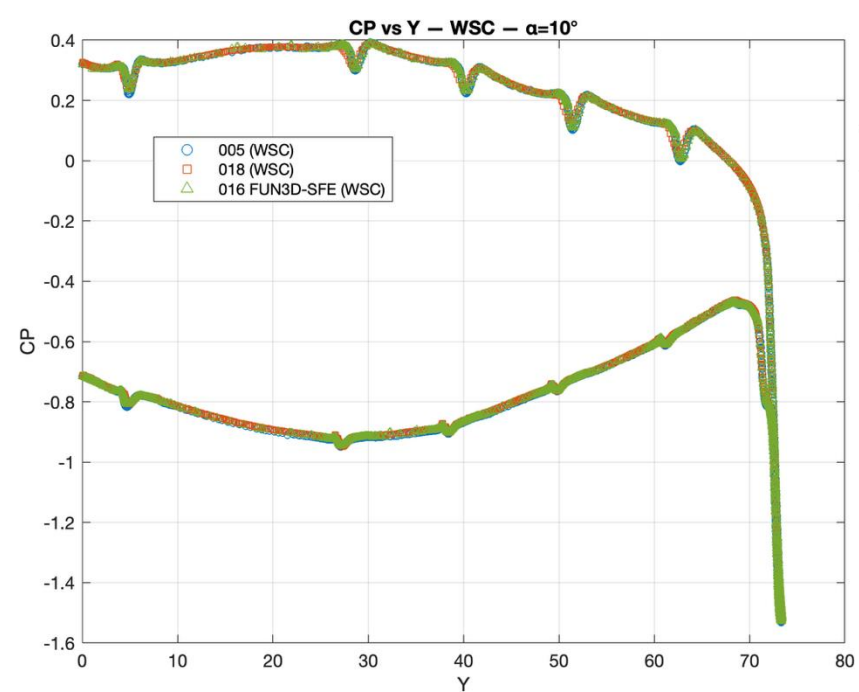
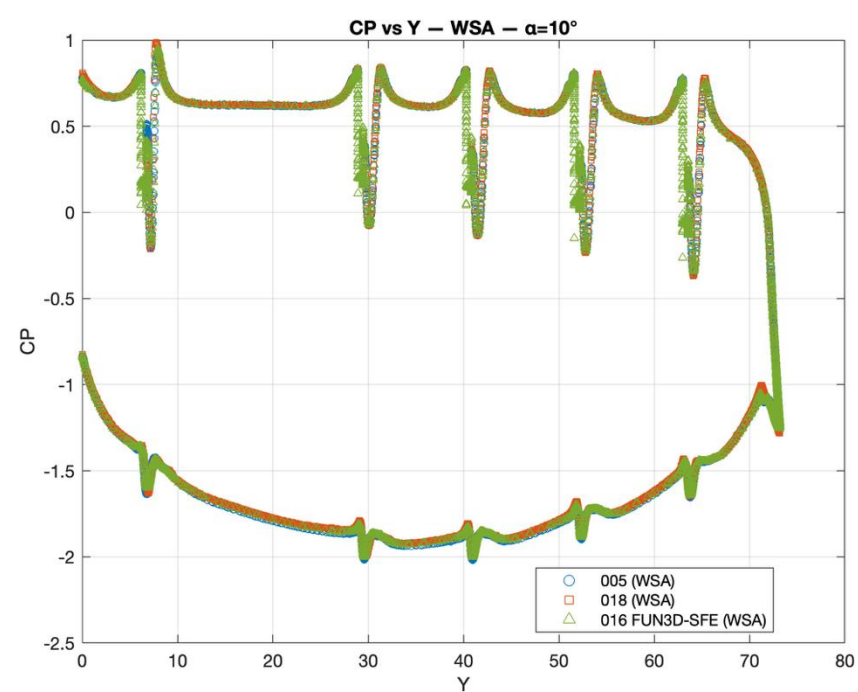


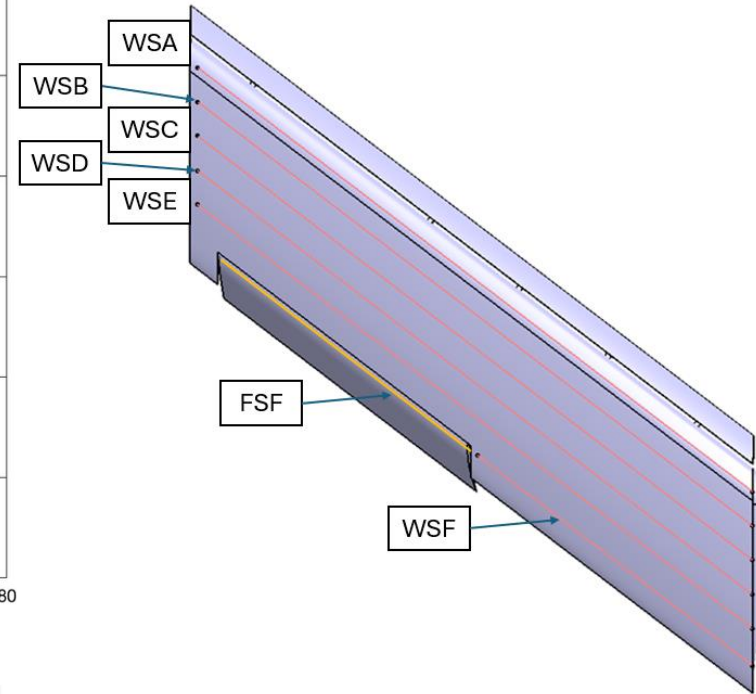
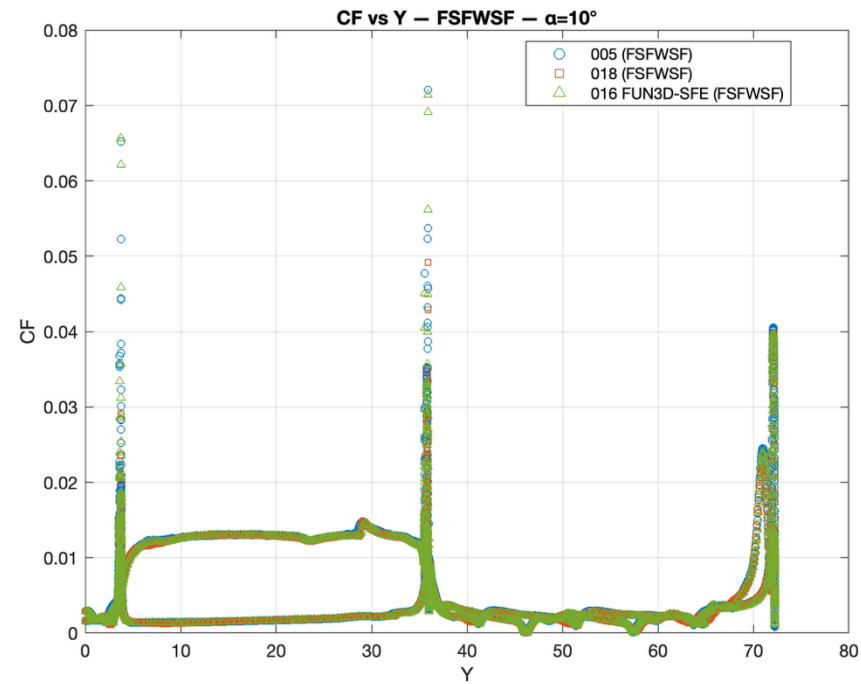
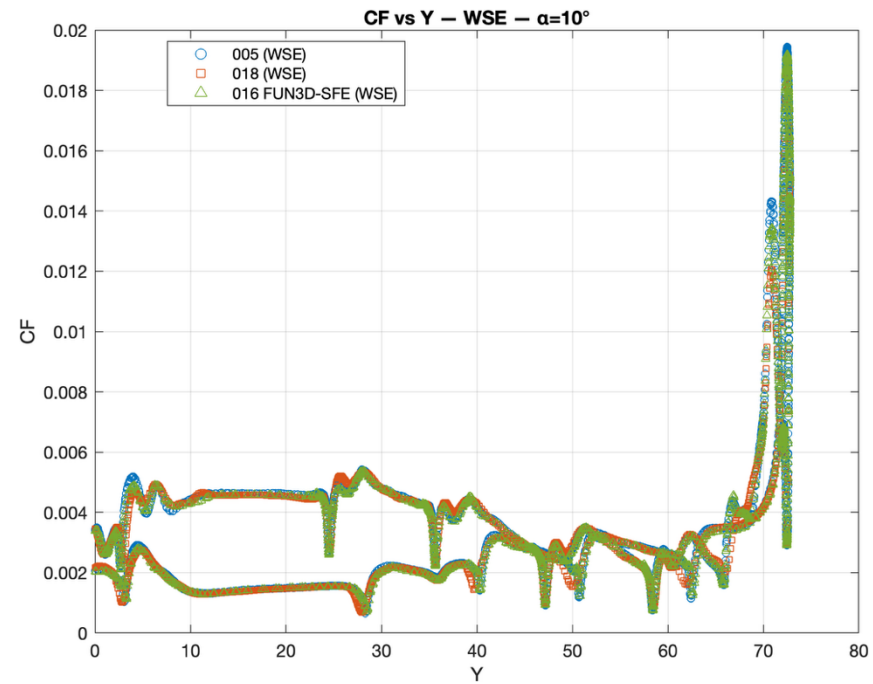
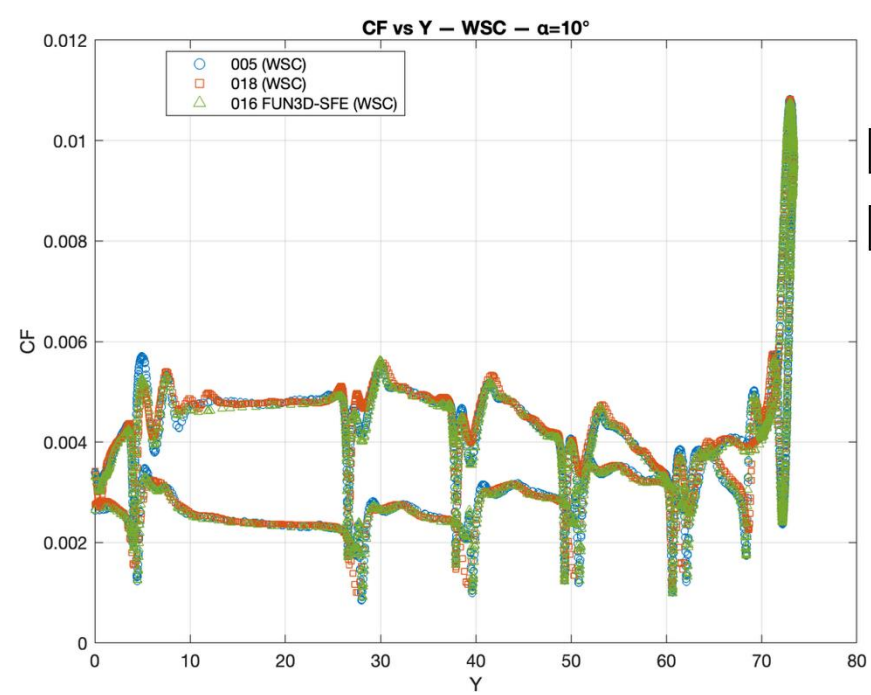
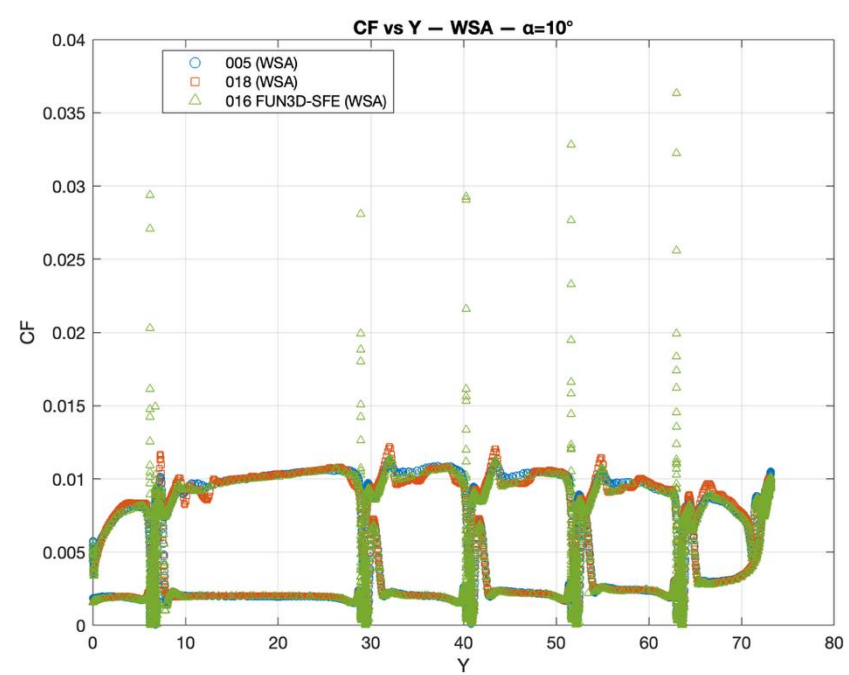




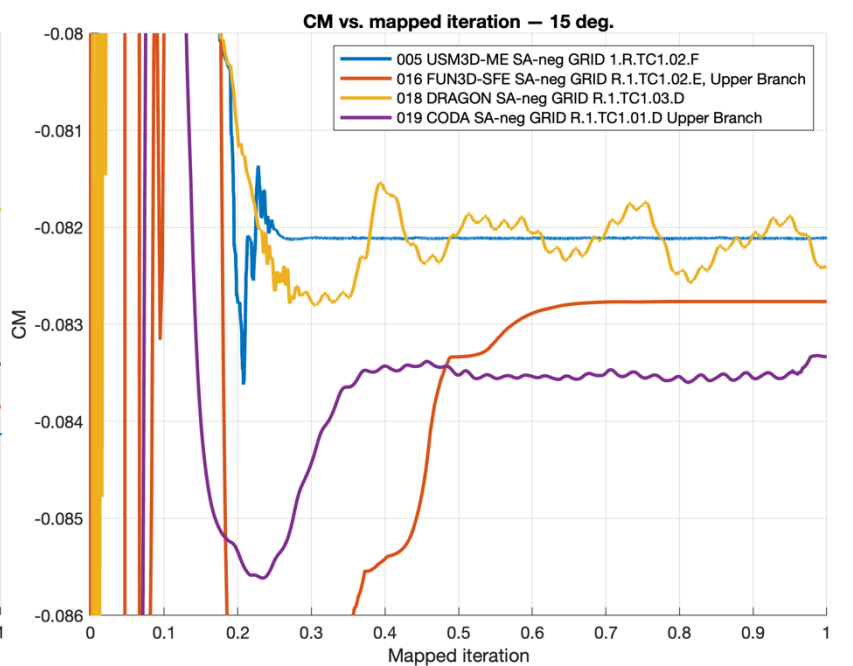
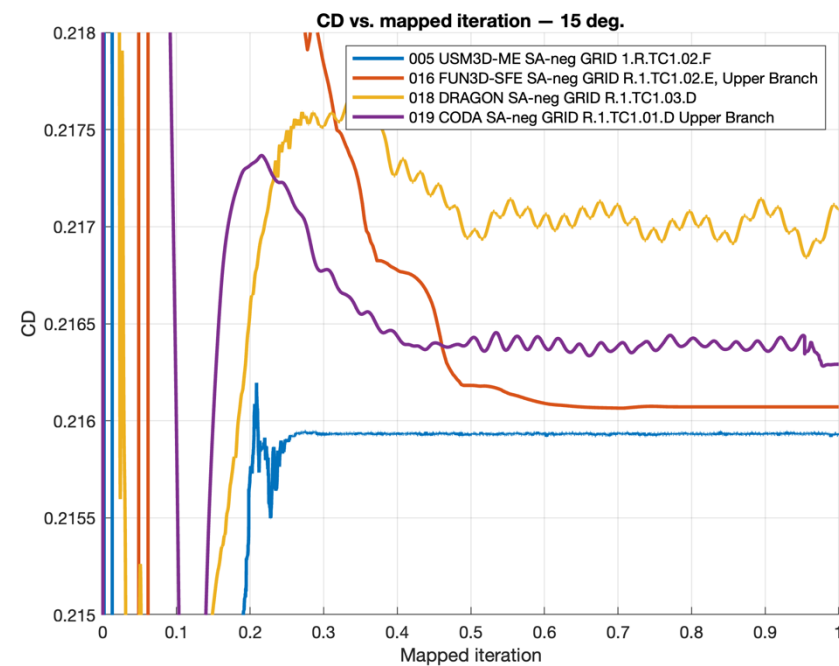
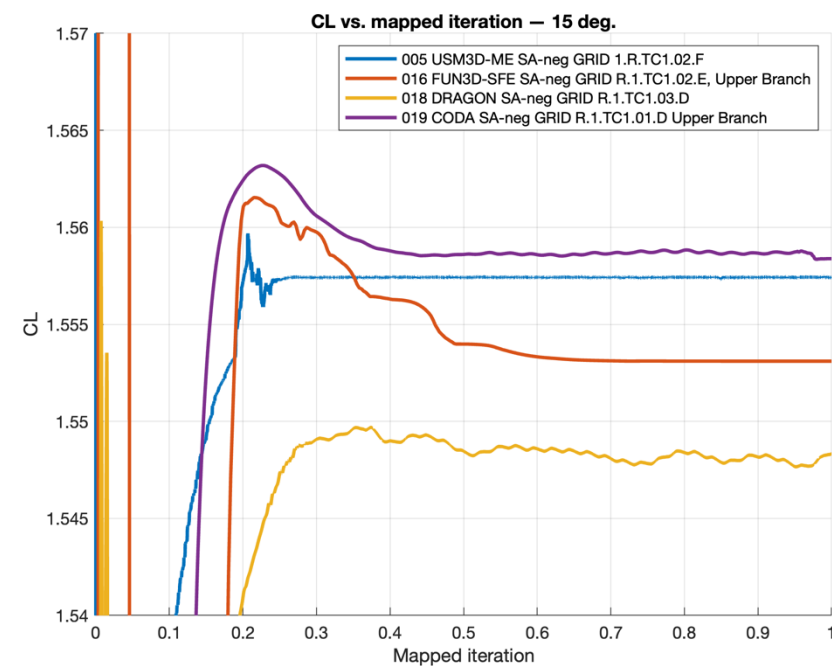
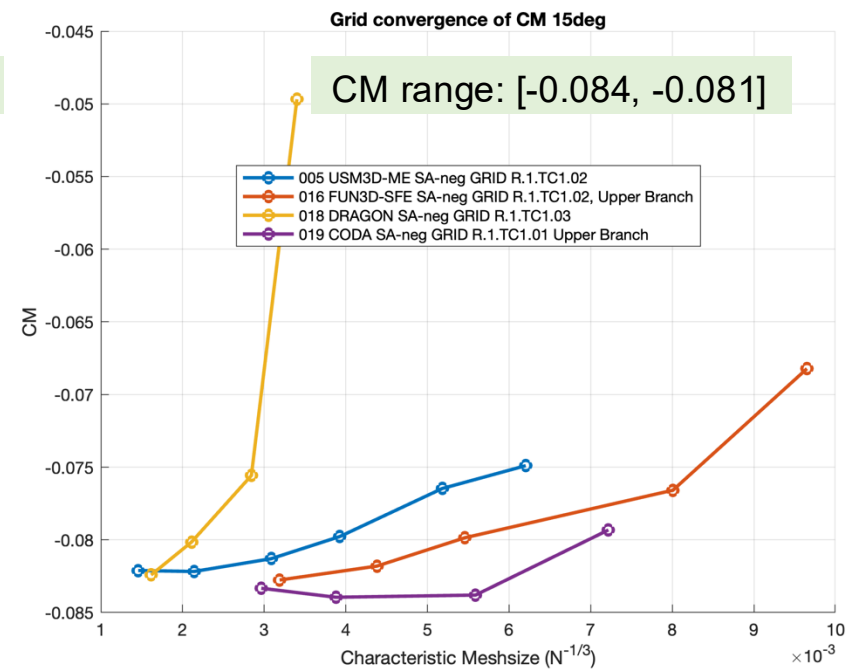
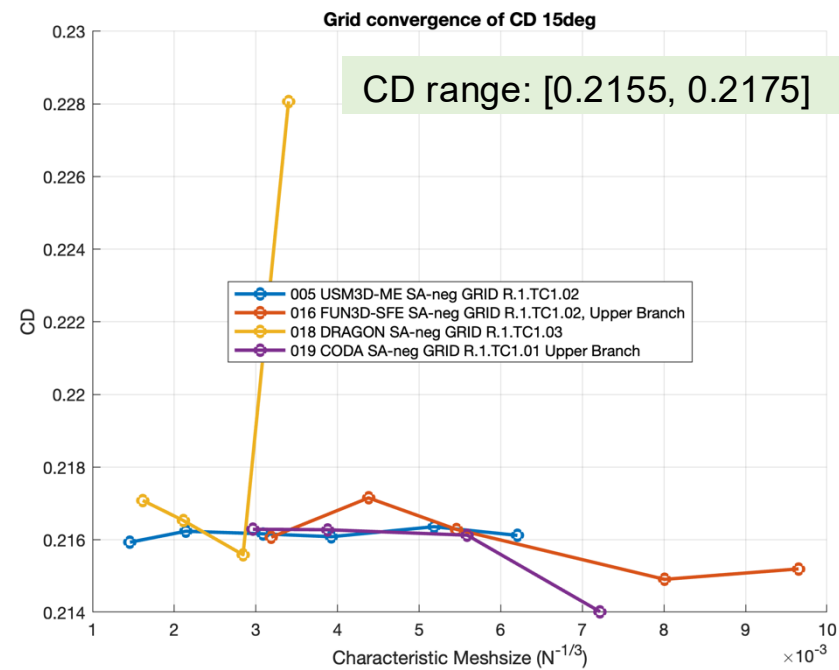
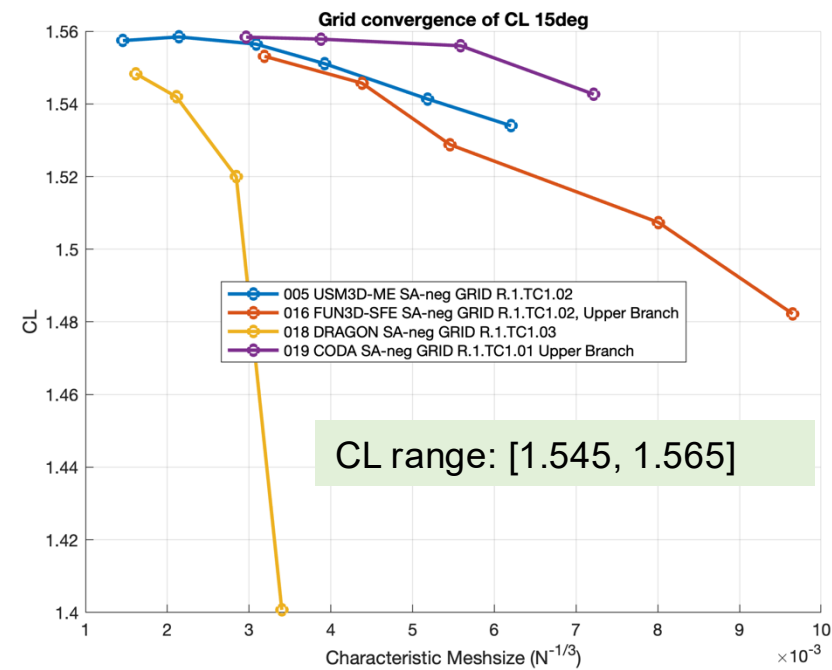


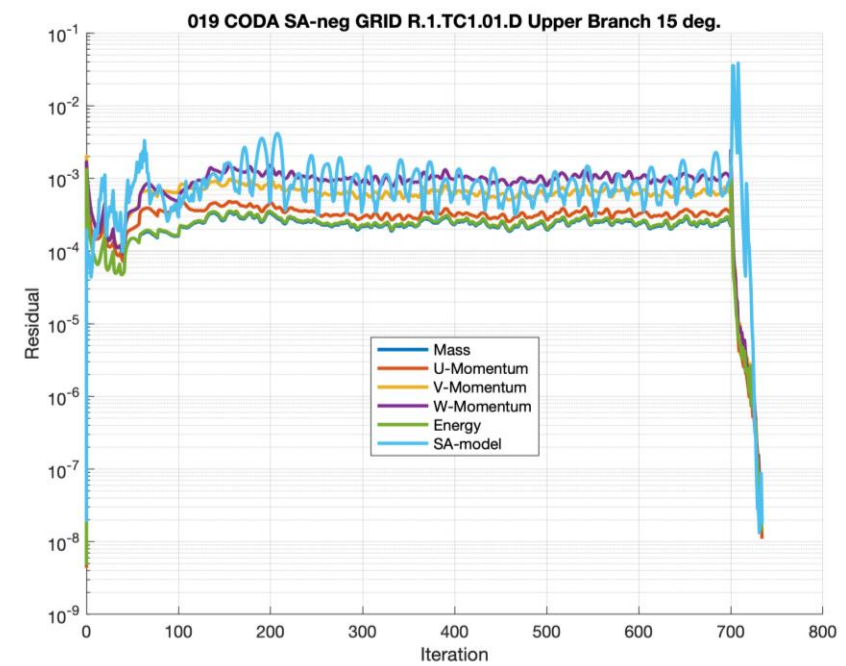
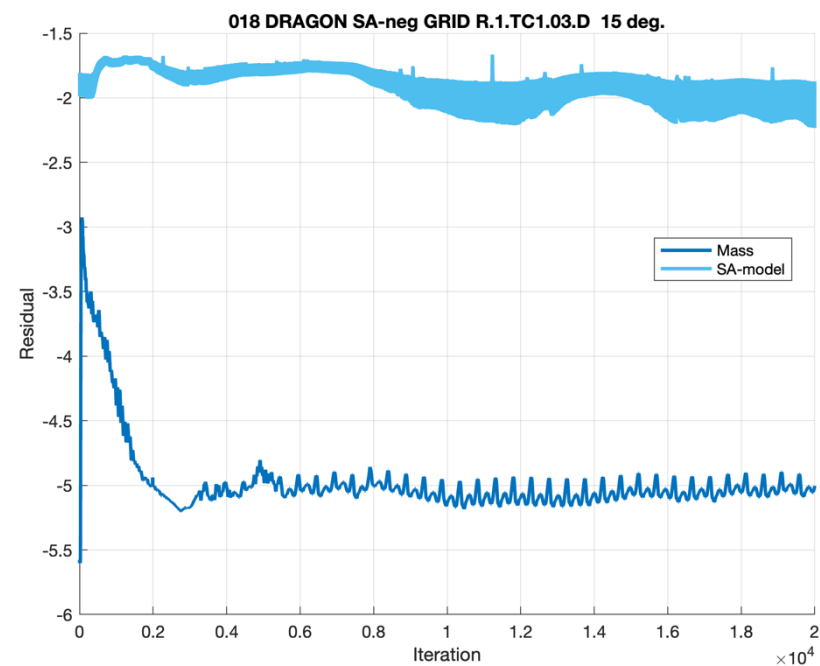
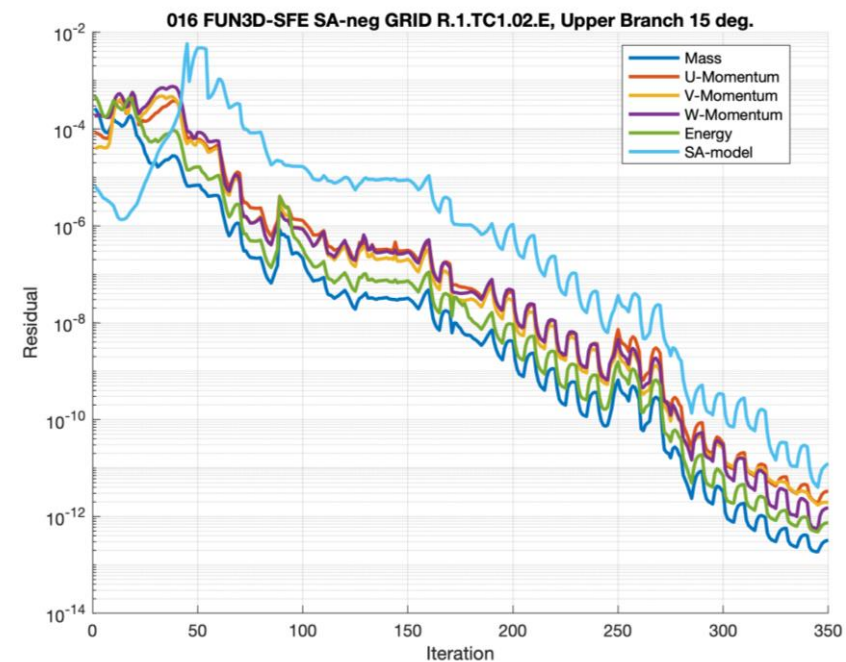
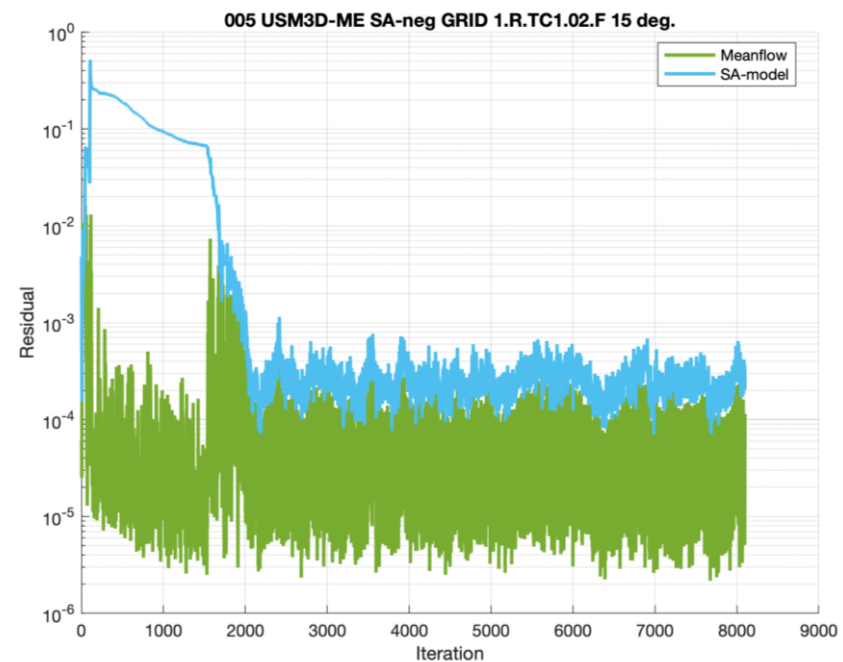


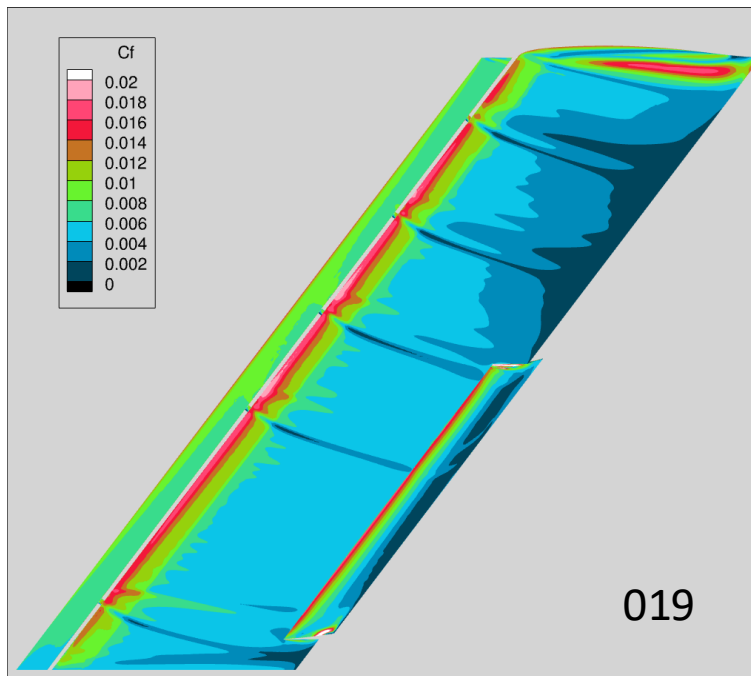
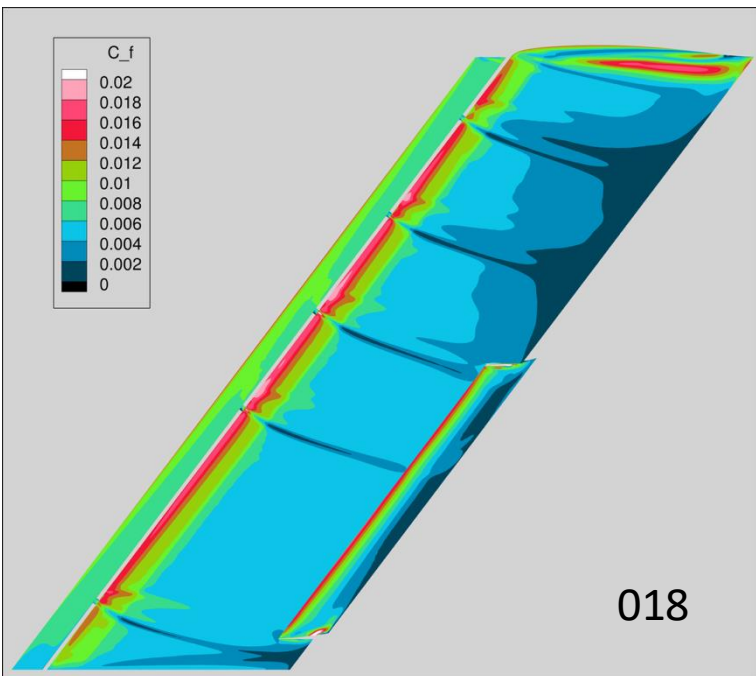
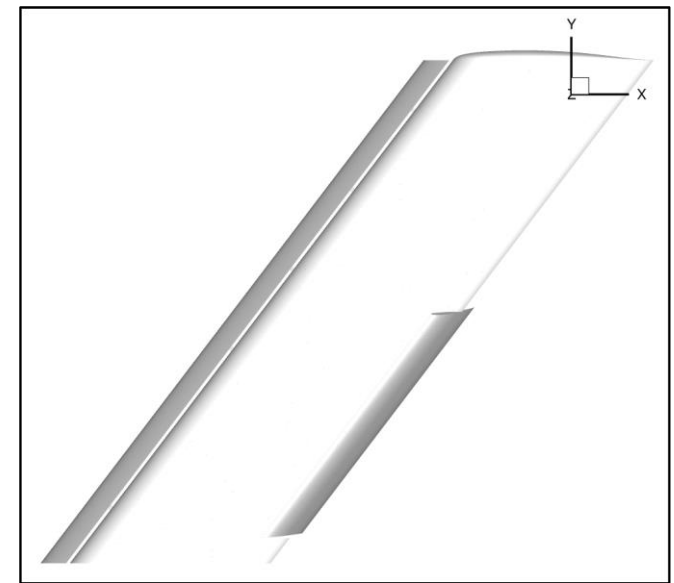
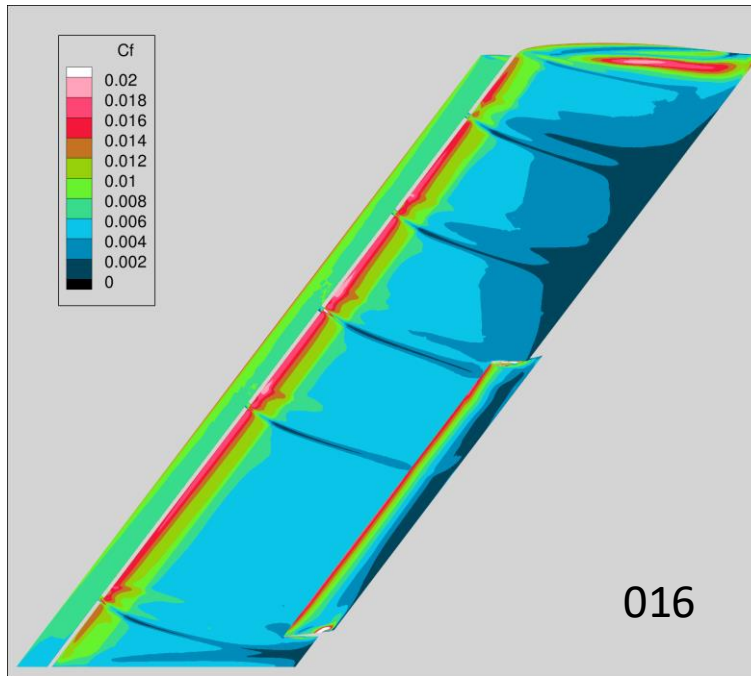
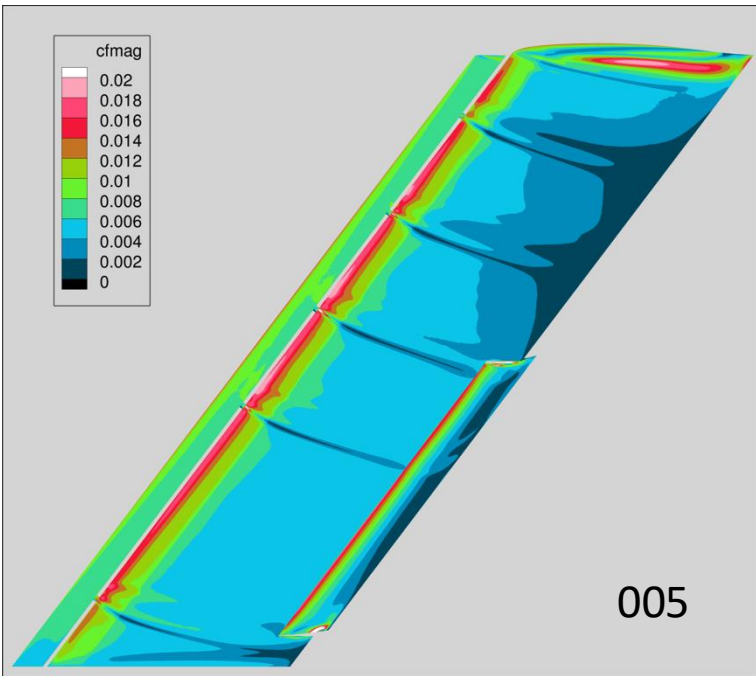


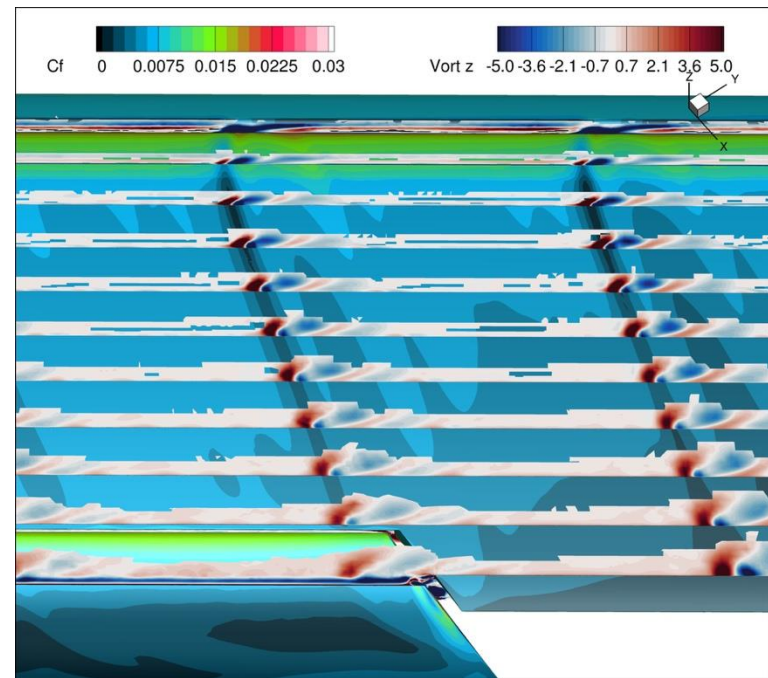
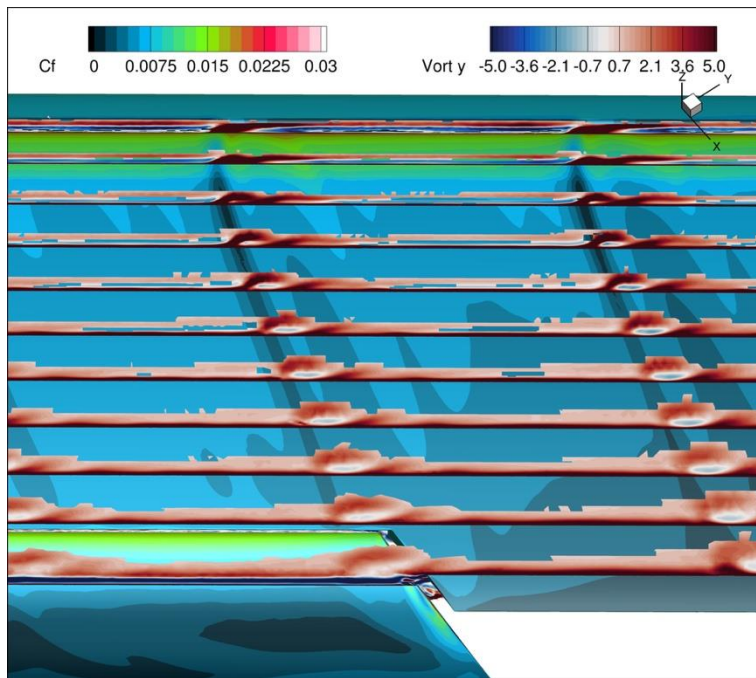
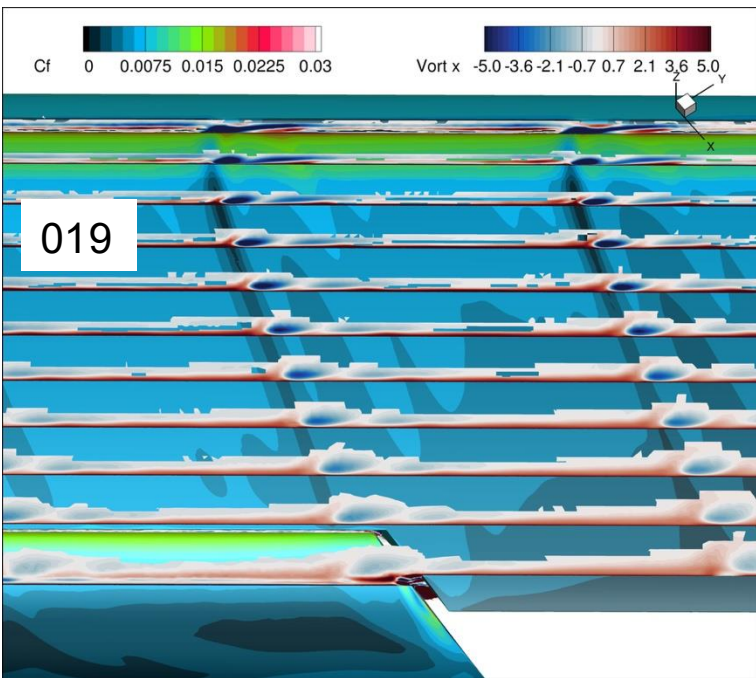
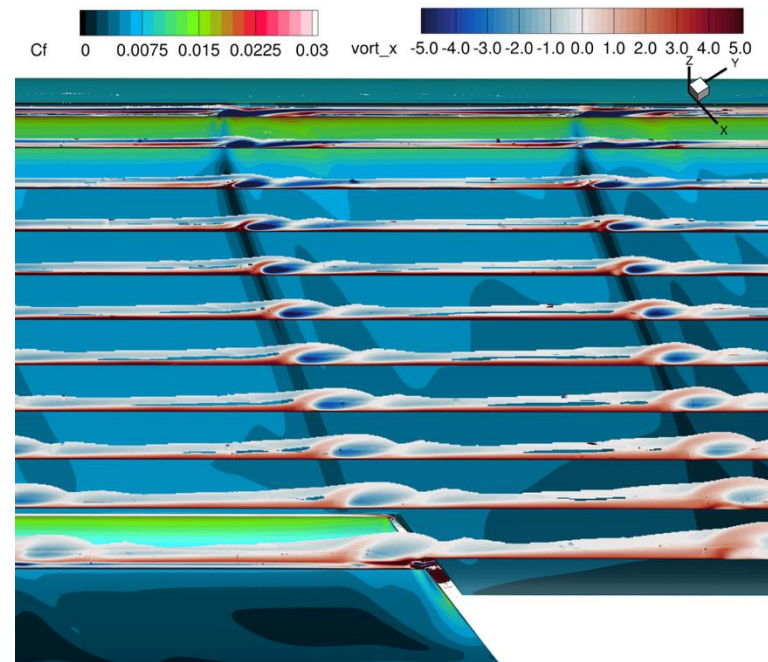
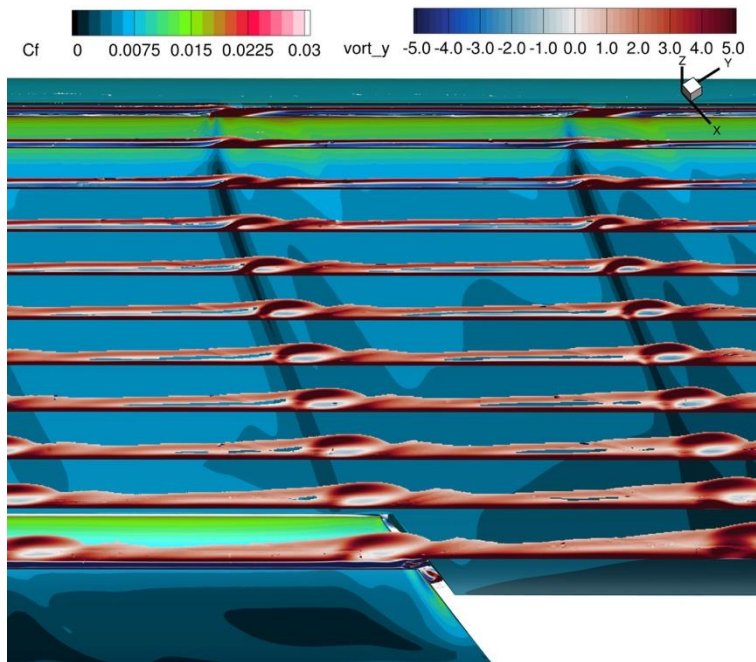
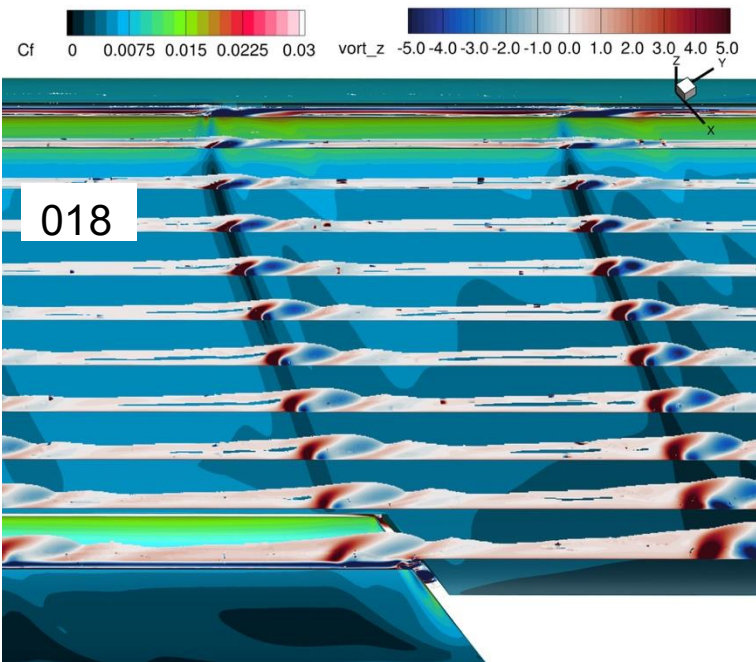


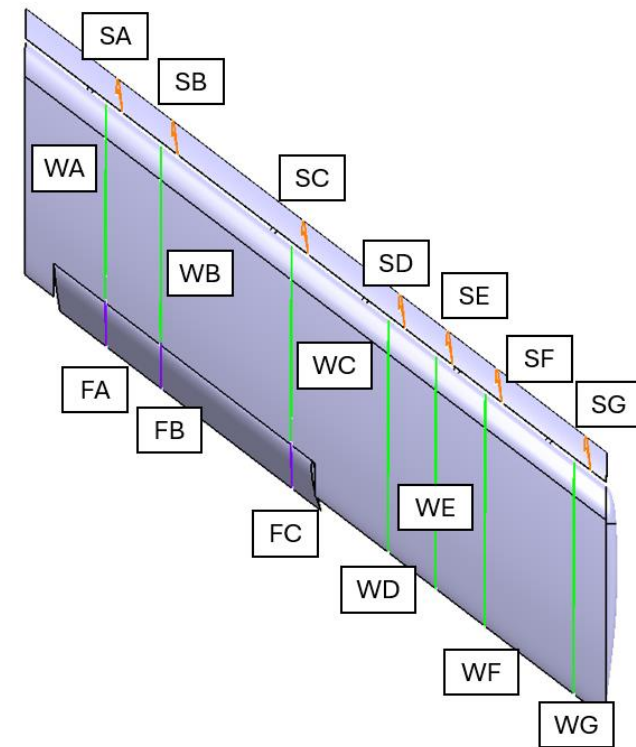
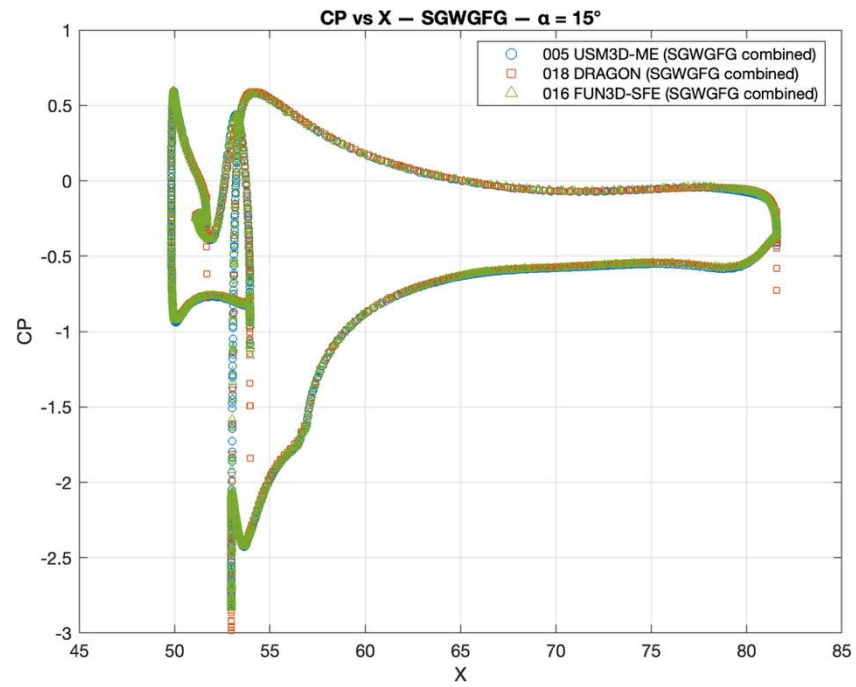
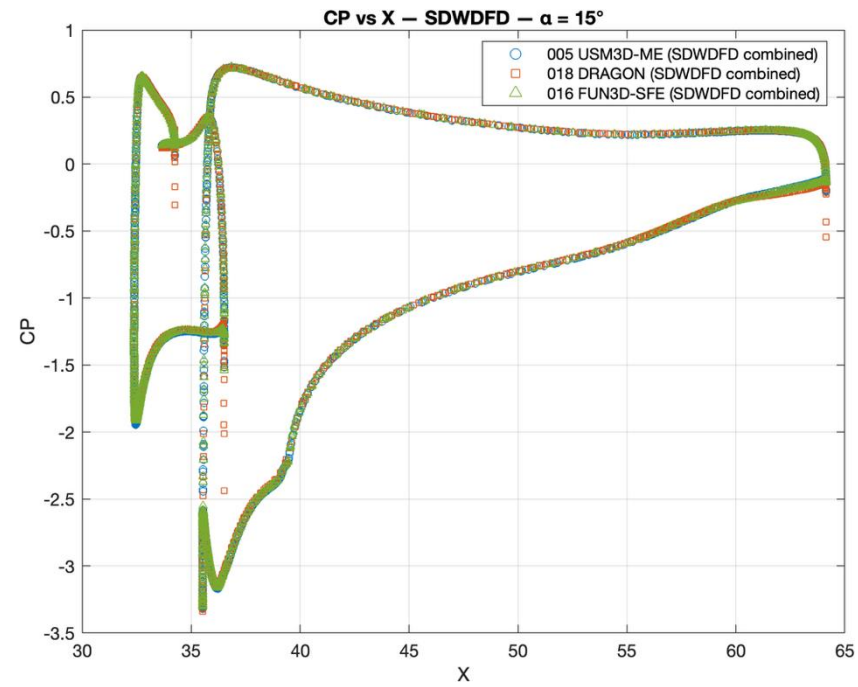
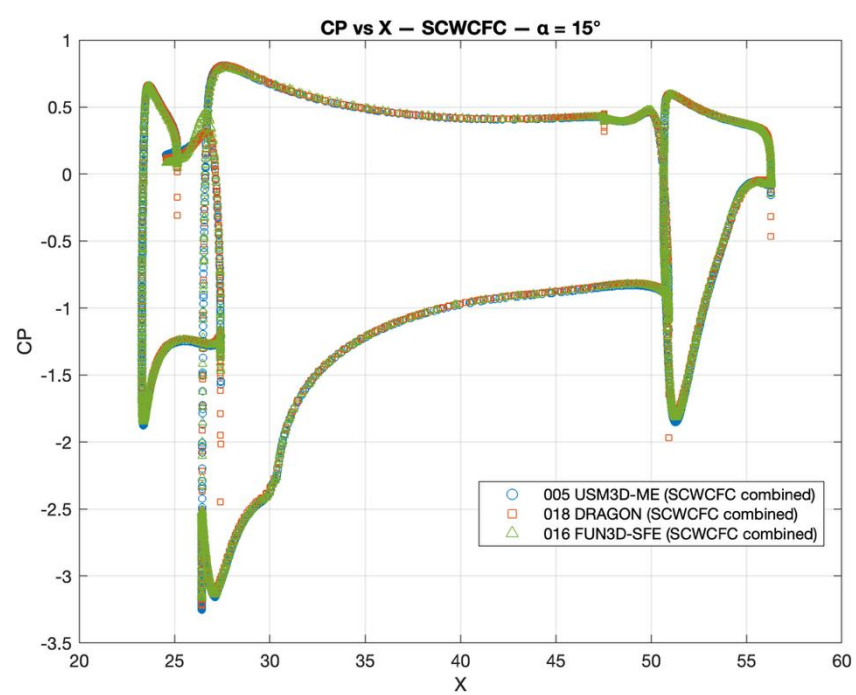
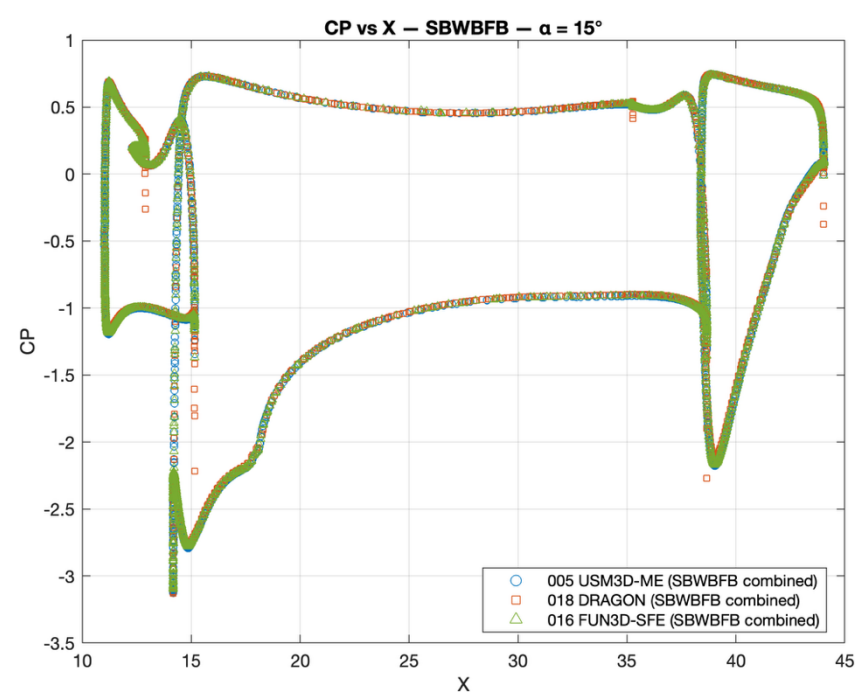
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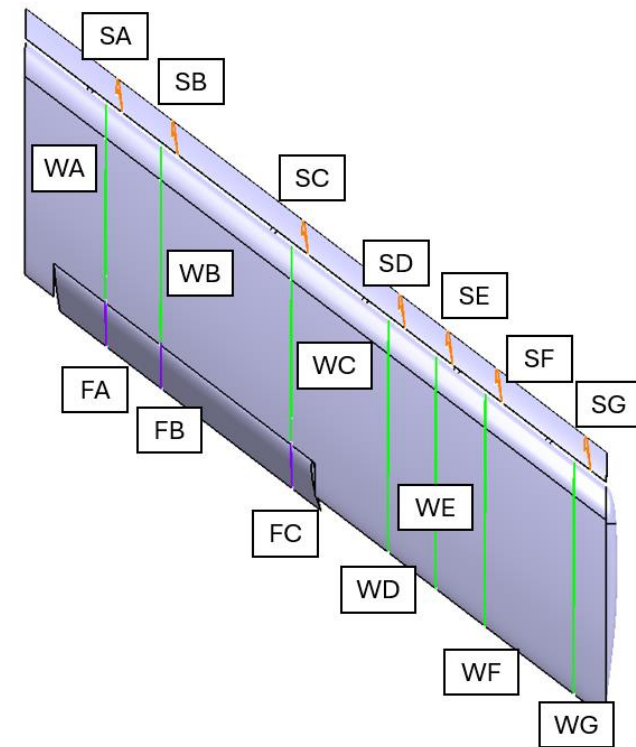
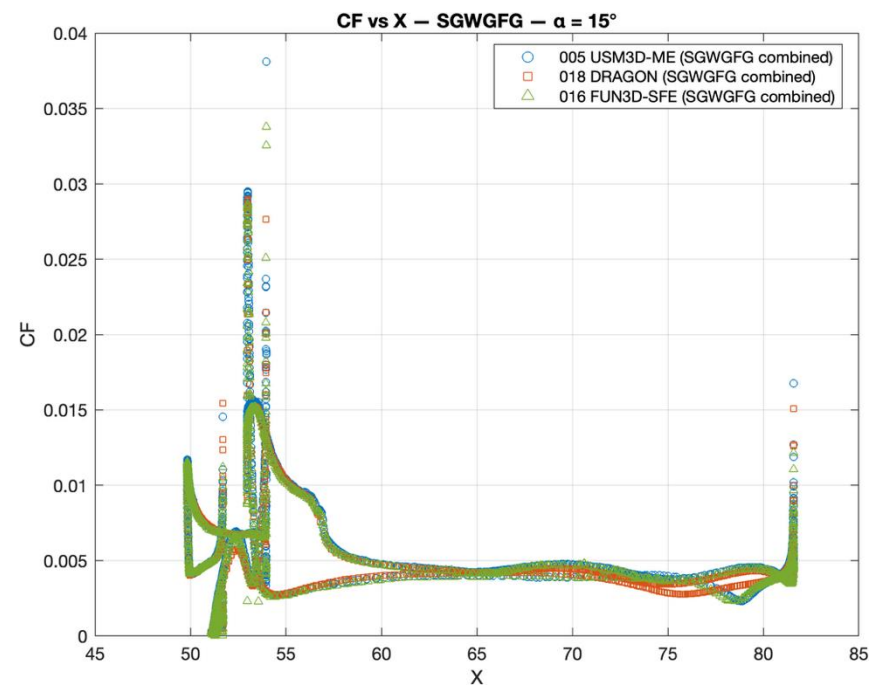
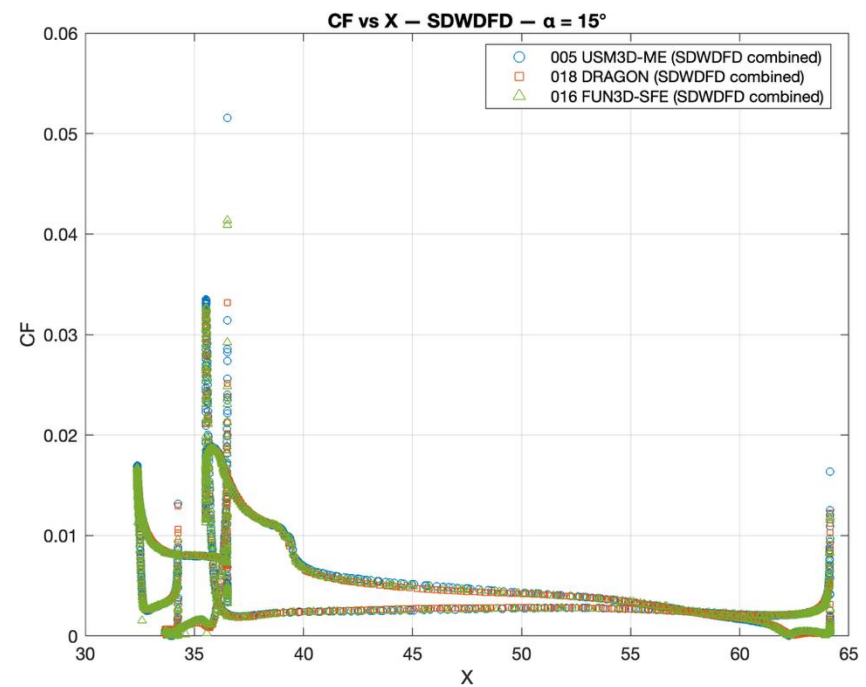
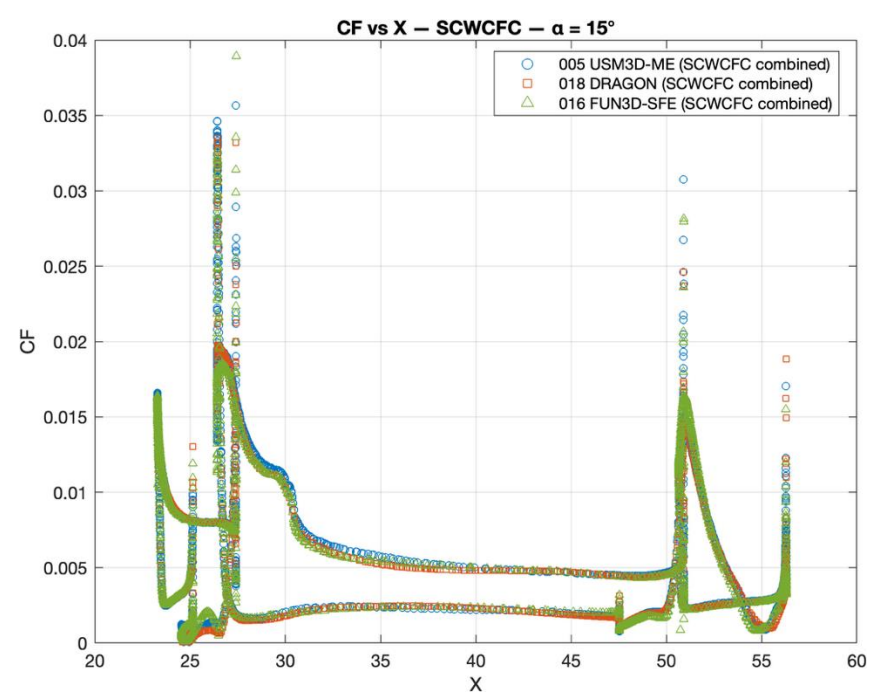
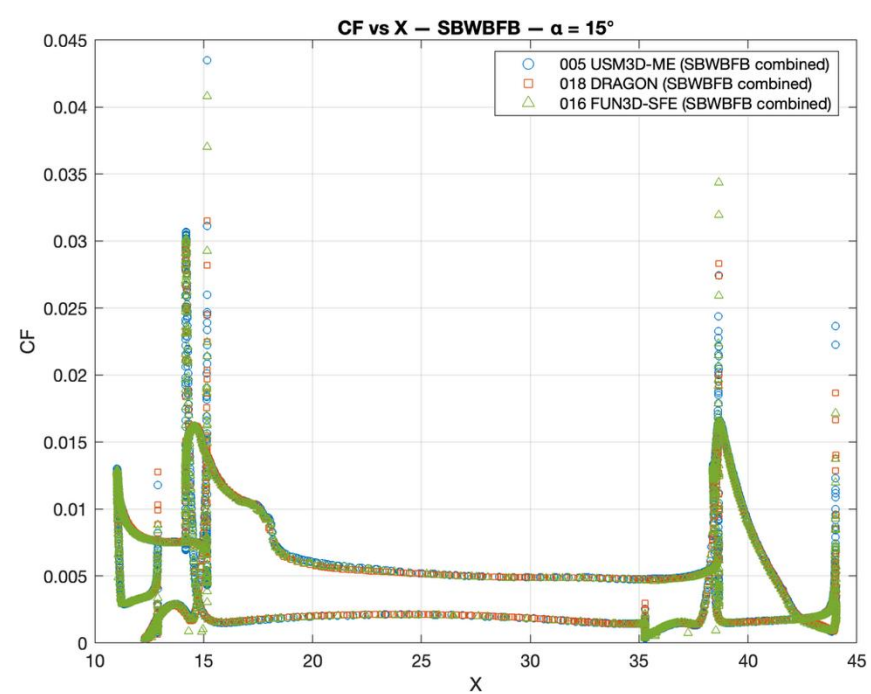


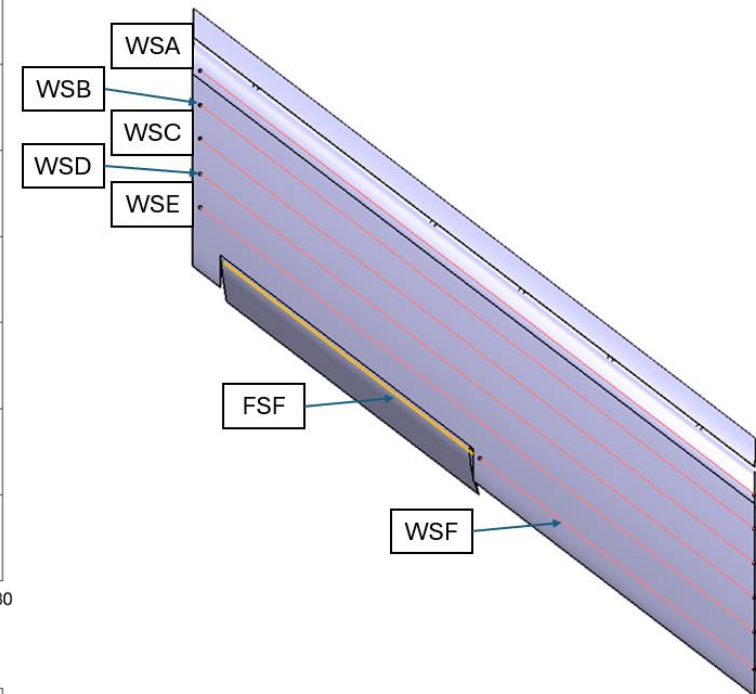
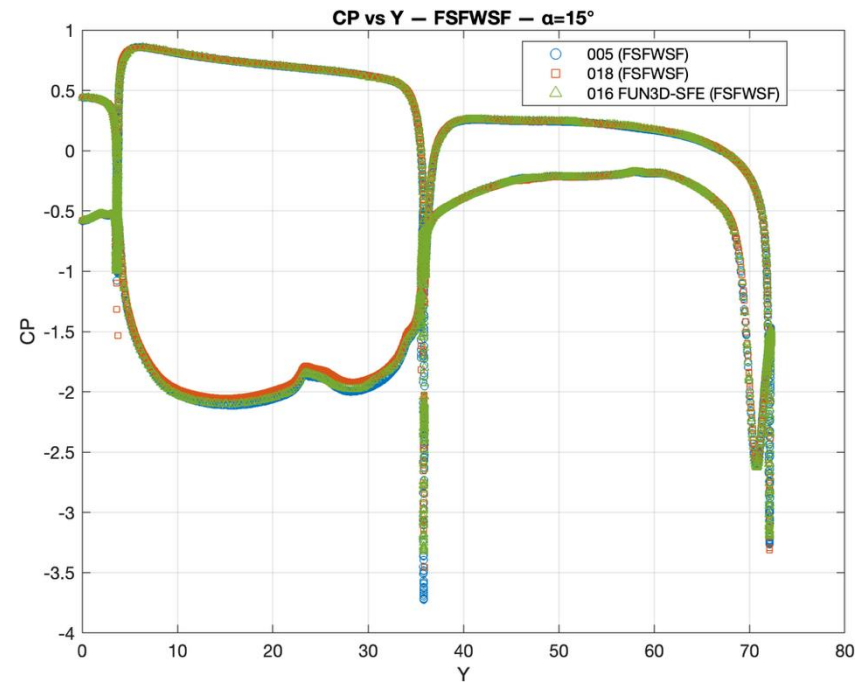
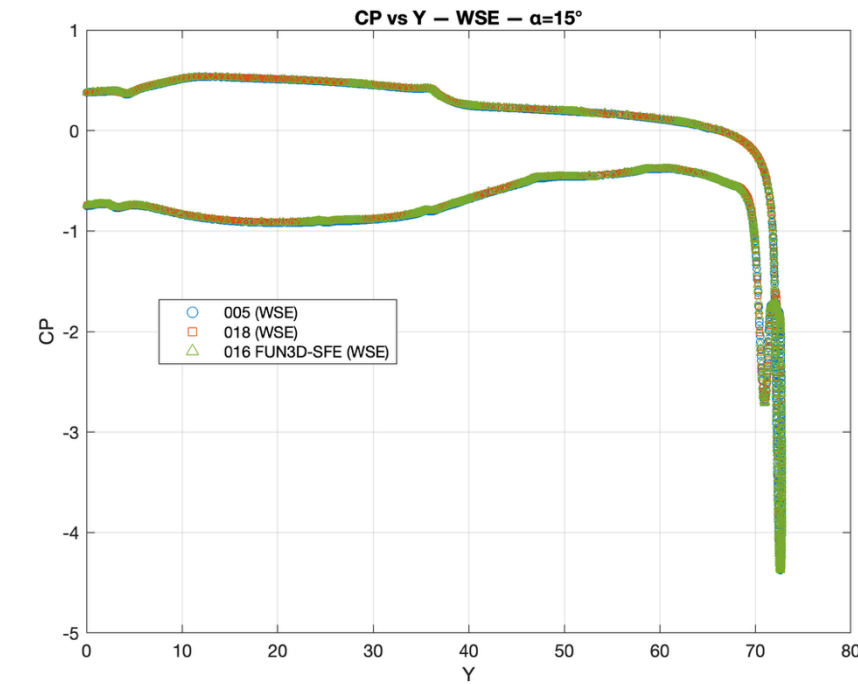
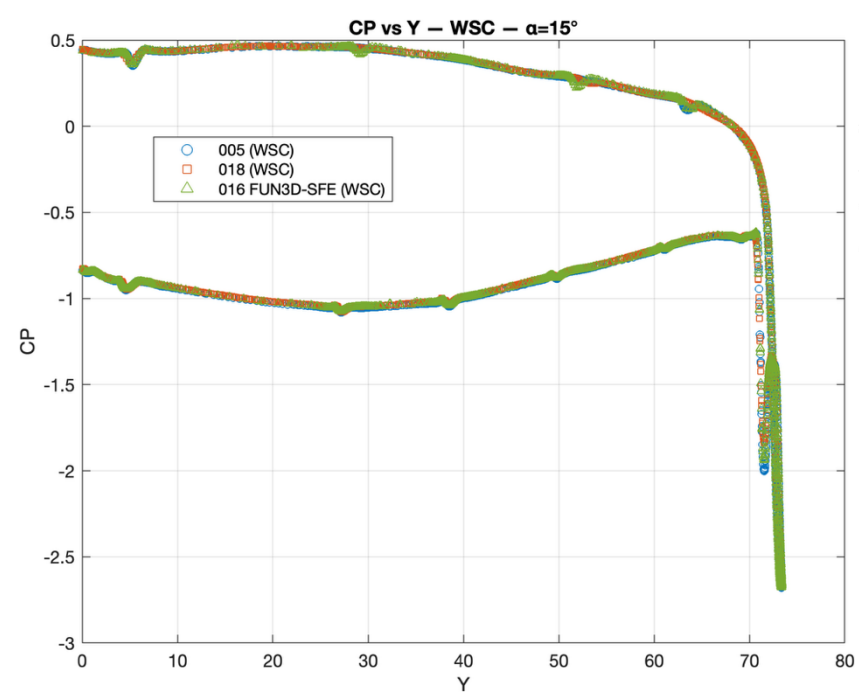
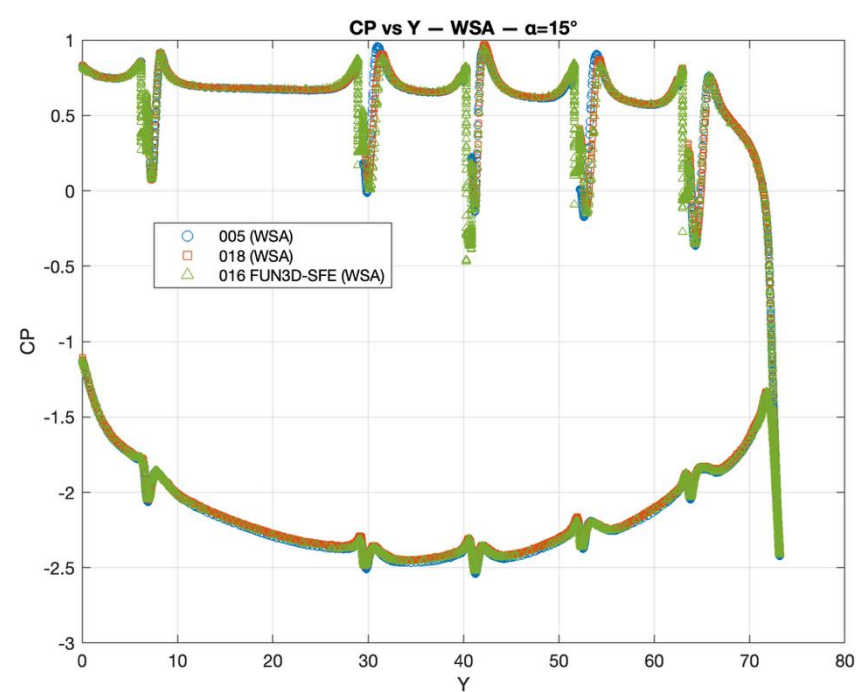


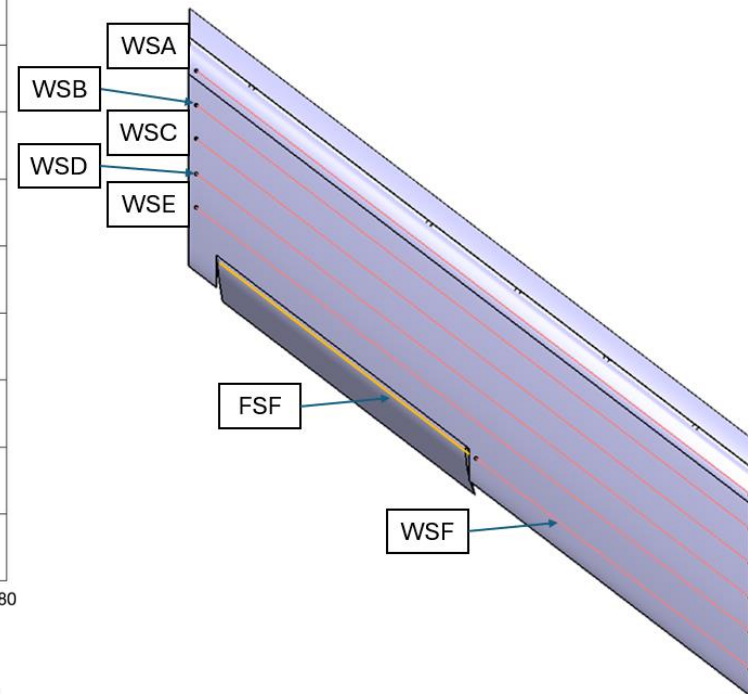
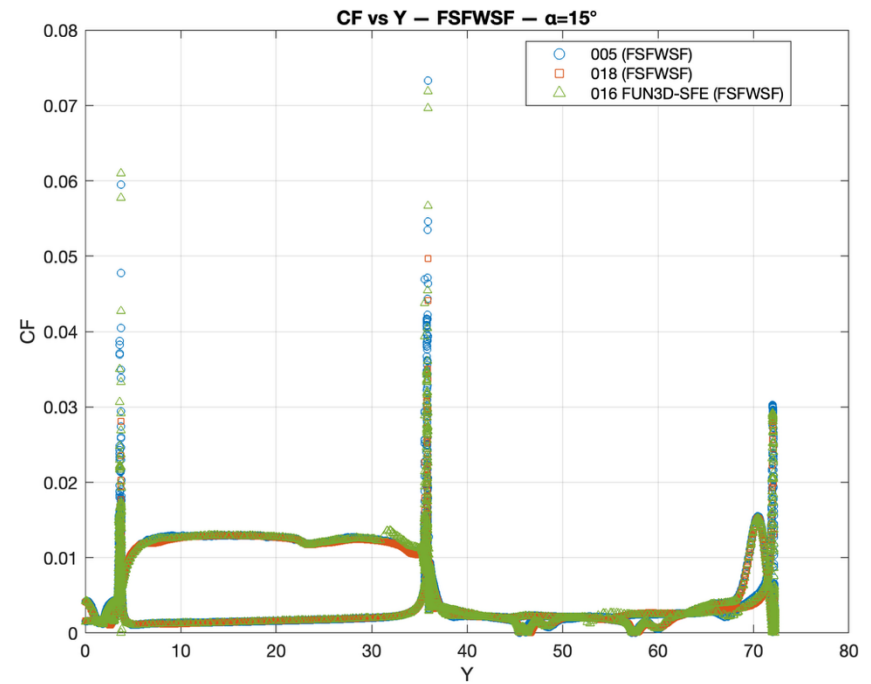
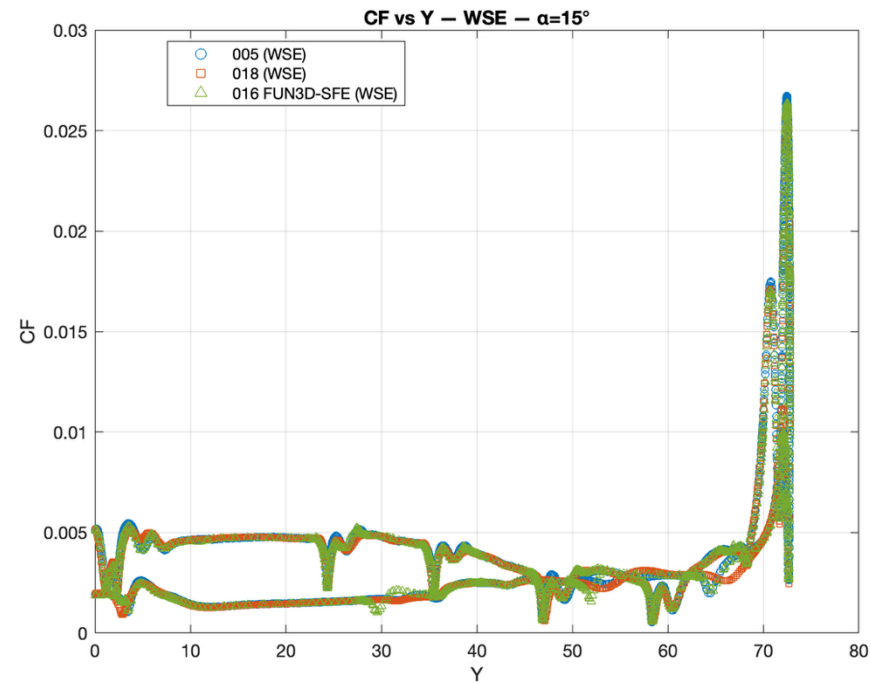
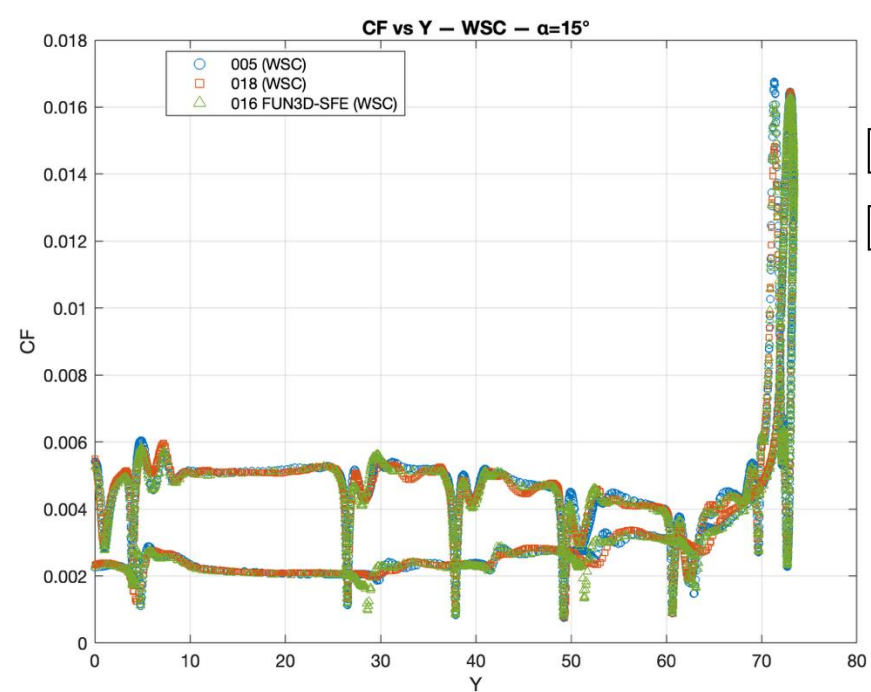
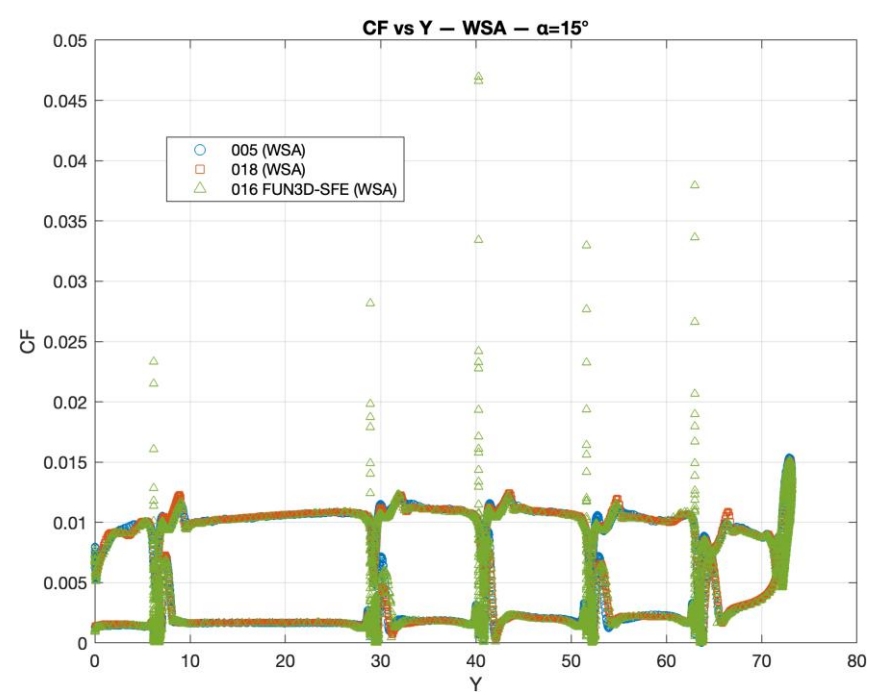






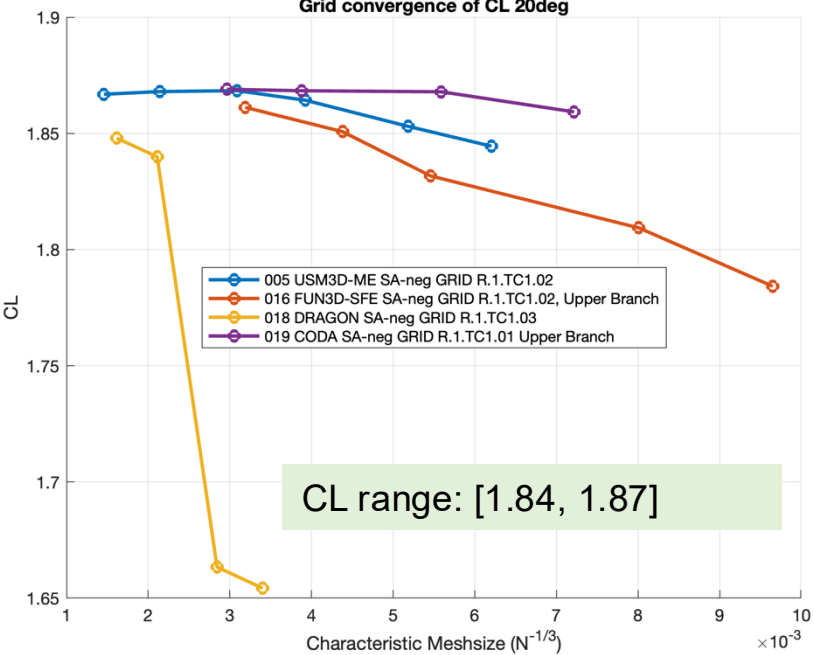




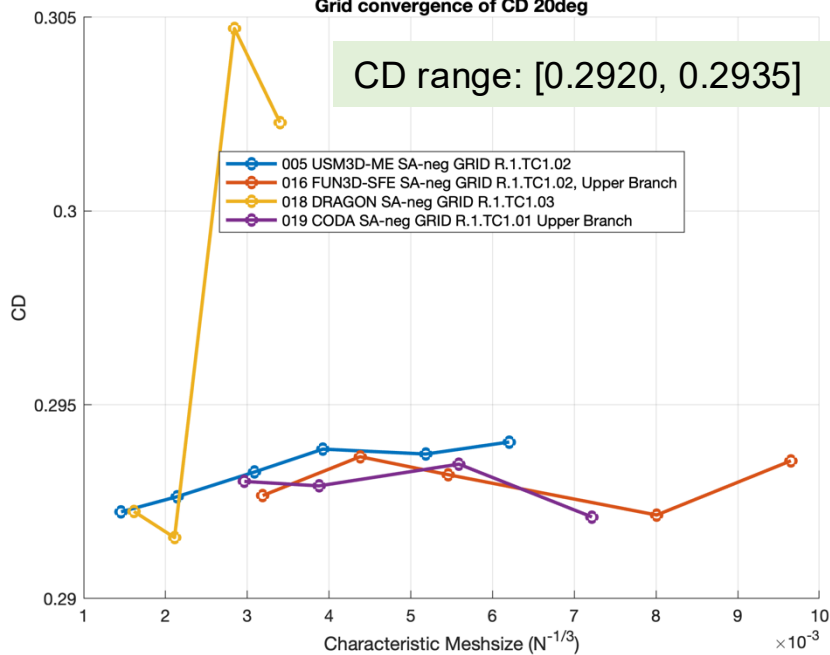


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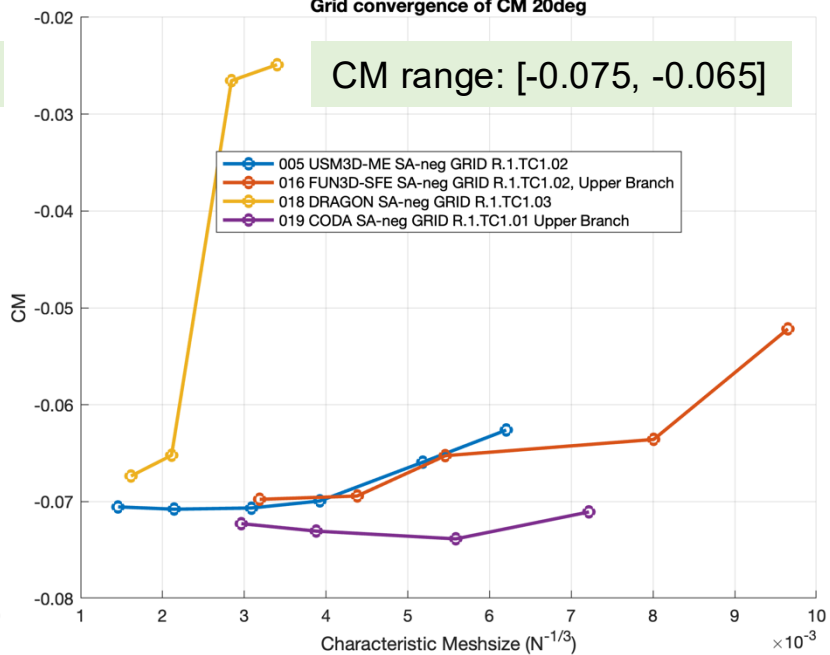
Grid convergence of CL 20deg



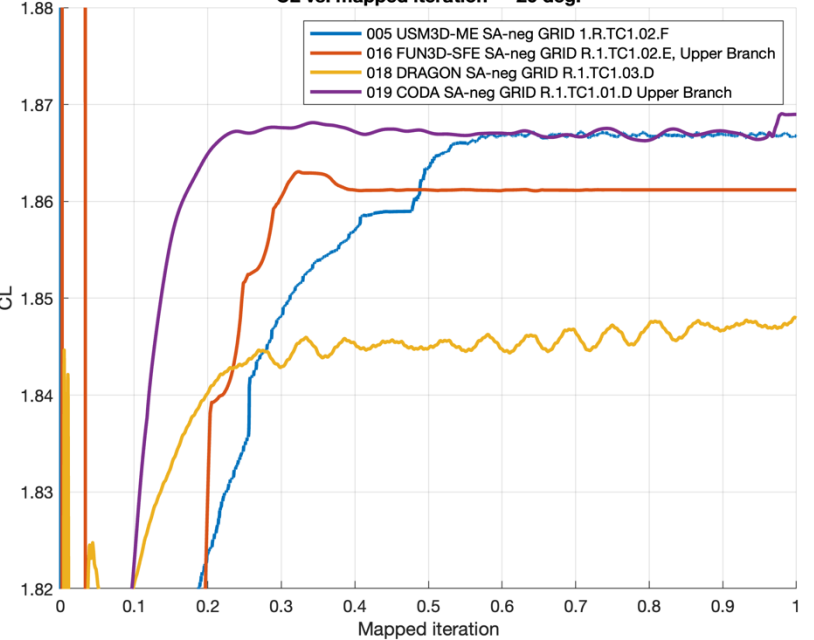
Grid convergence of CD 20deg



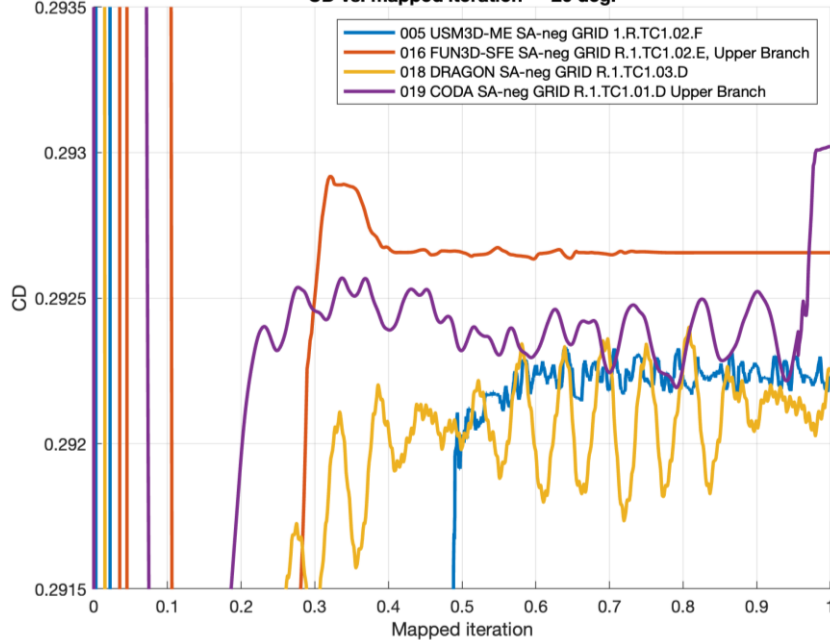
Grid convergence of CM 20deg



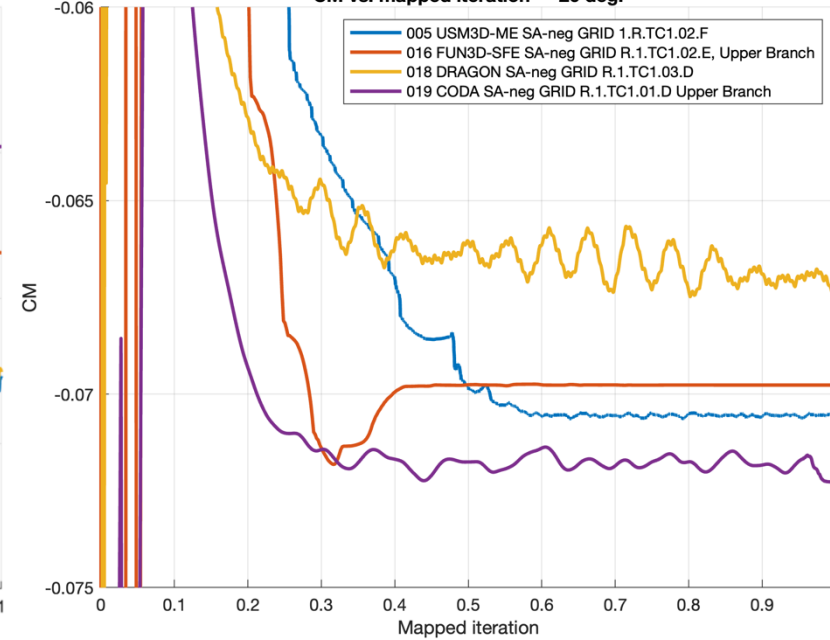
CL vs. mapped iteration — 20 deg.

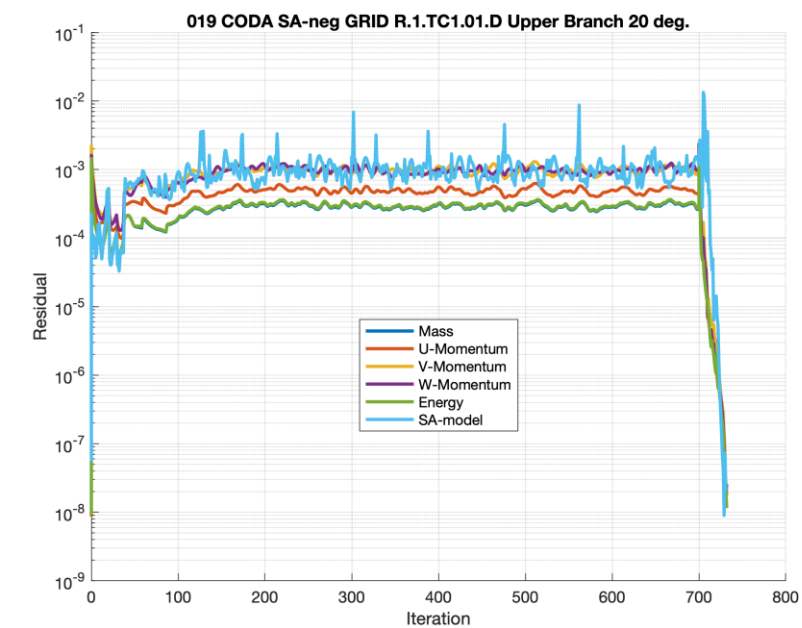
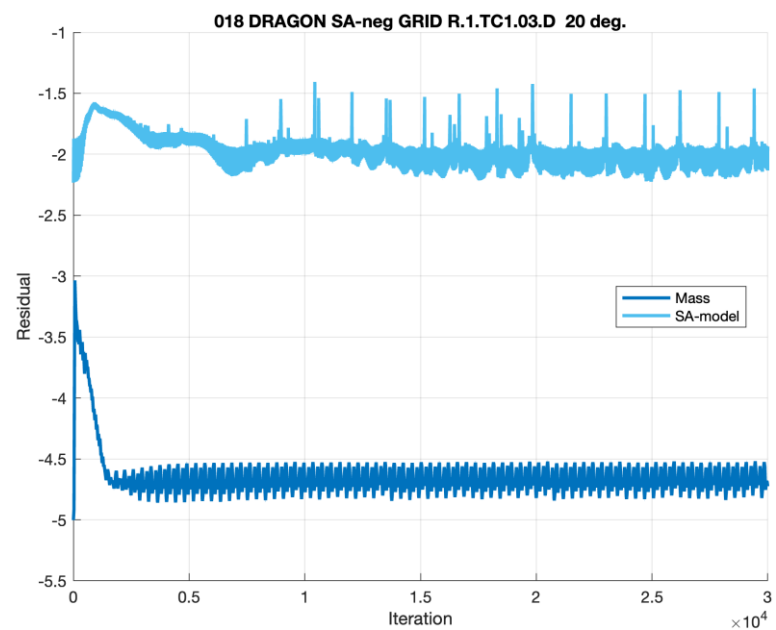
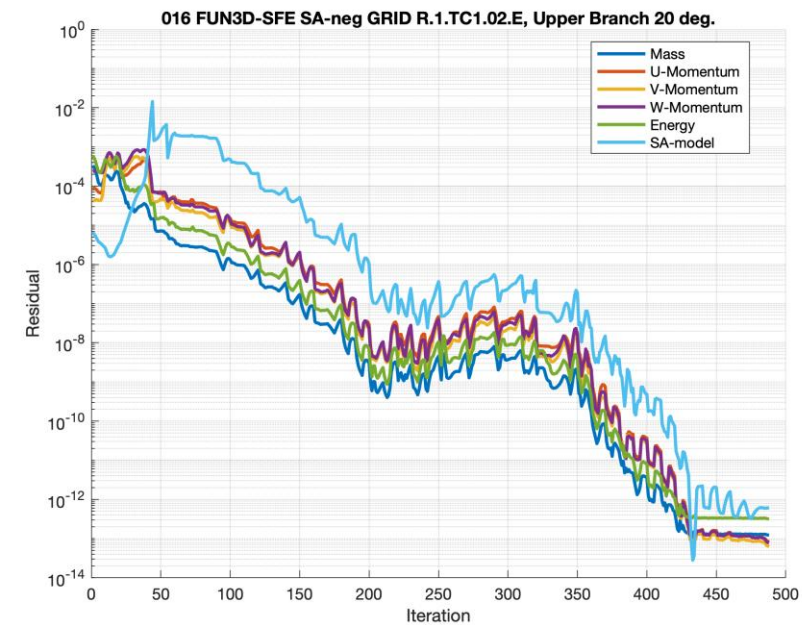
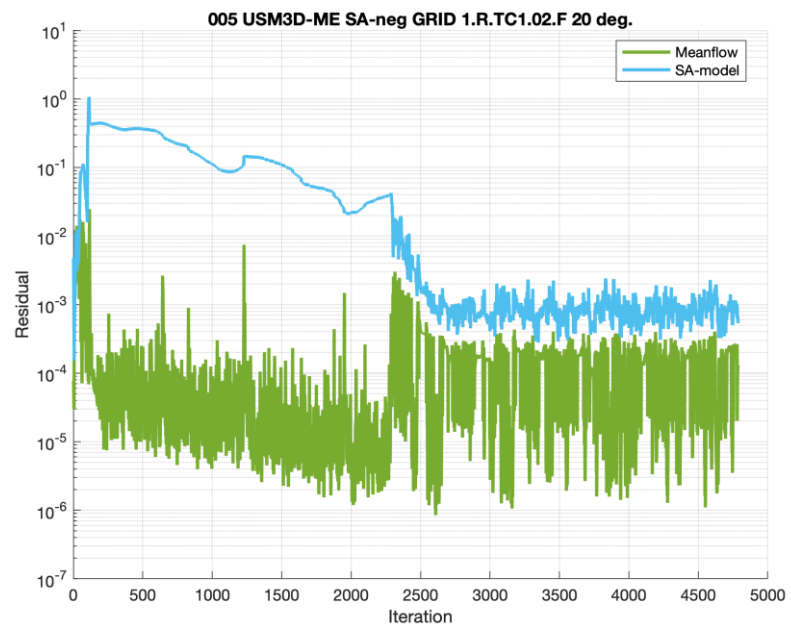


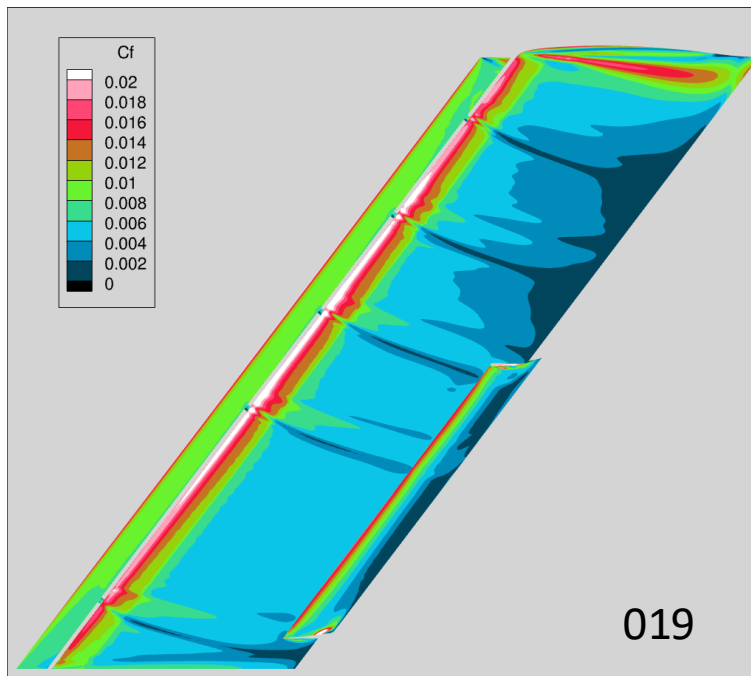
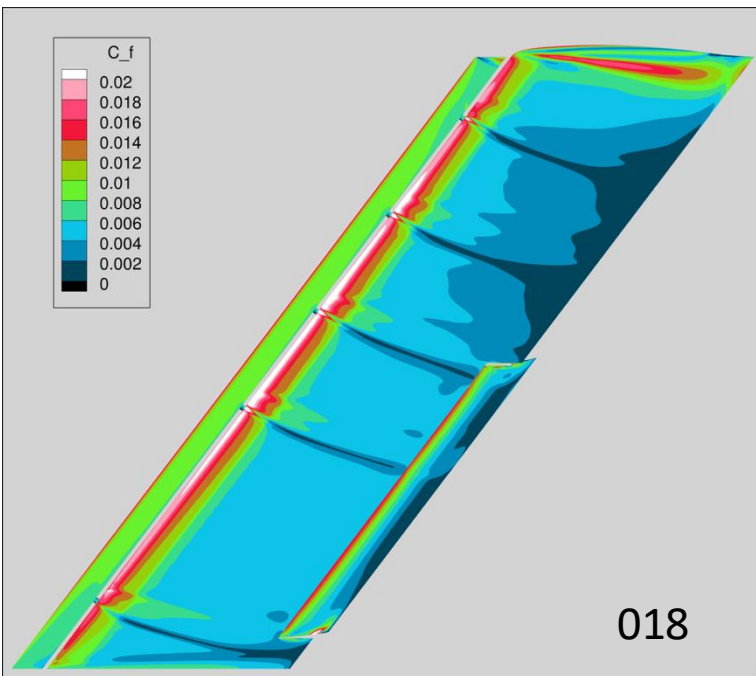
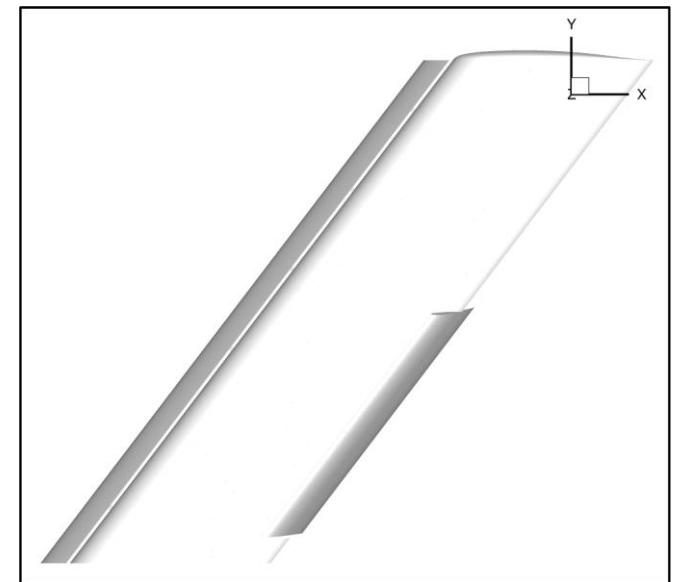
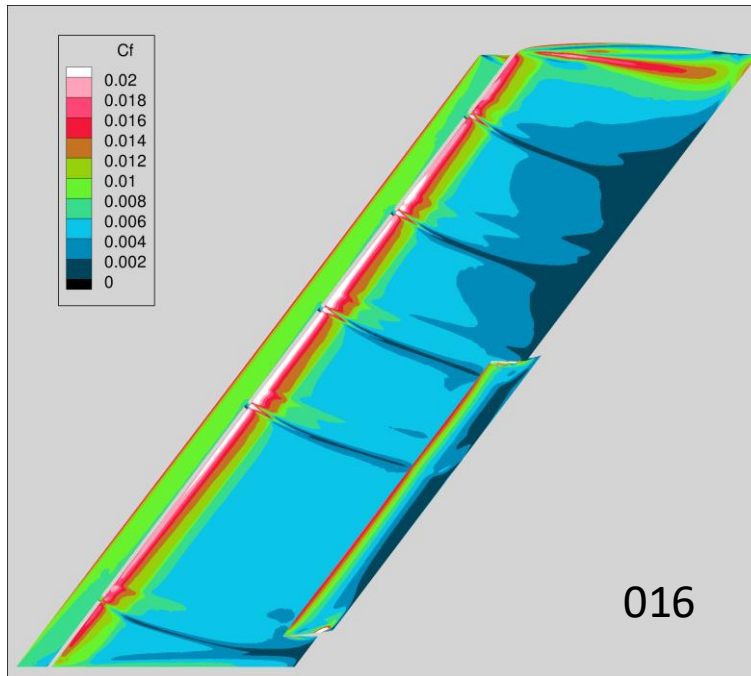
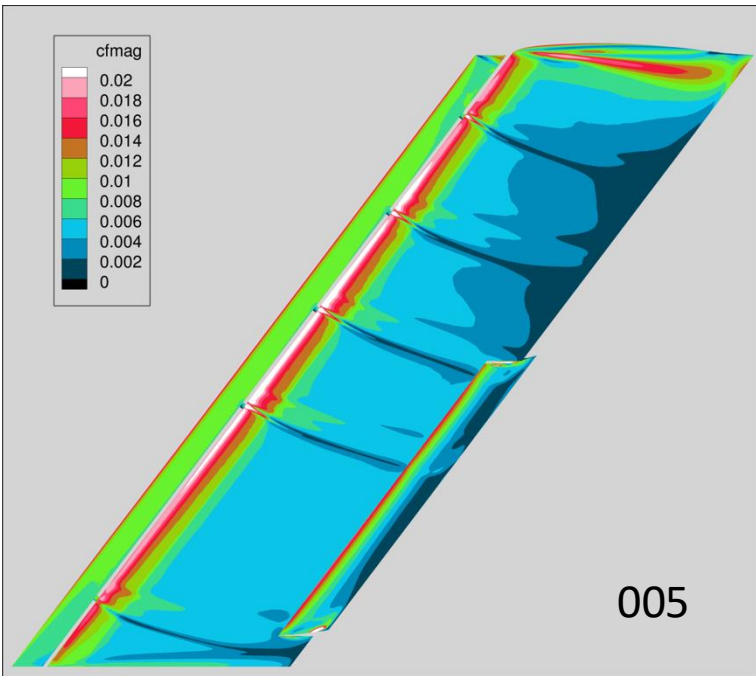
CD vs. mapped iteration — 20 deg.

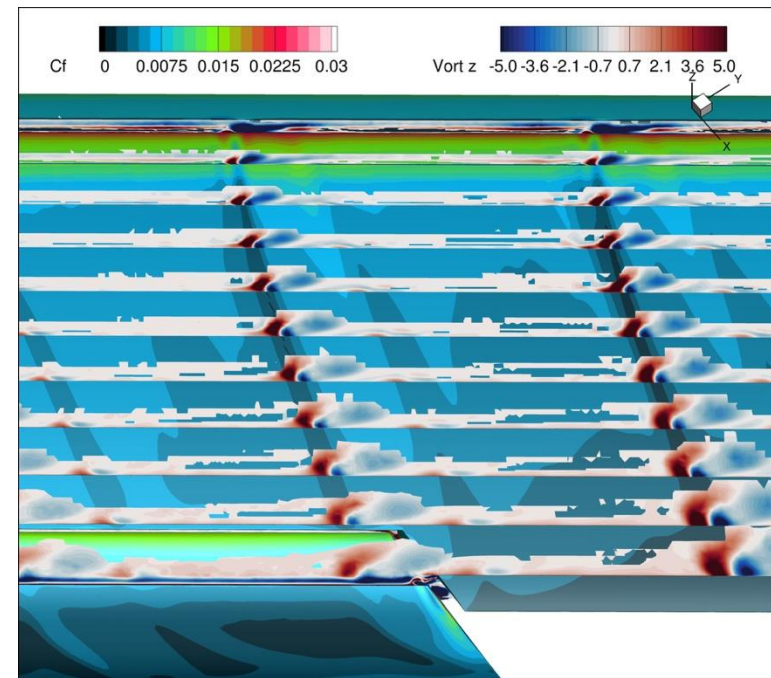
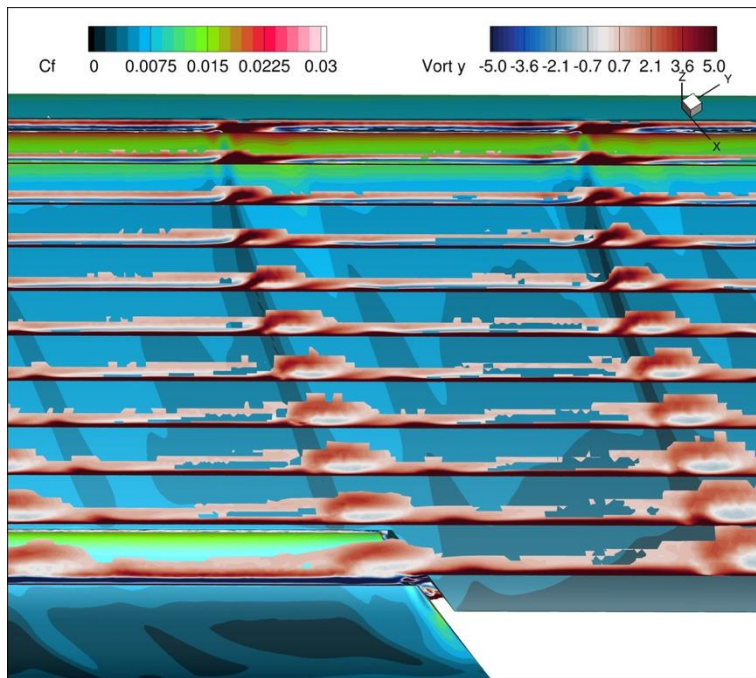
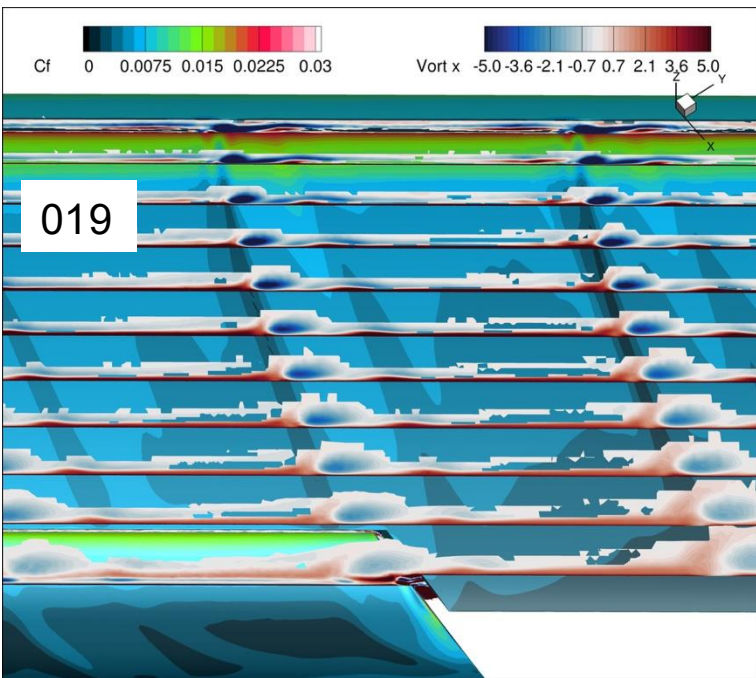
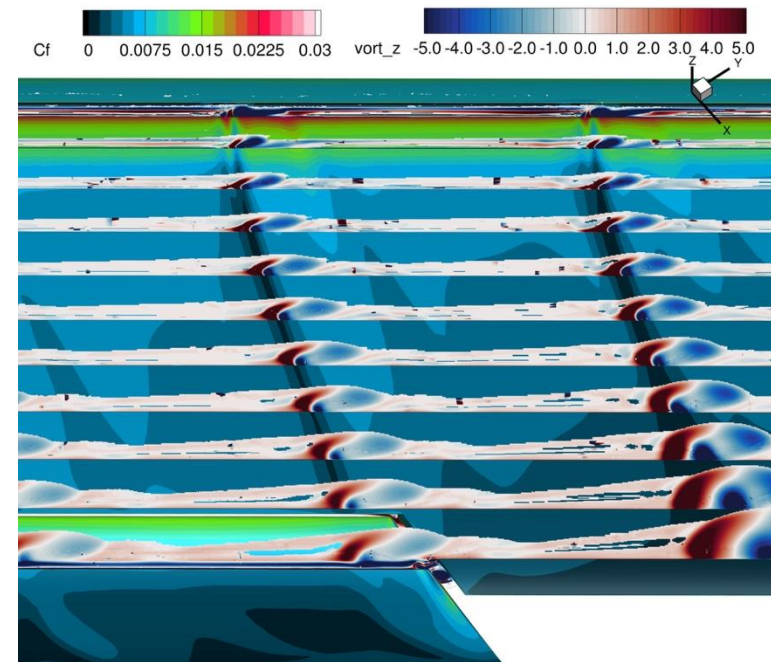
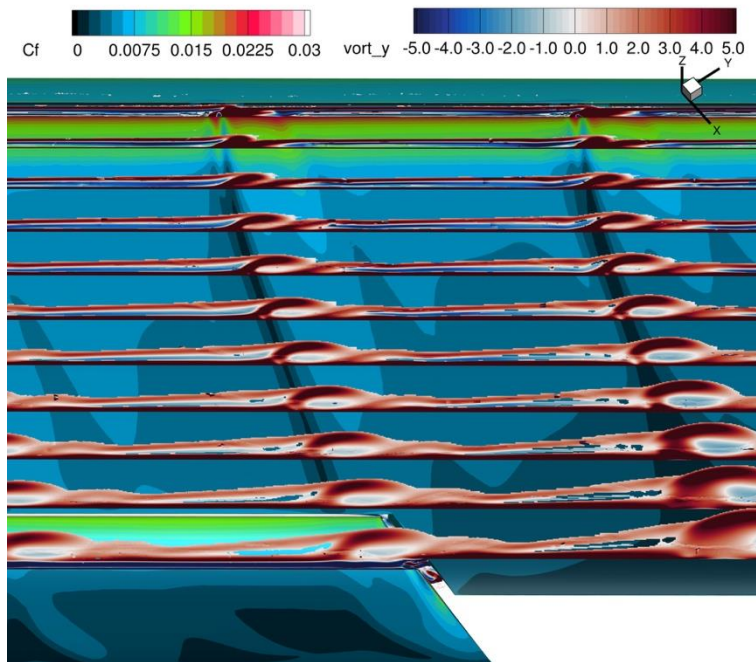
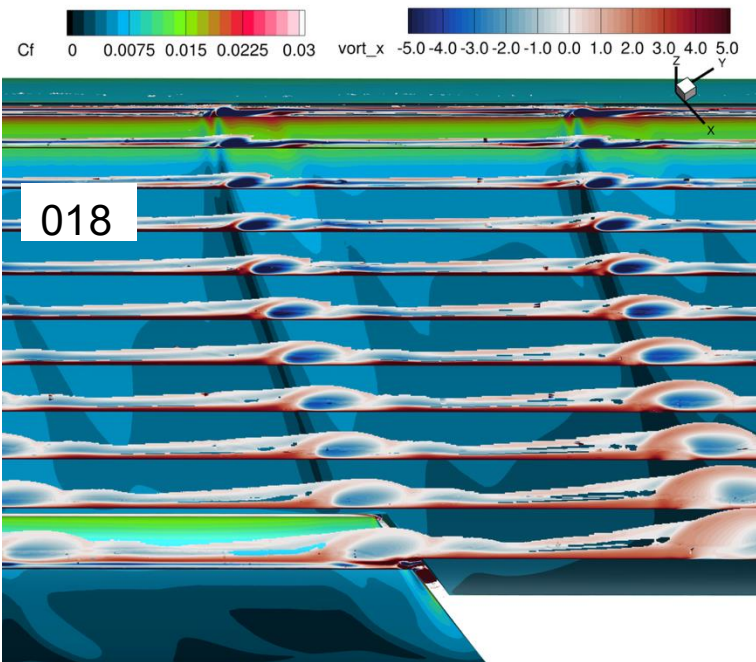


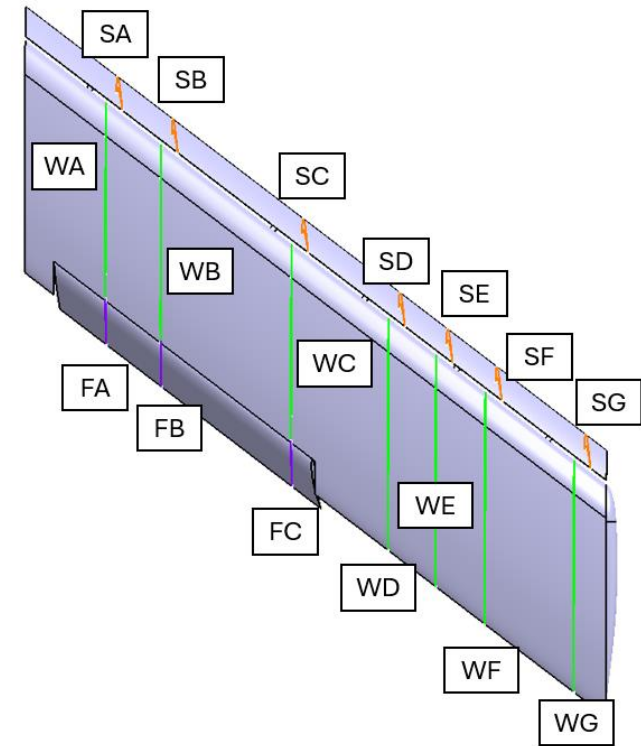
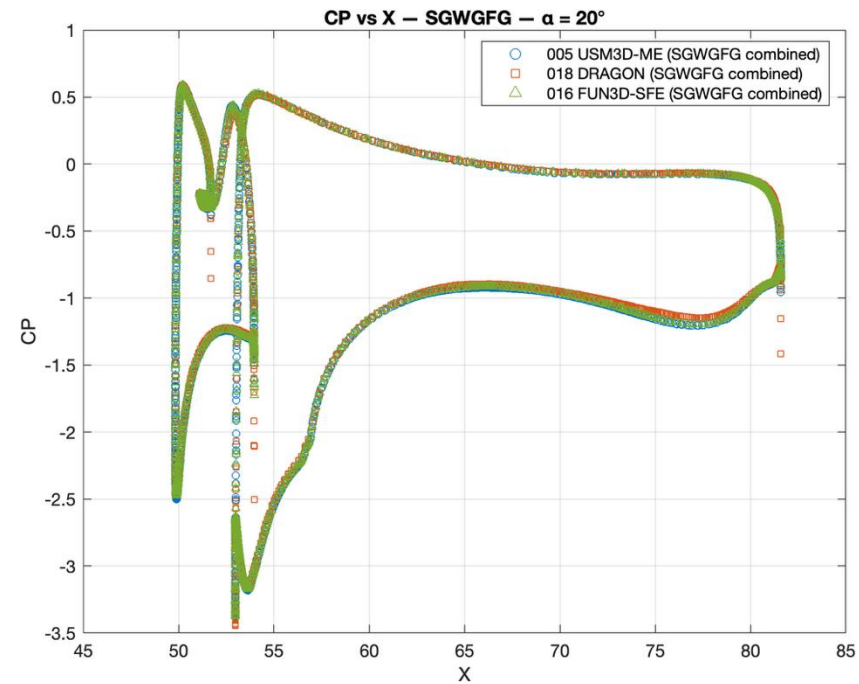
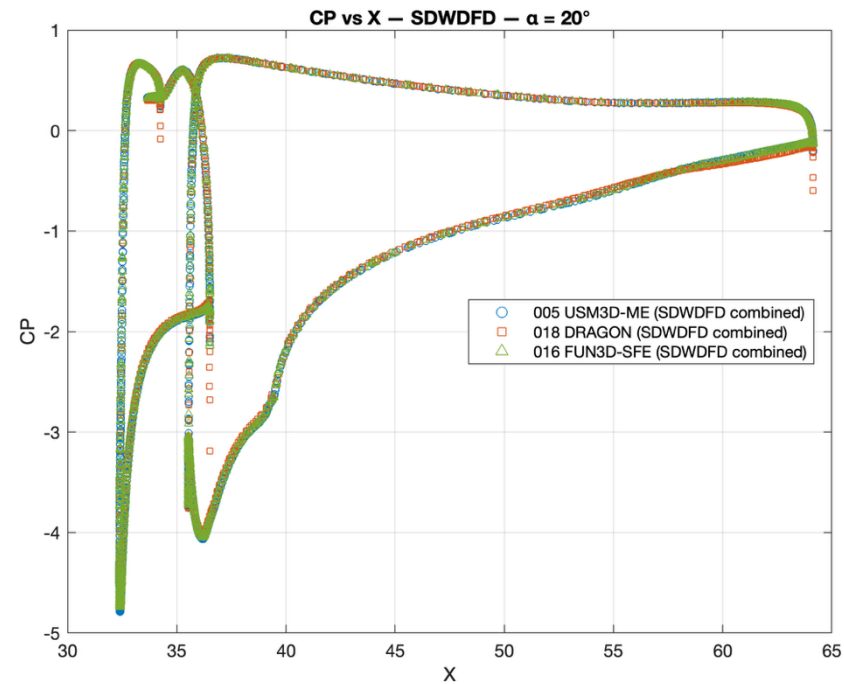
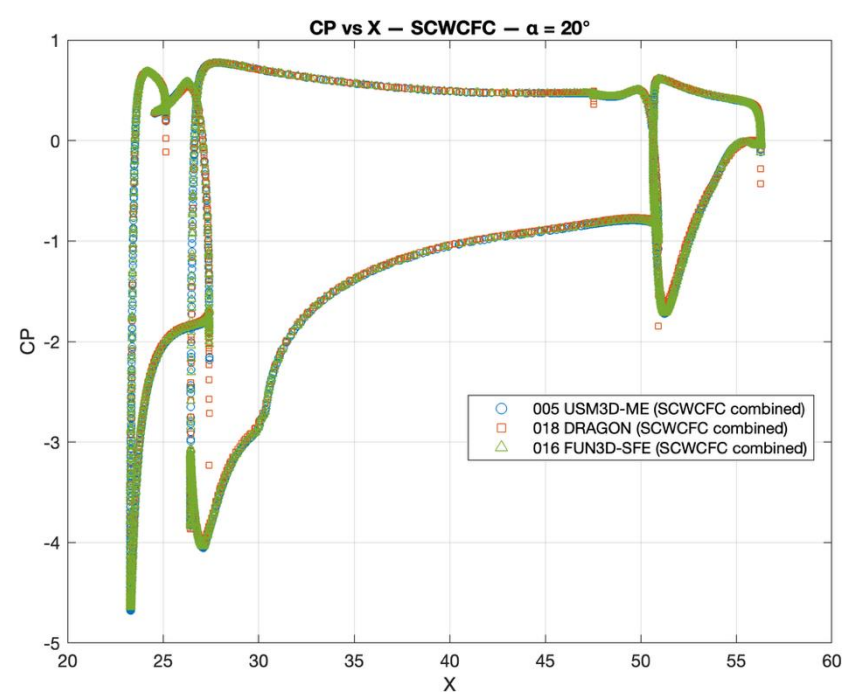
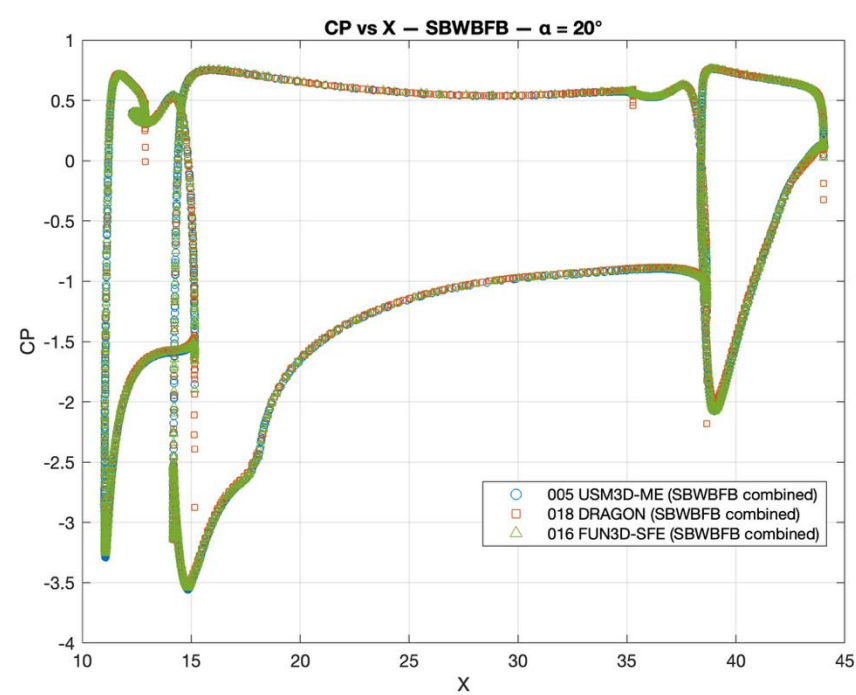
CM vs. mapped iteration — 20 deg.

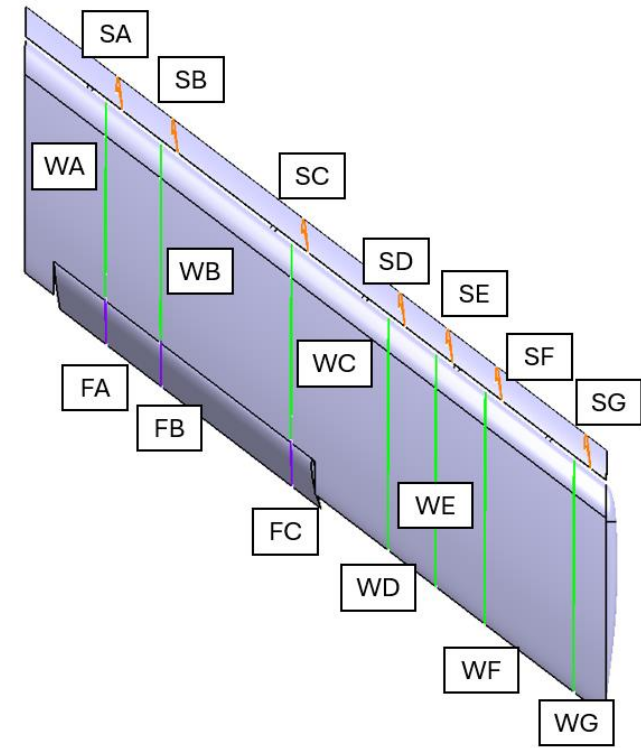
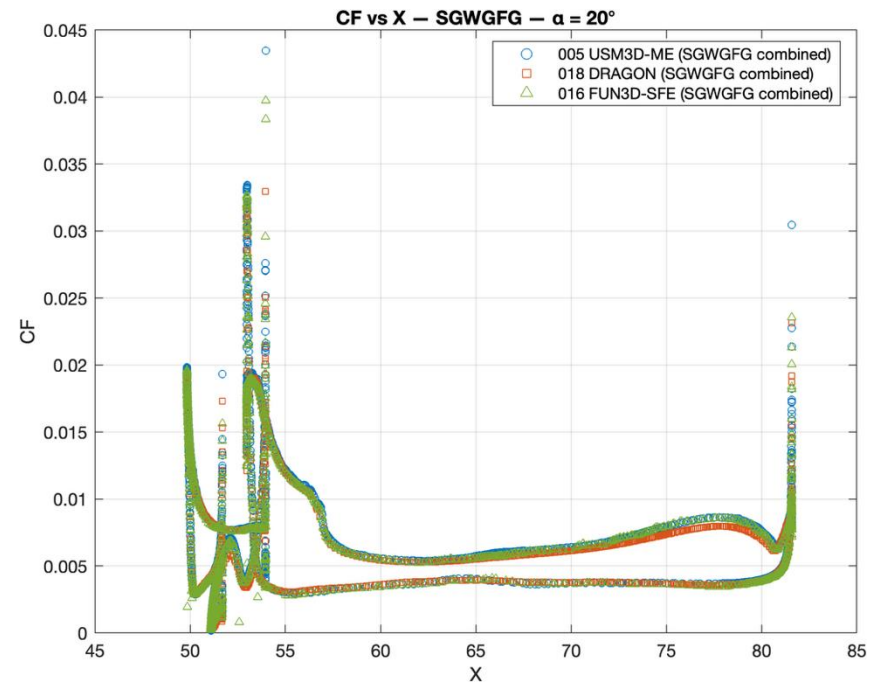
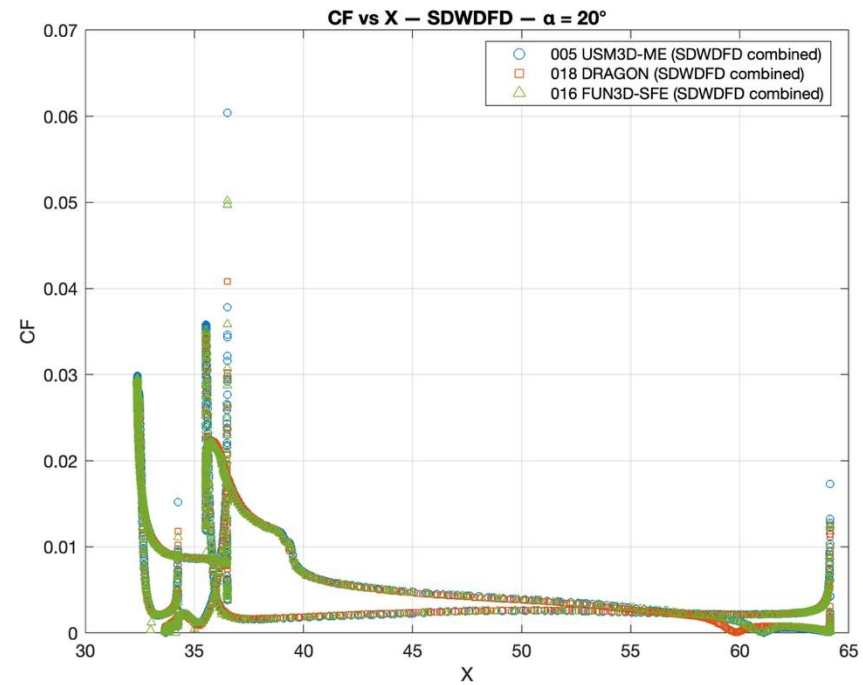
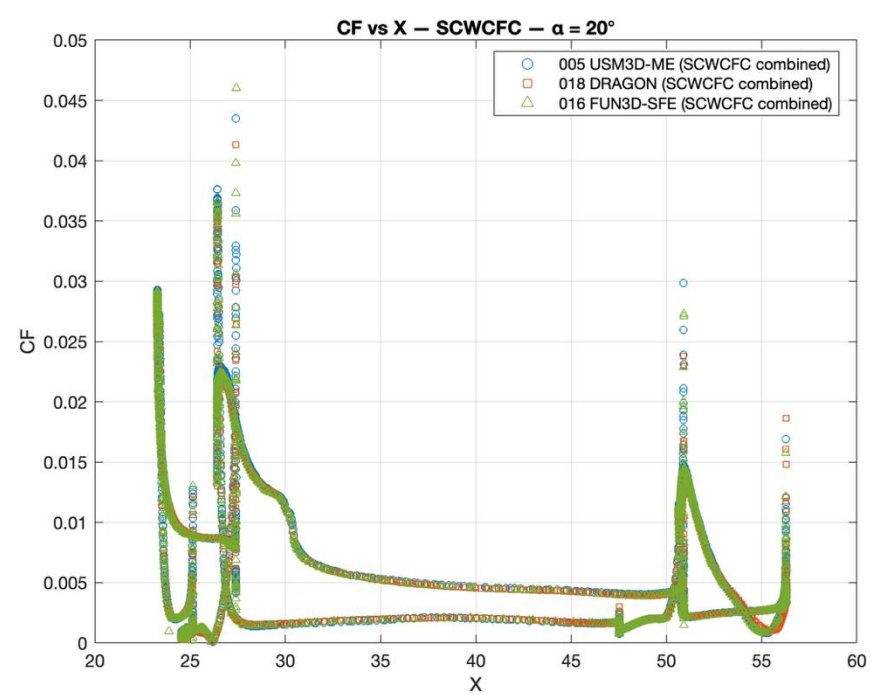
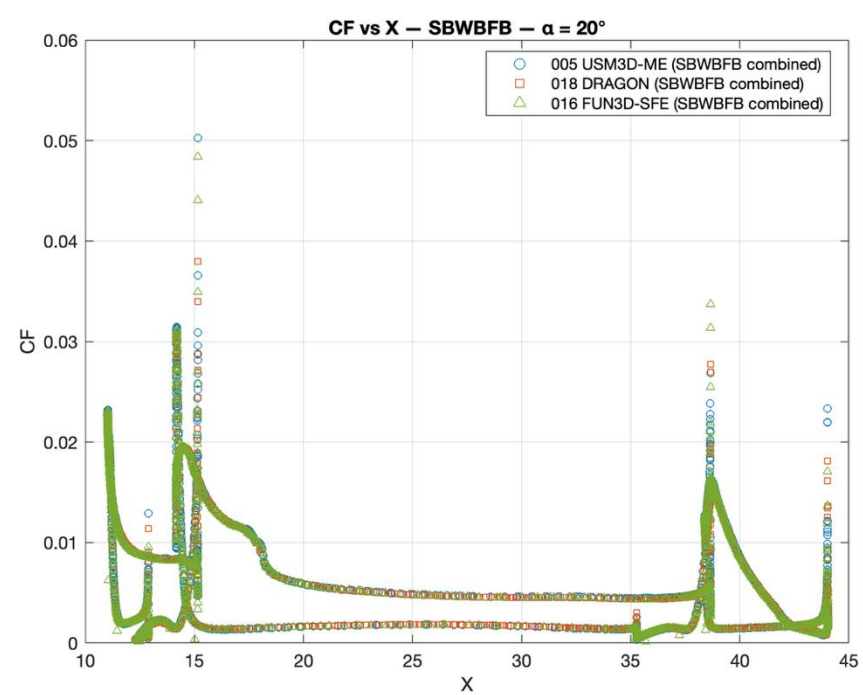


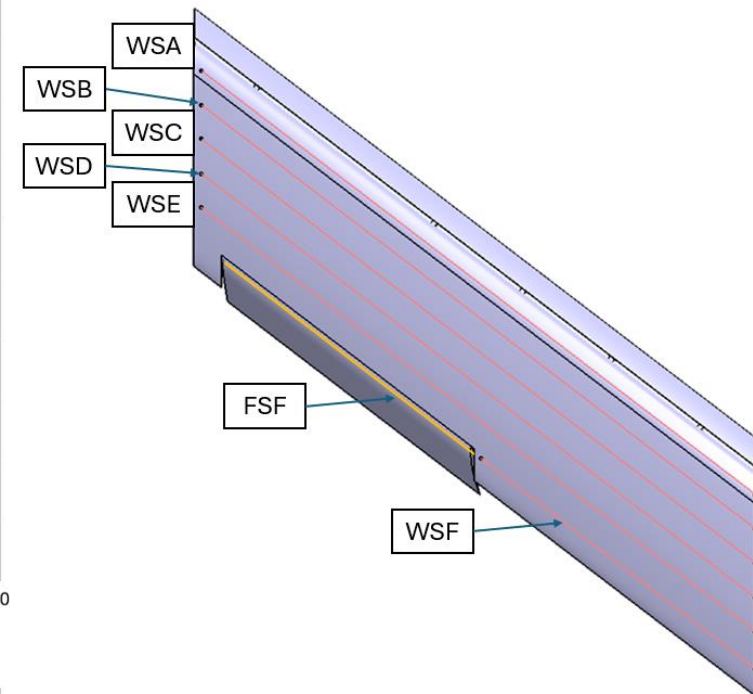
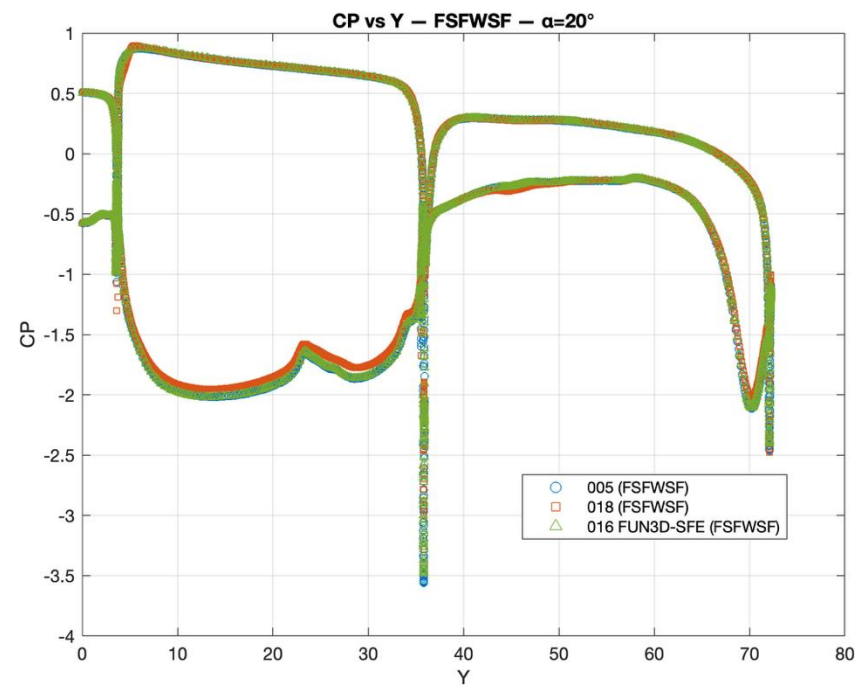
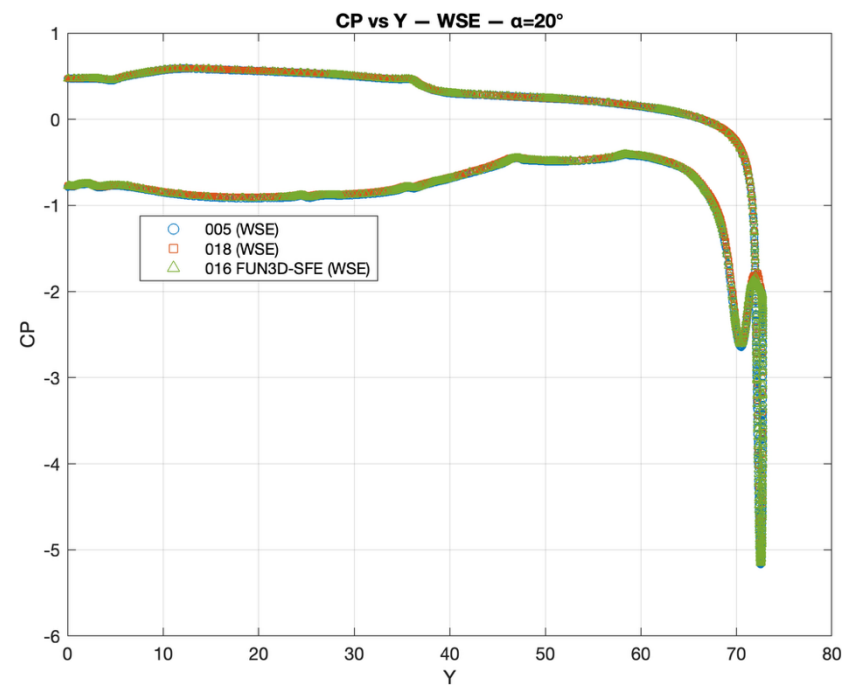
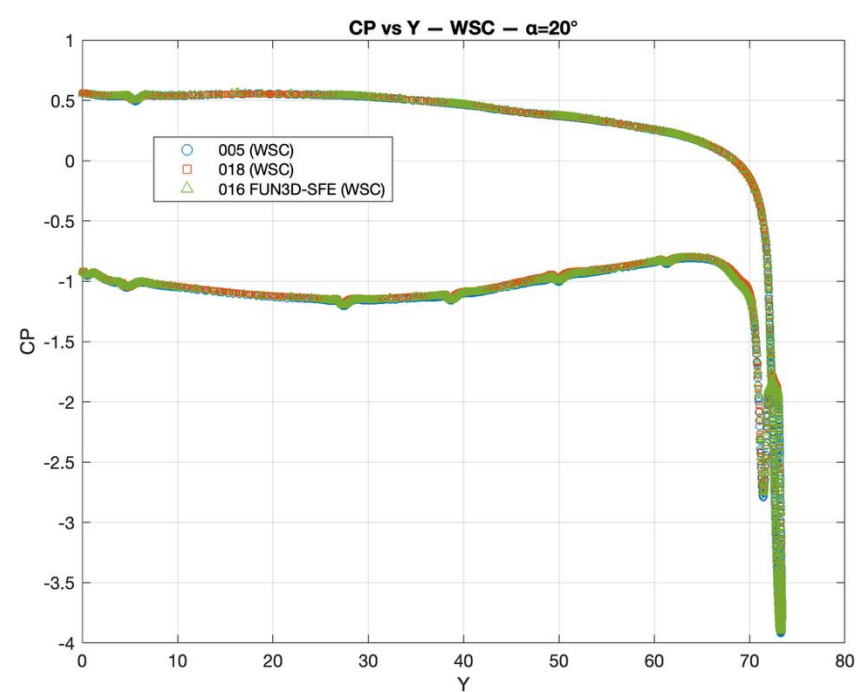
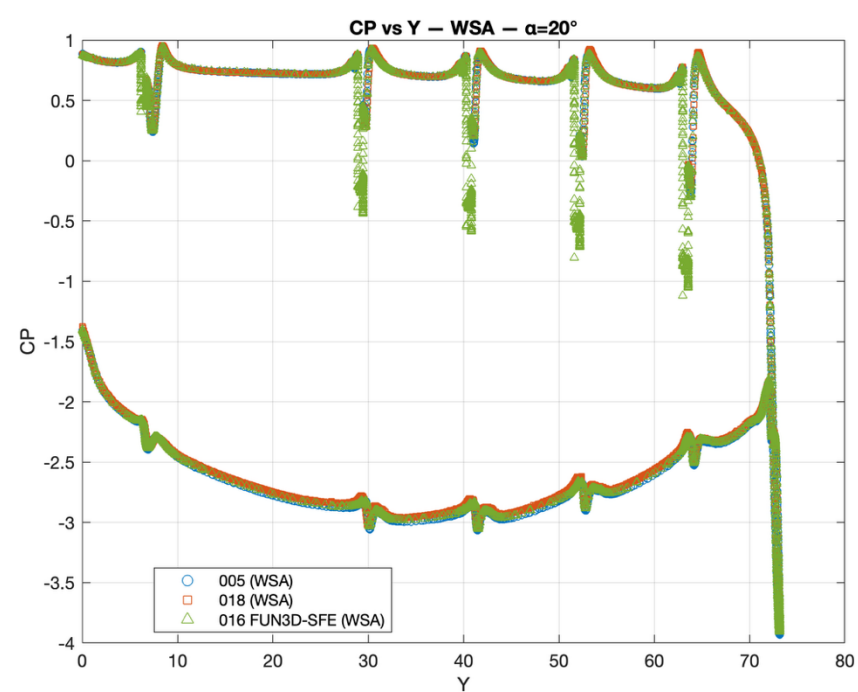


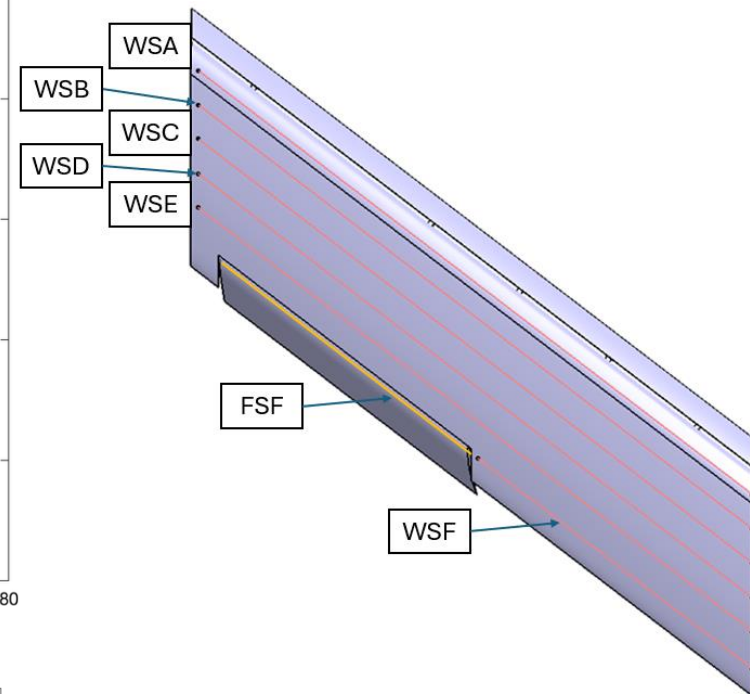
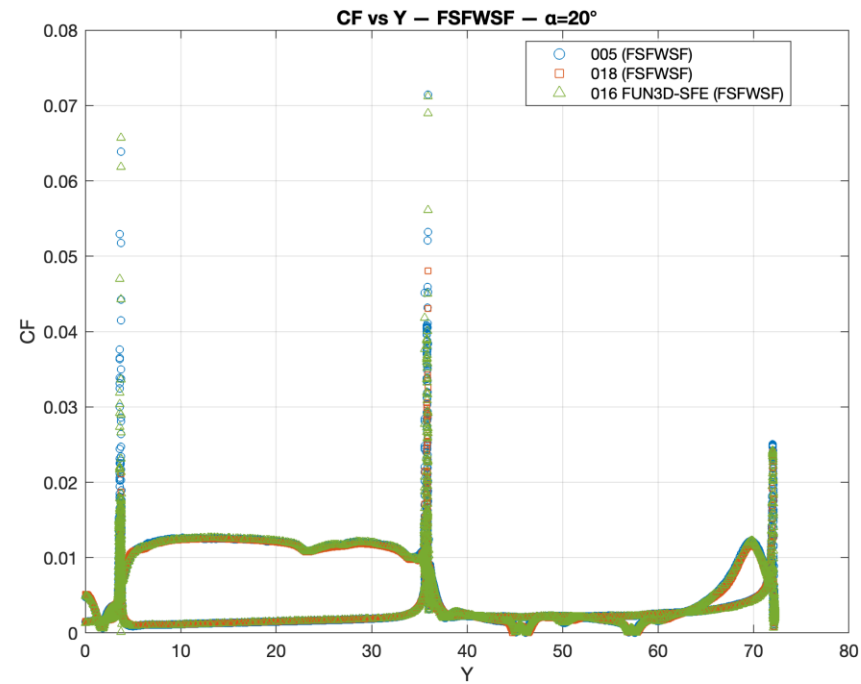
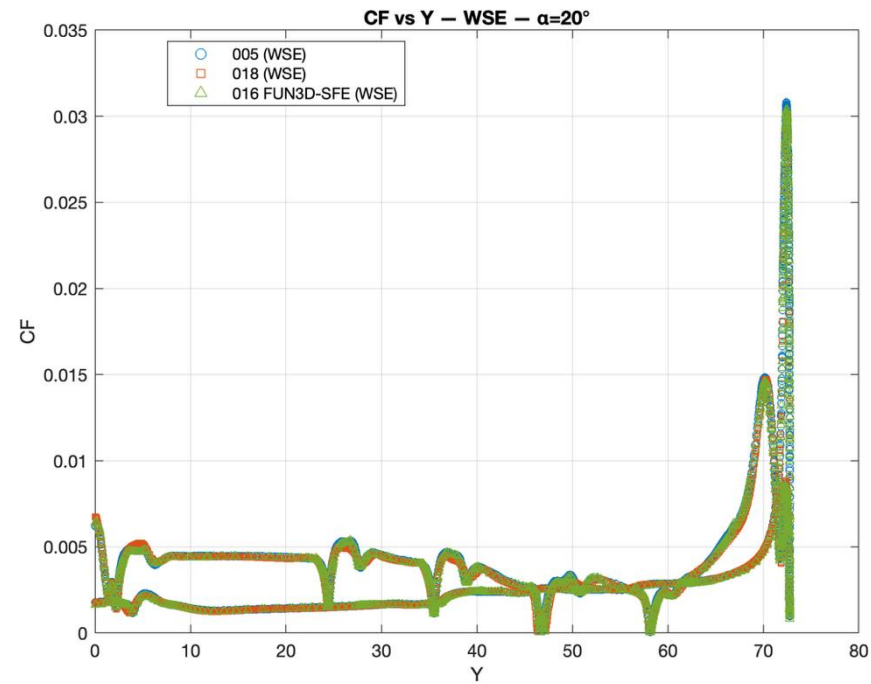
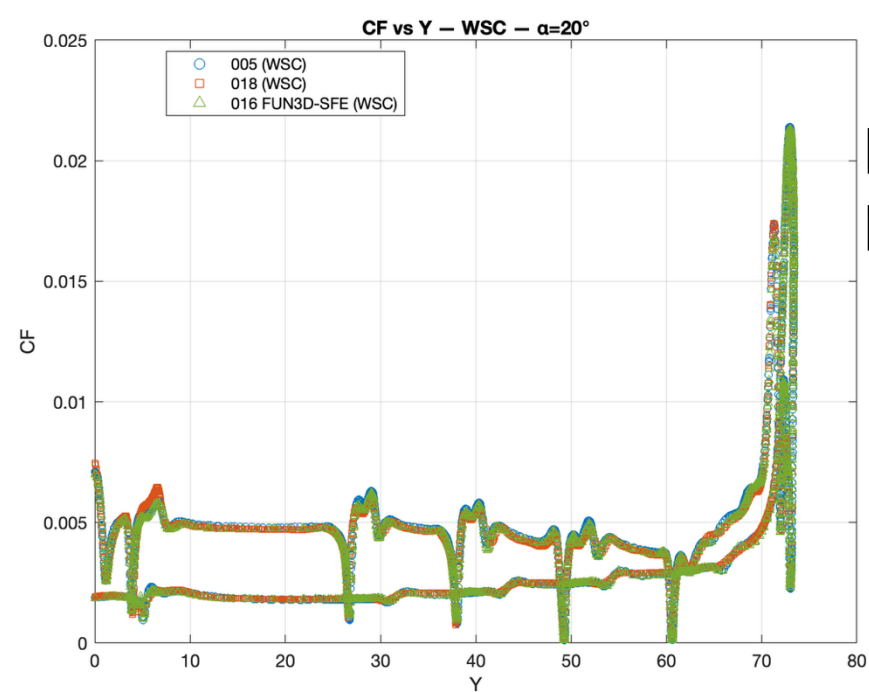
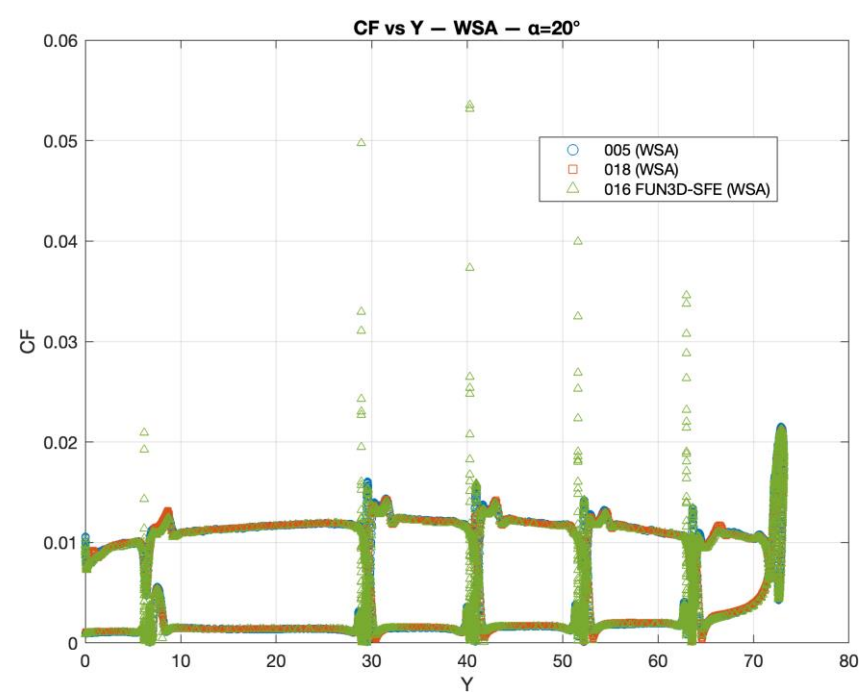




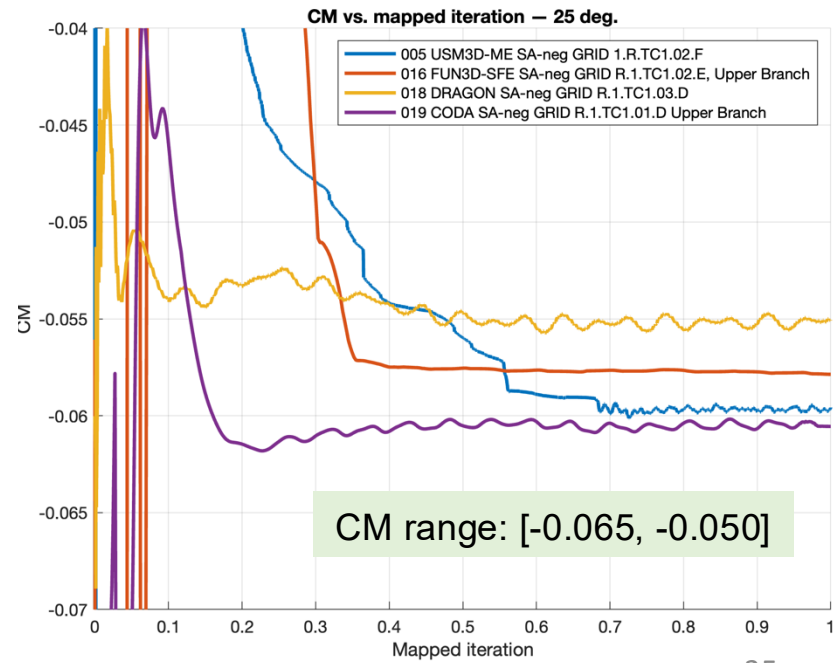
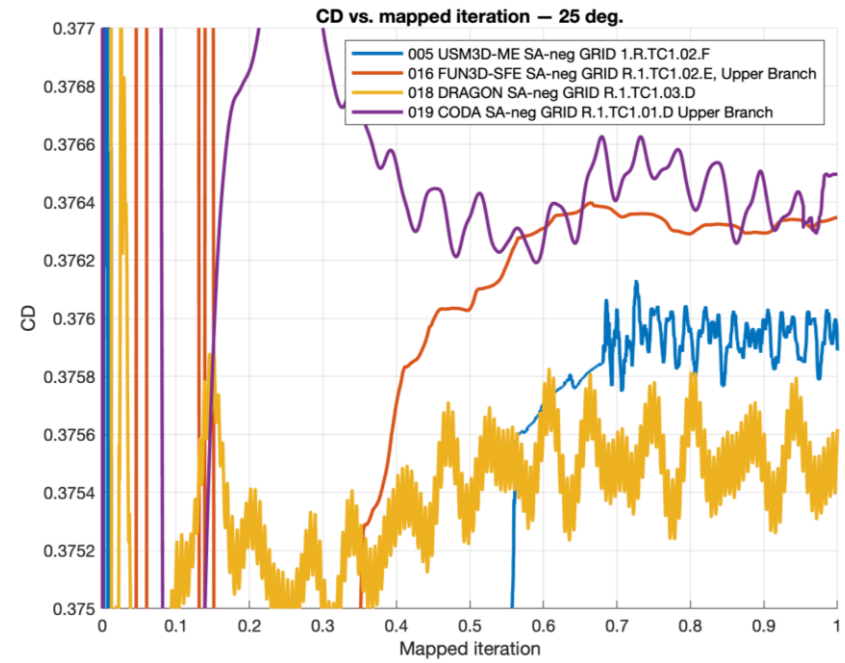
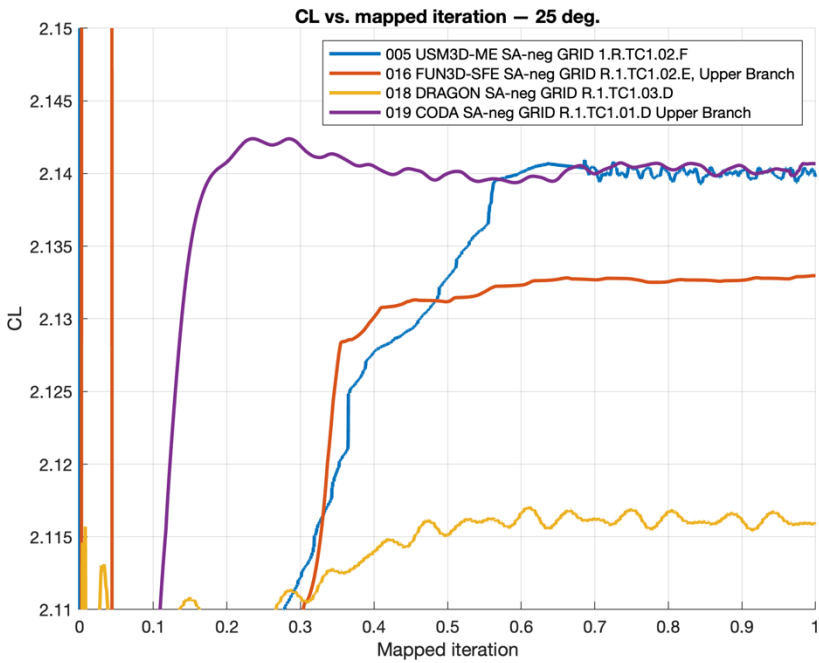
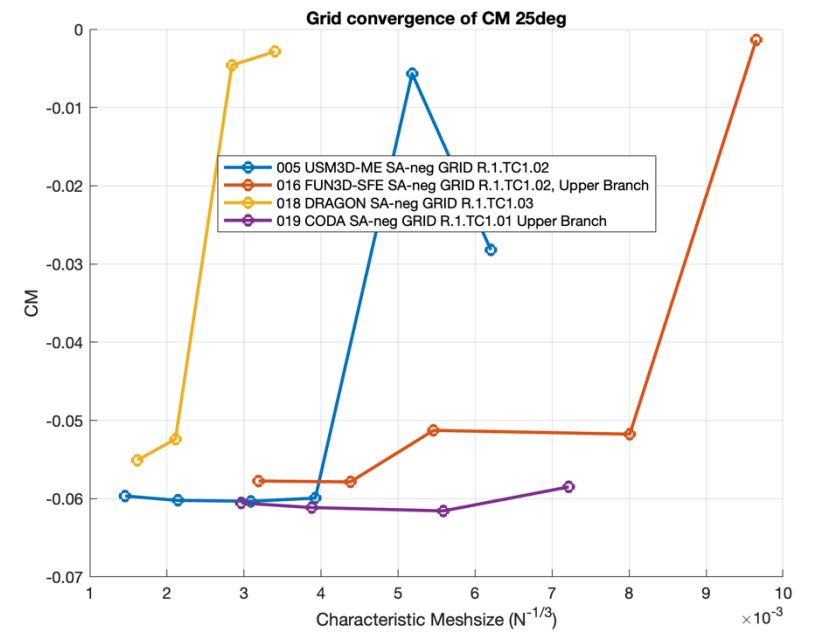
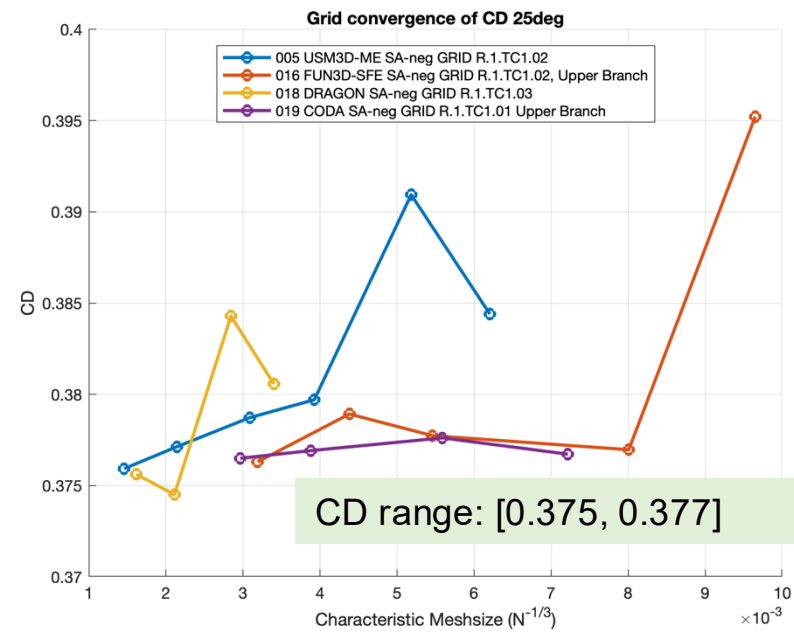
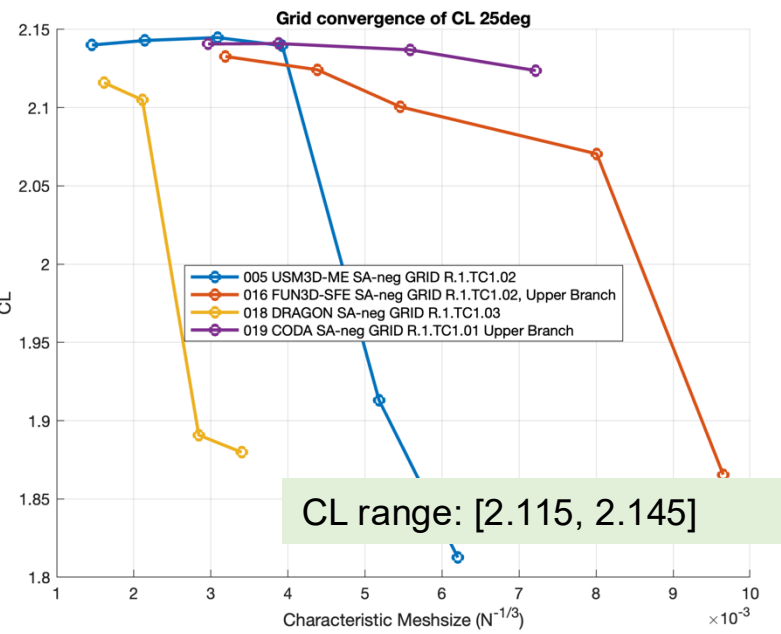


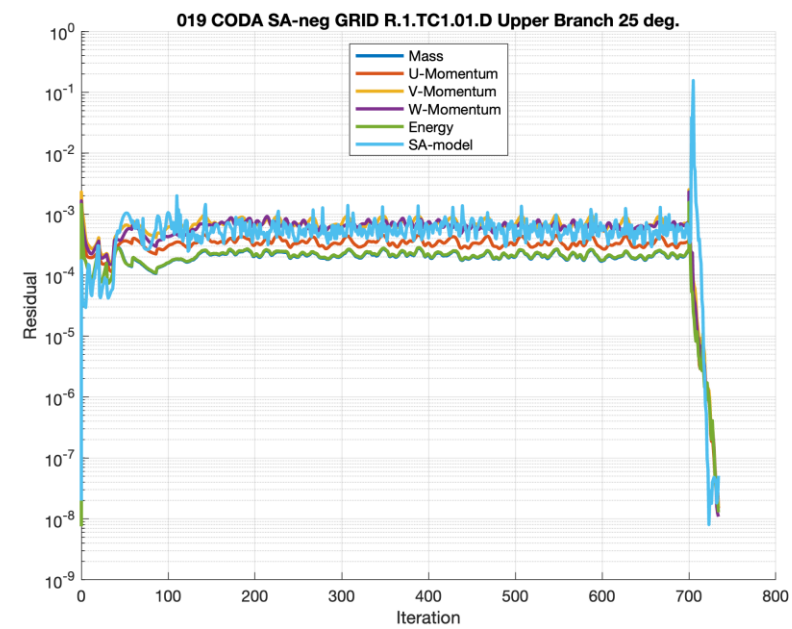
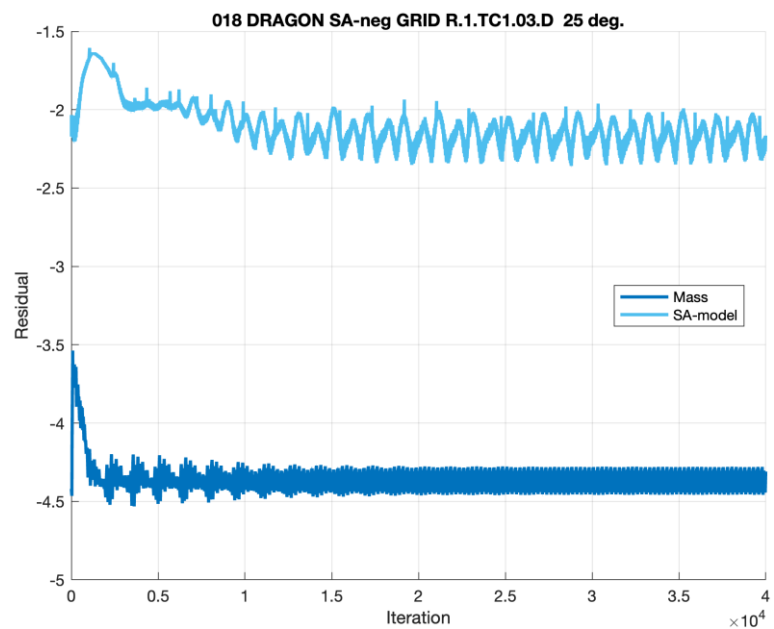
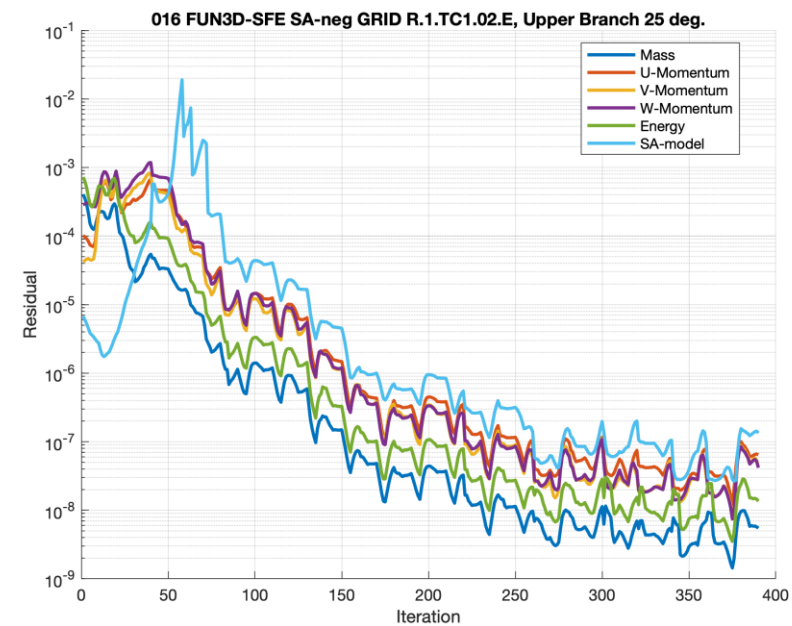
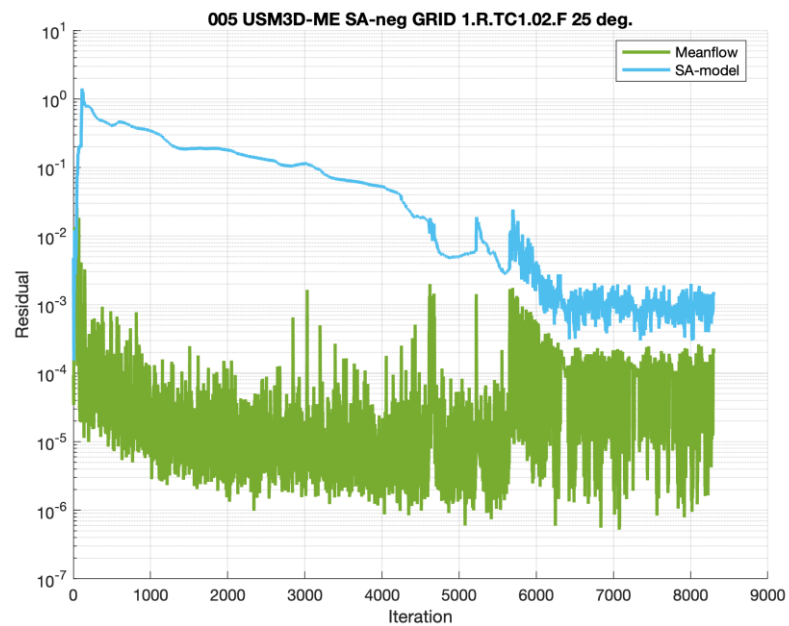


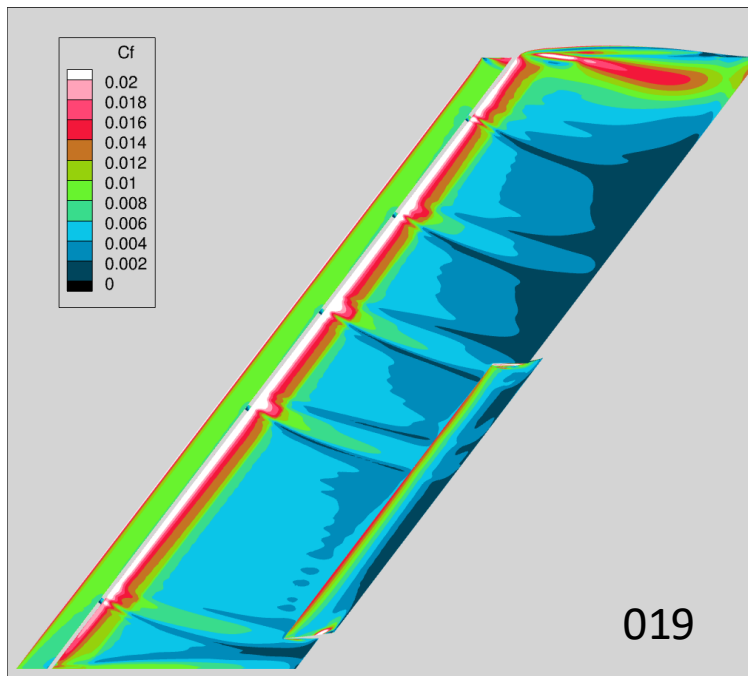
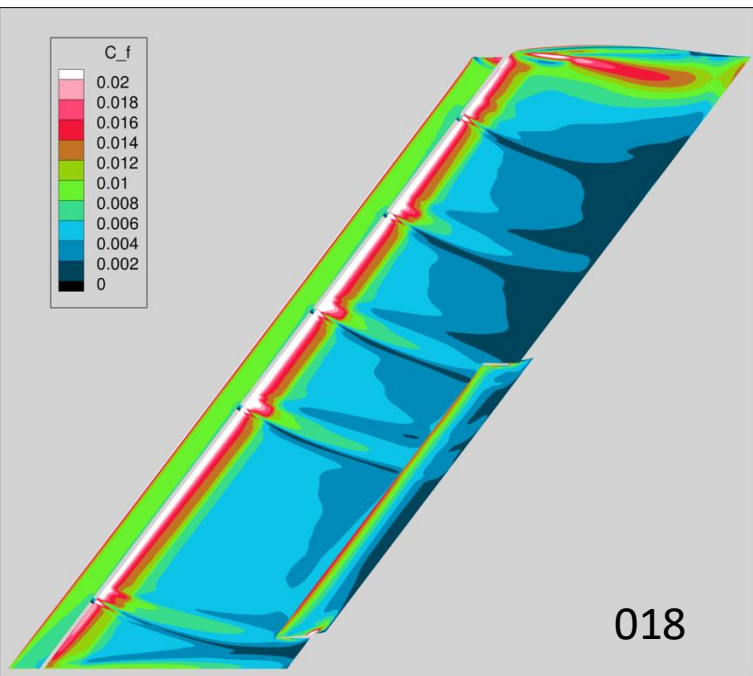
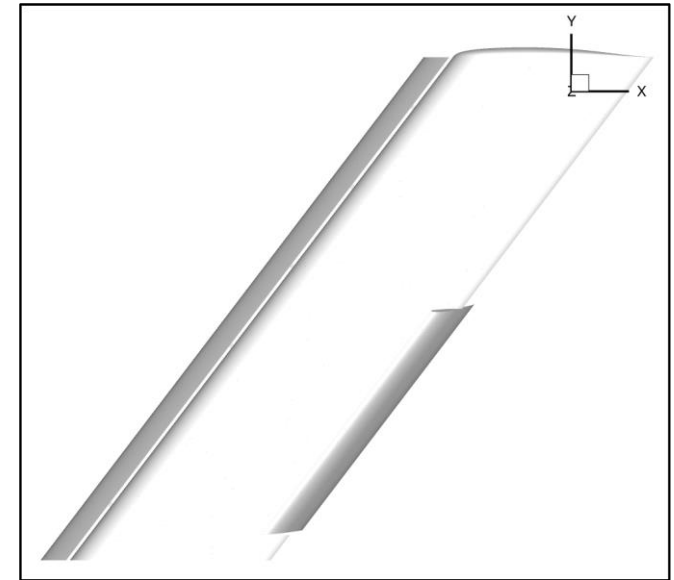
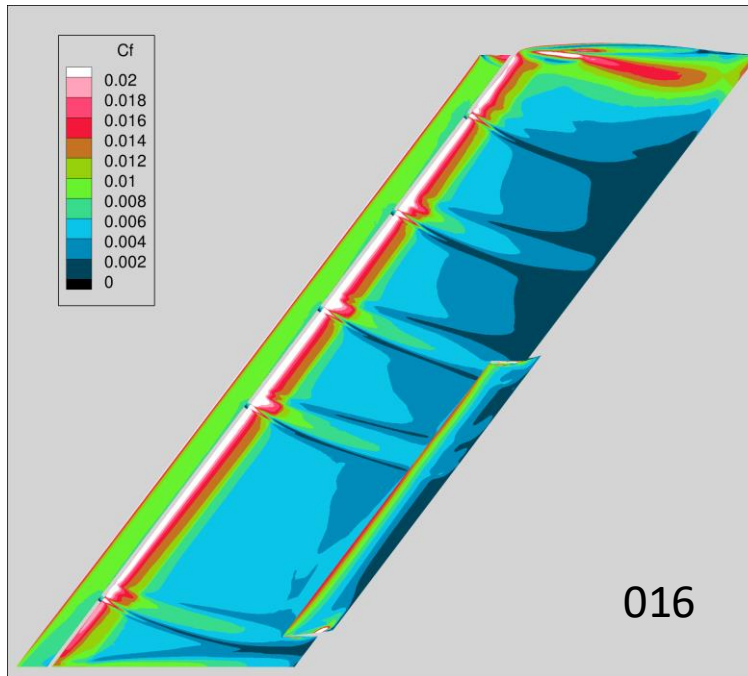
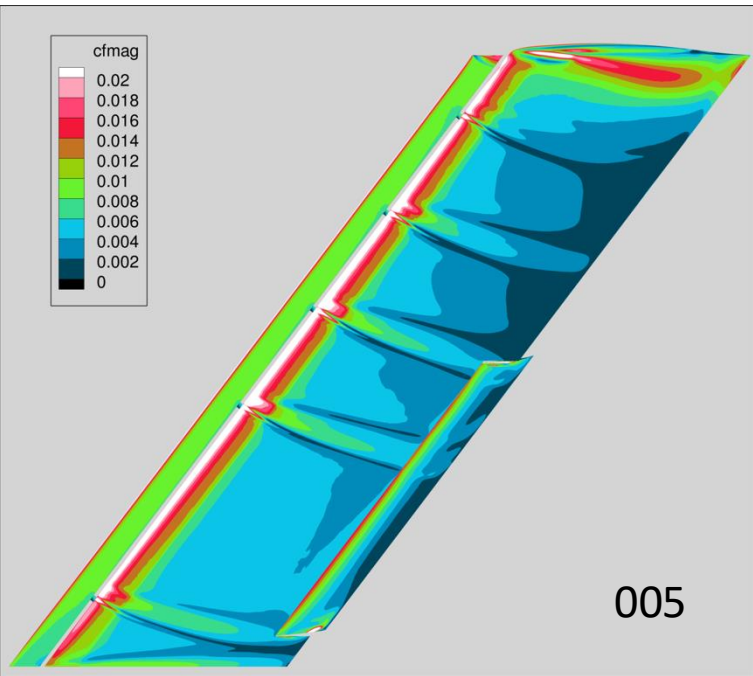


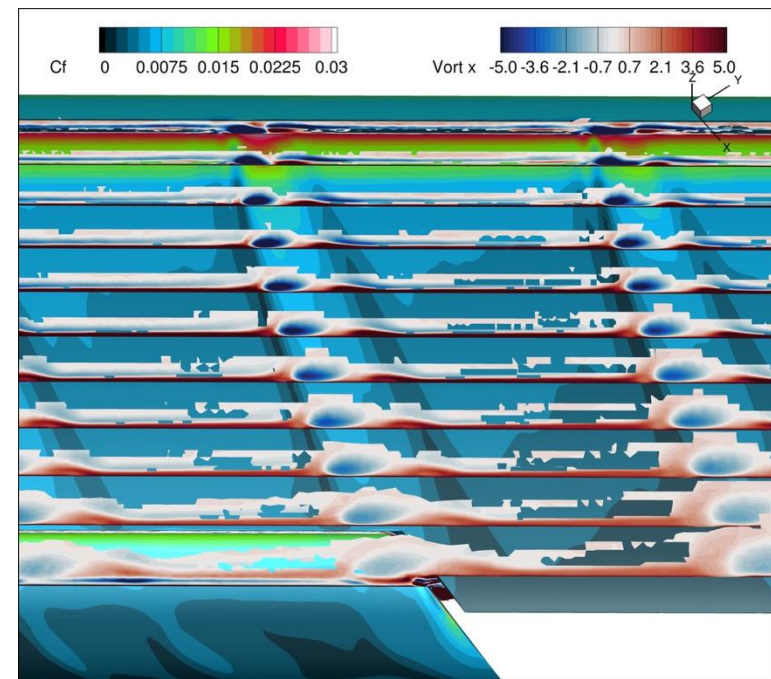
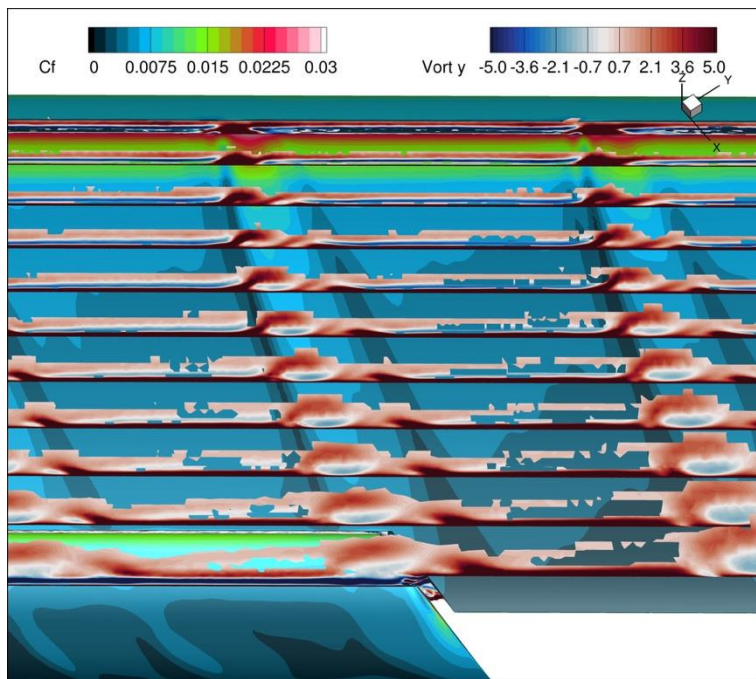
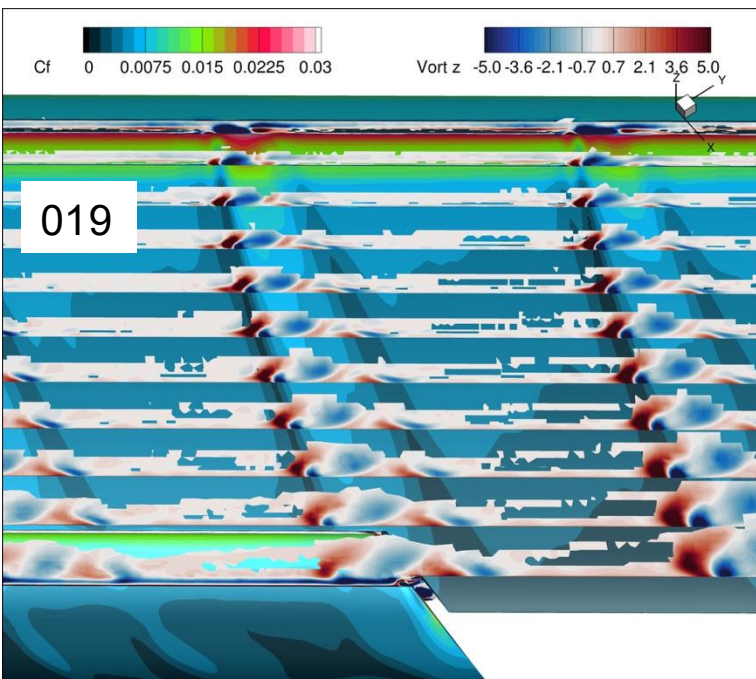
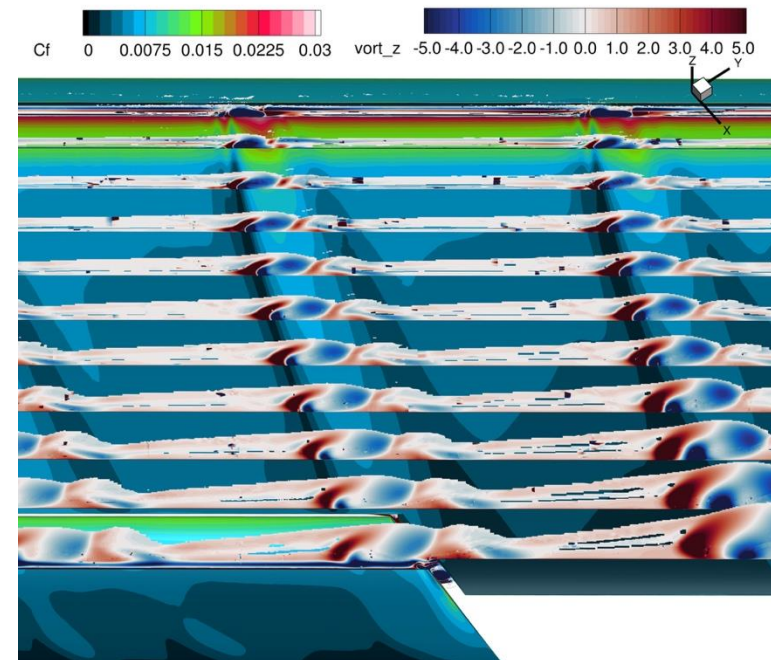
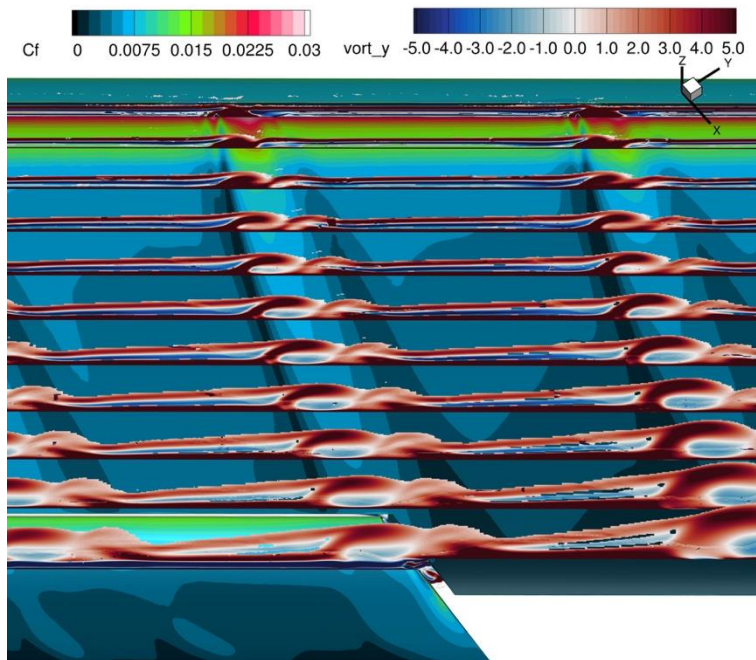
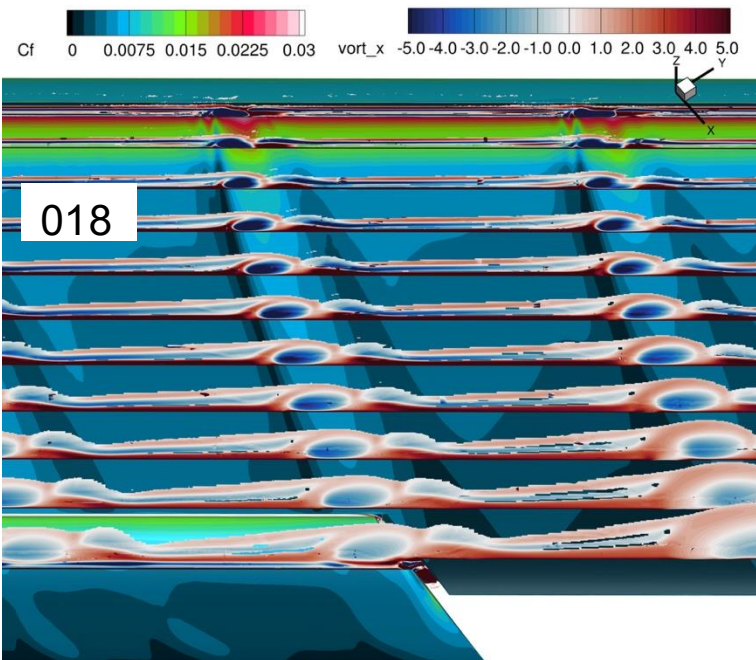


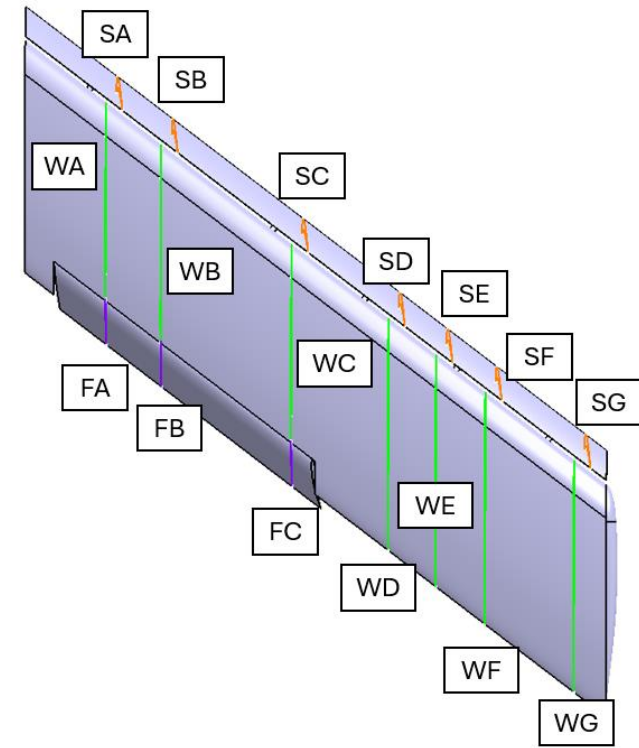
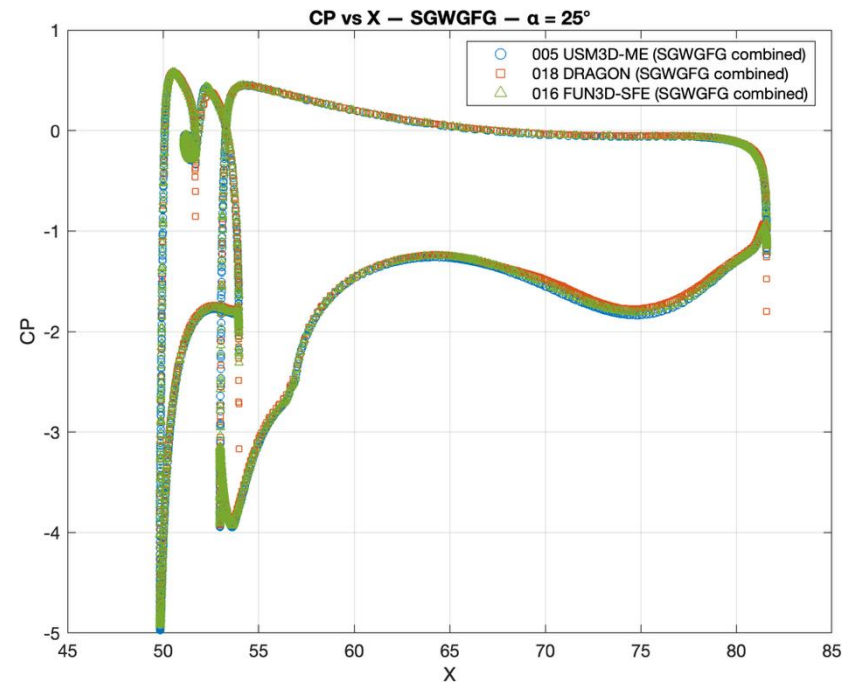
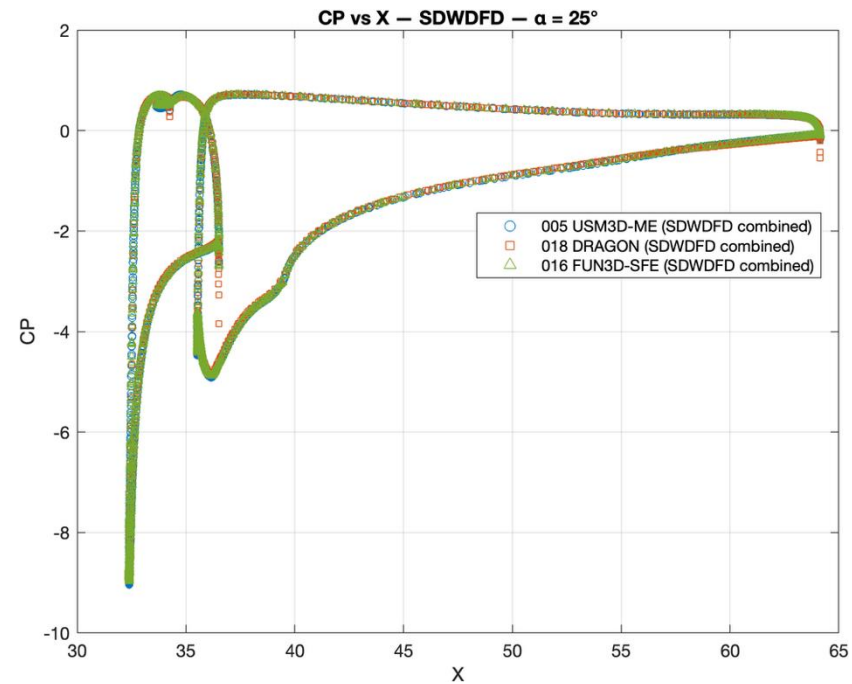
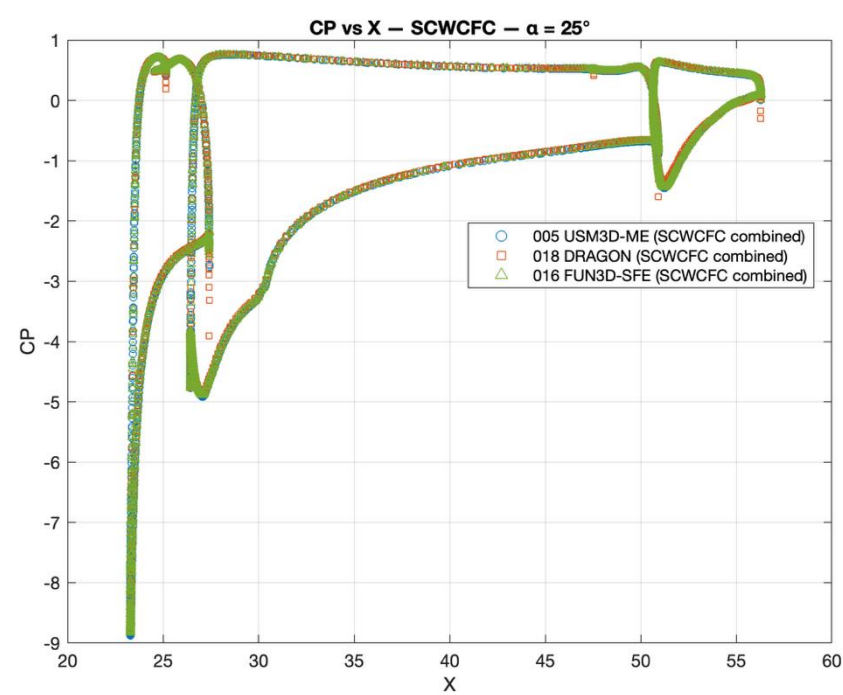
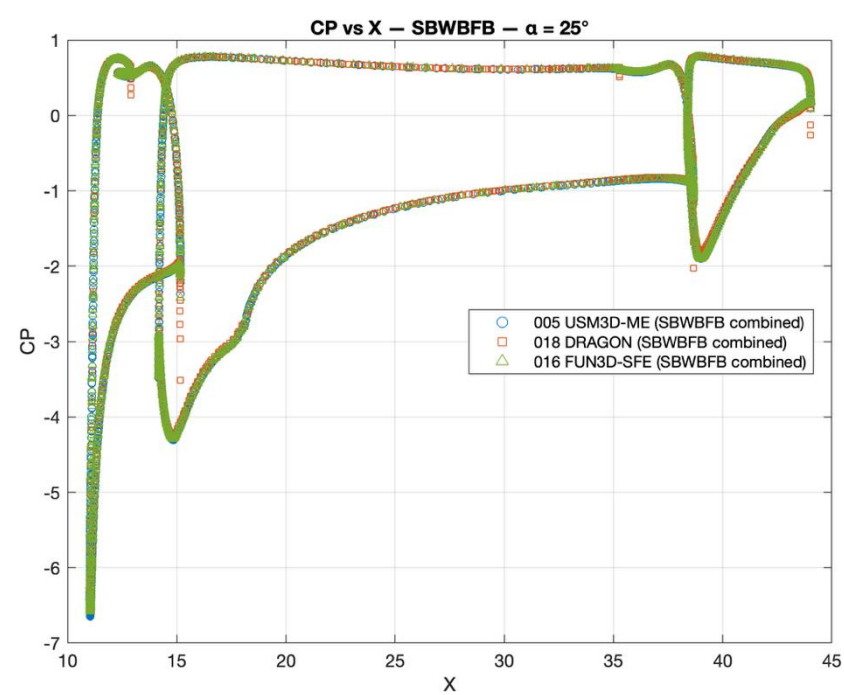
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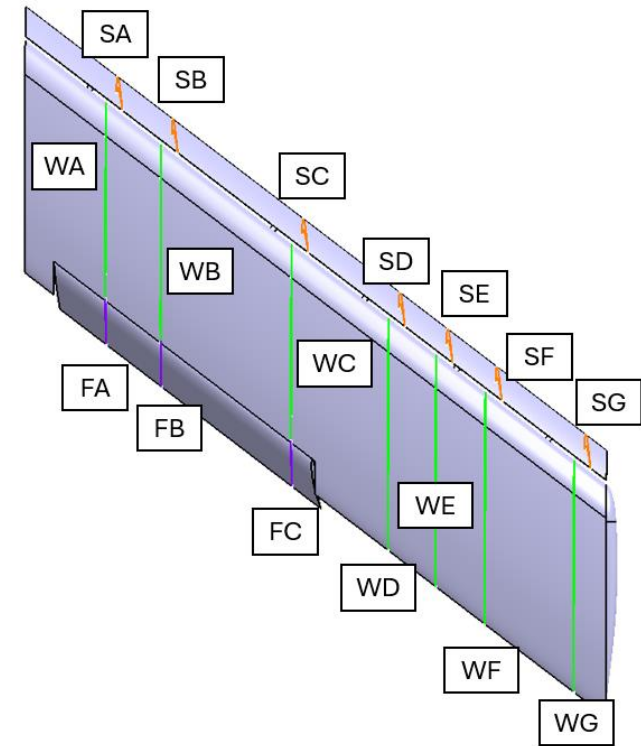
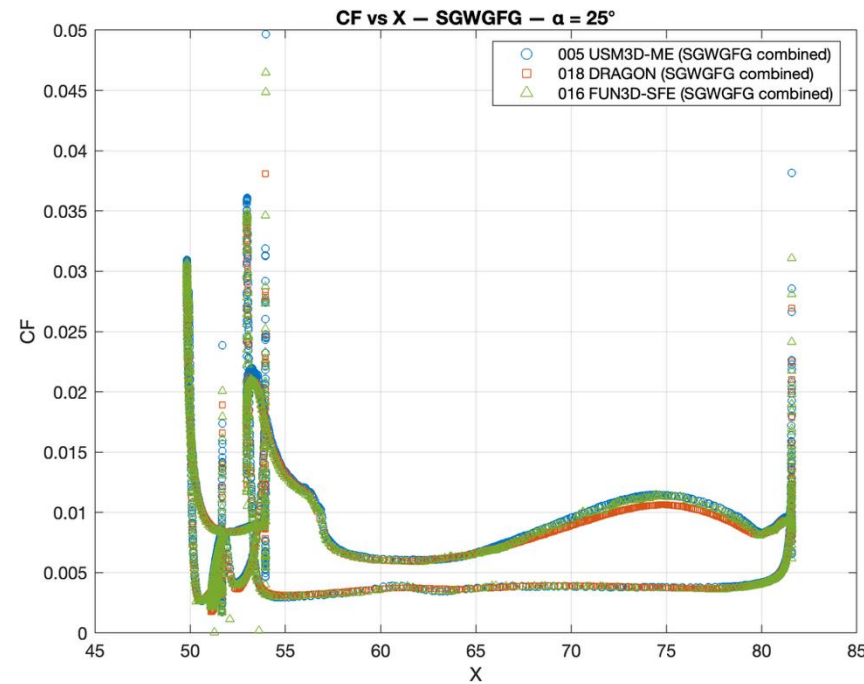
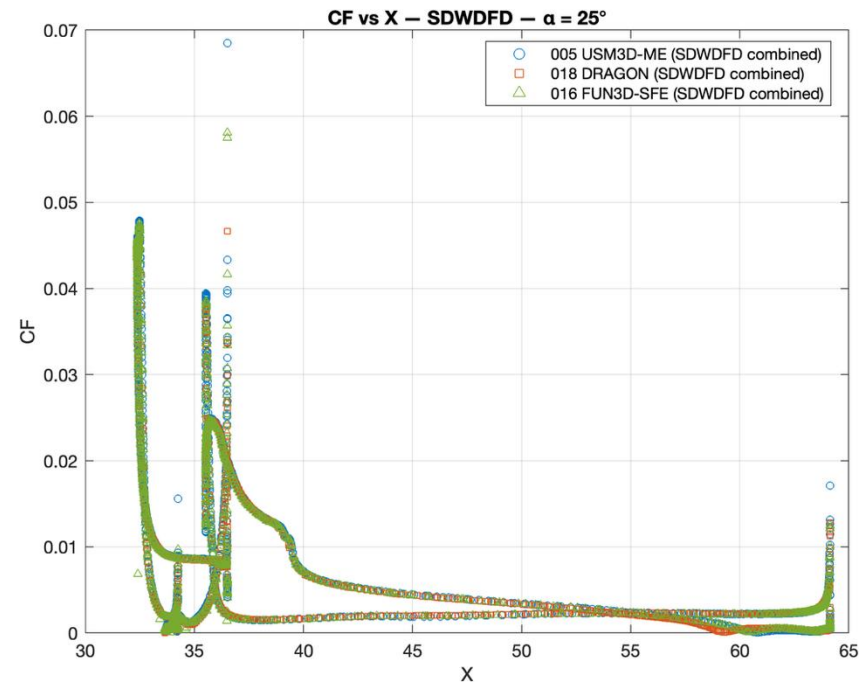
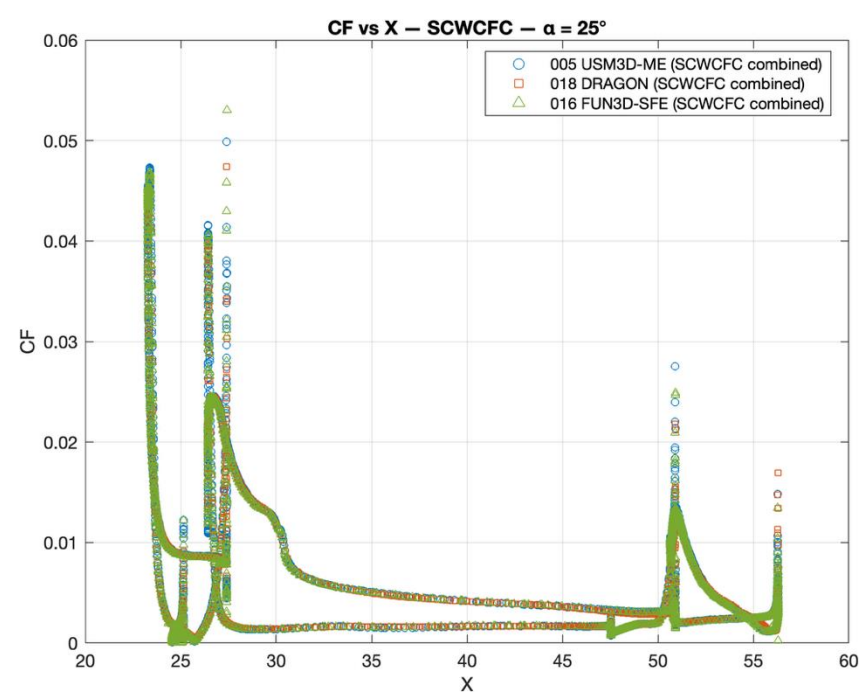
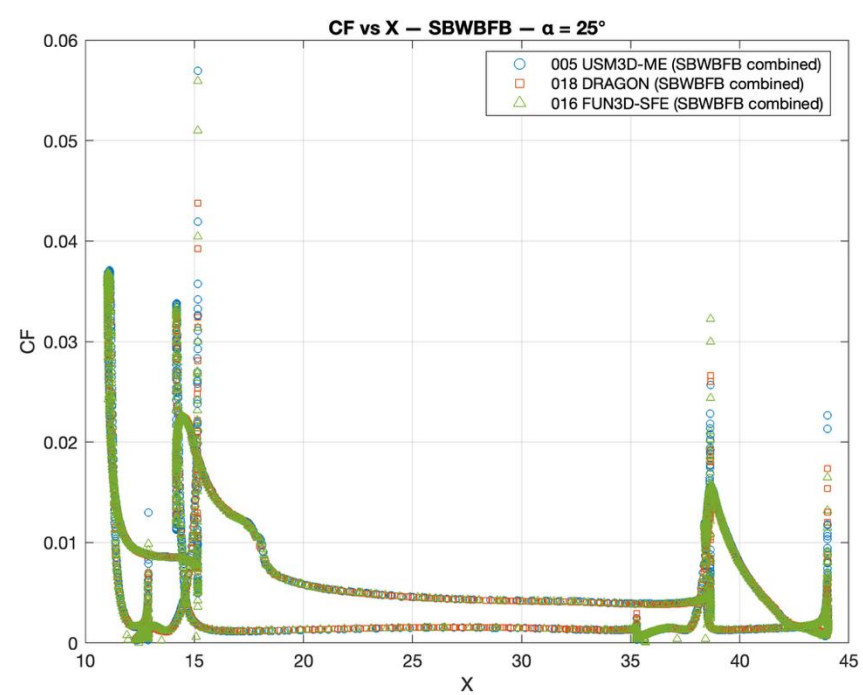


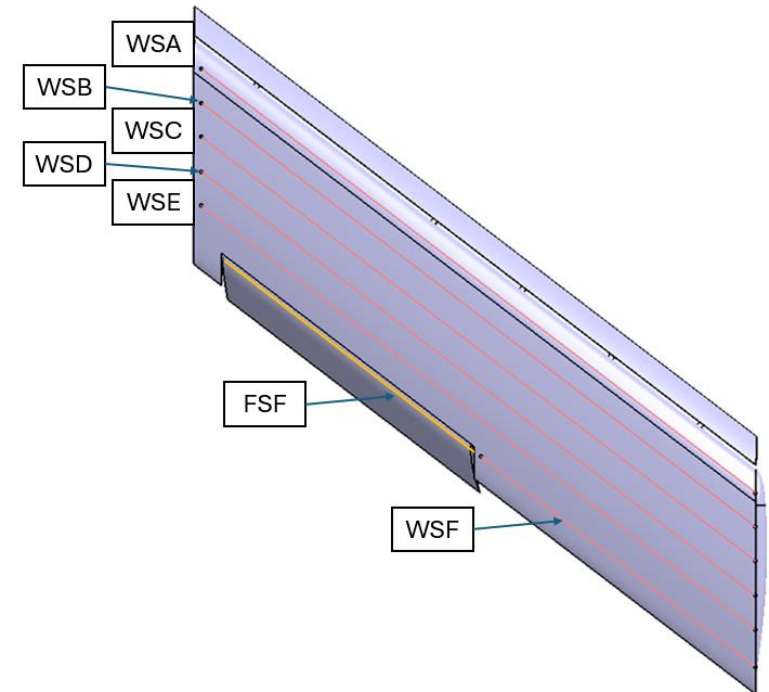
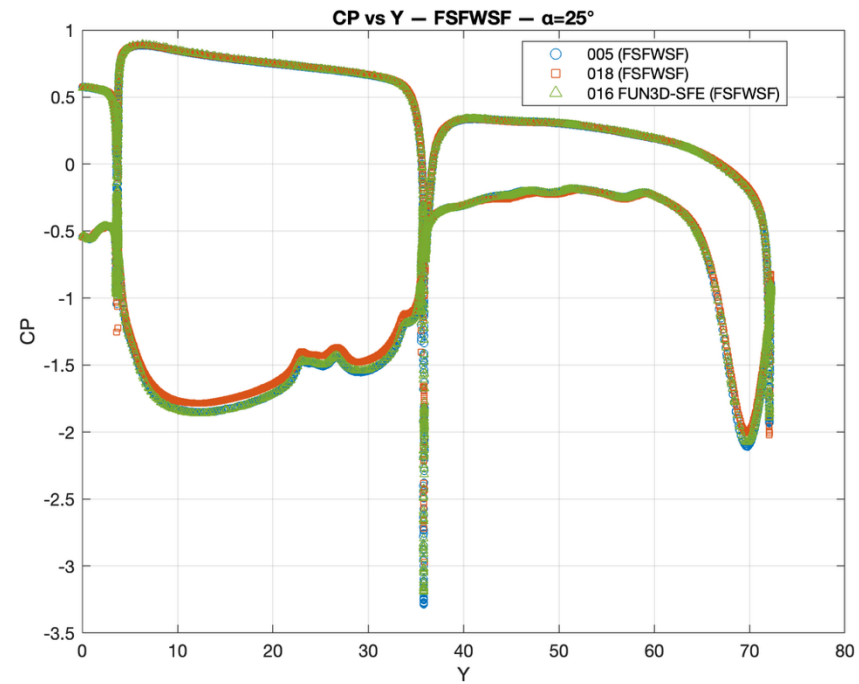
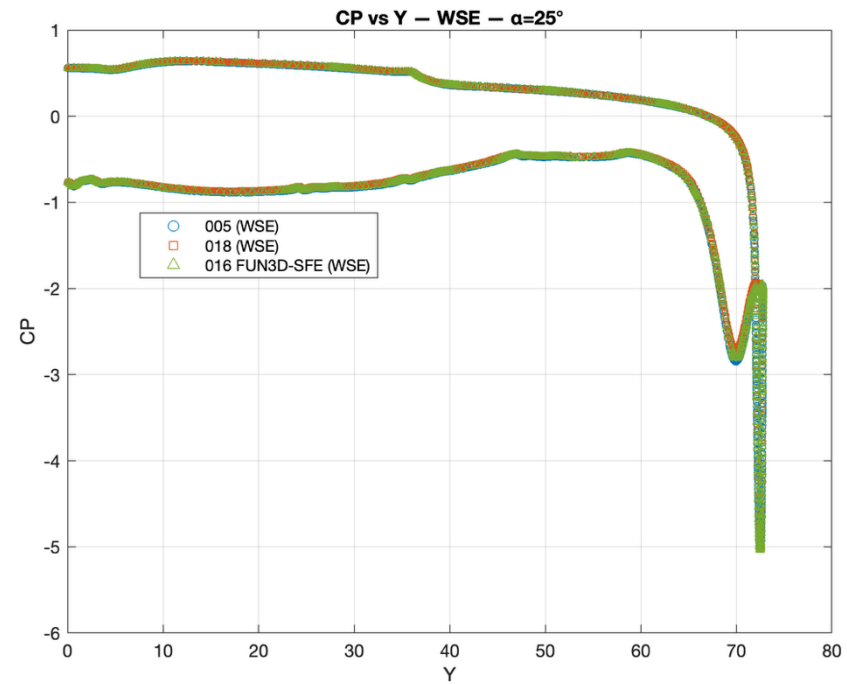
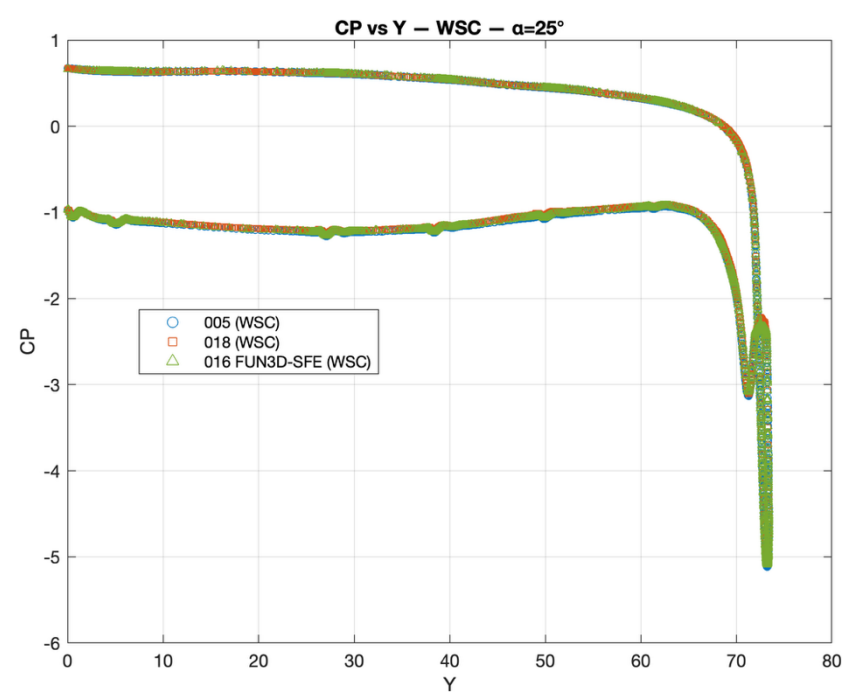
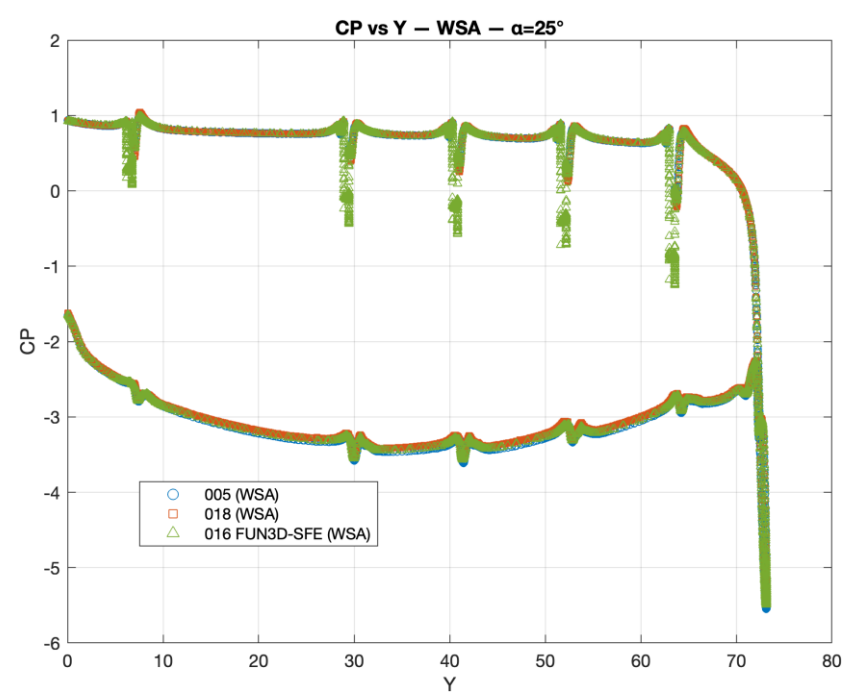


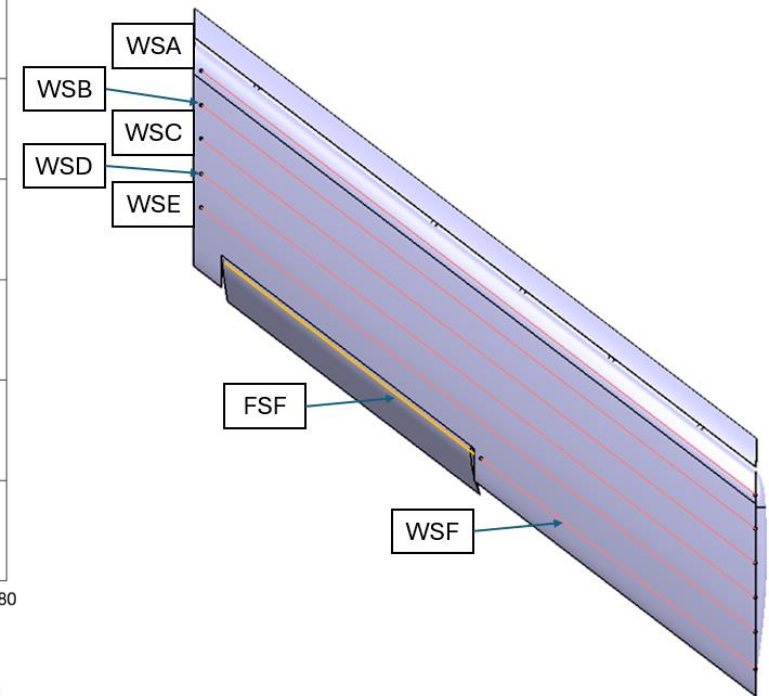
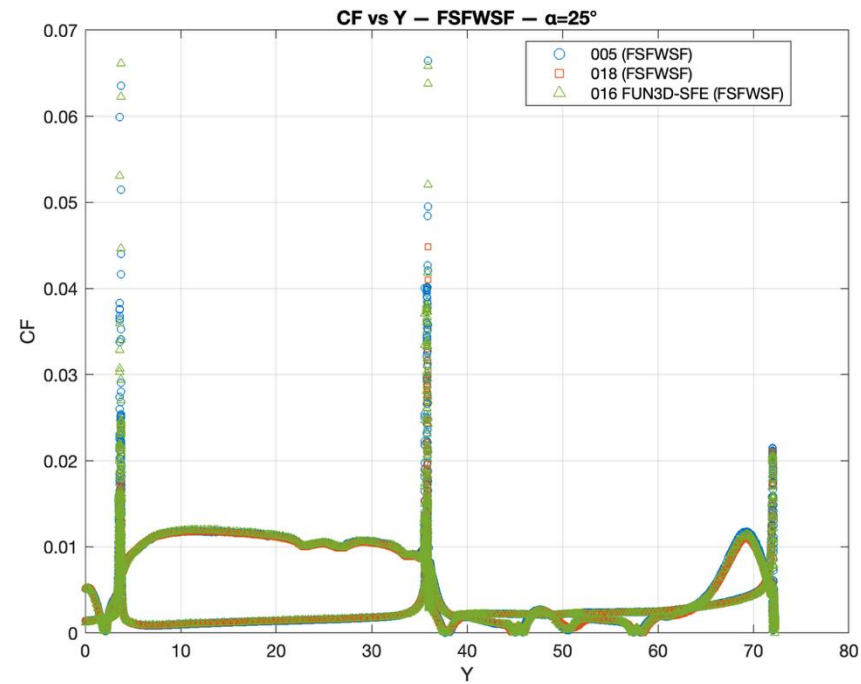
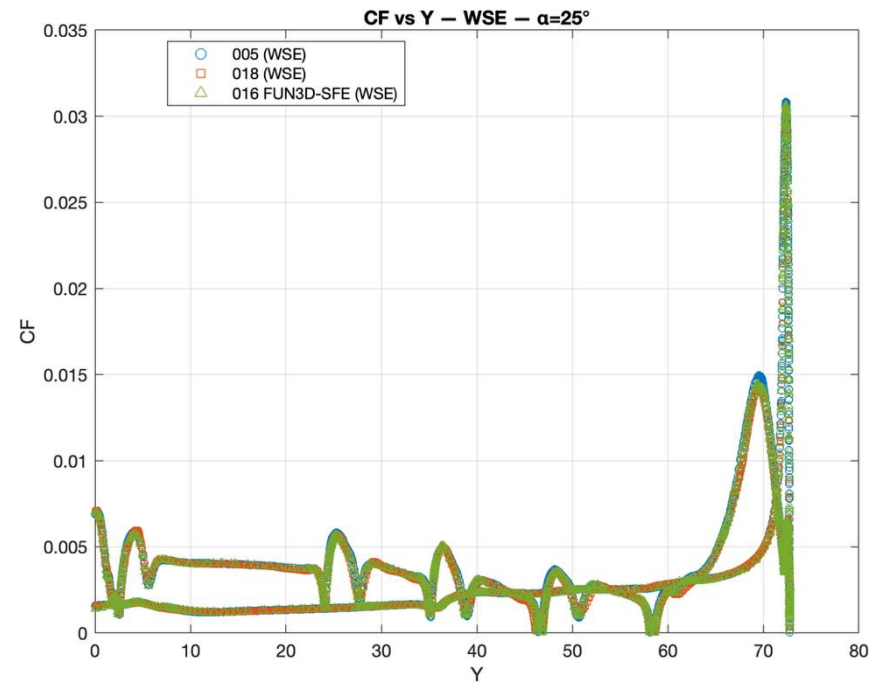
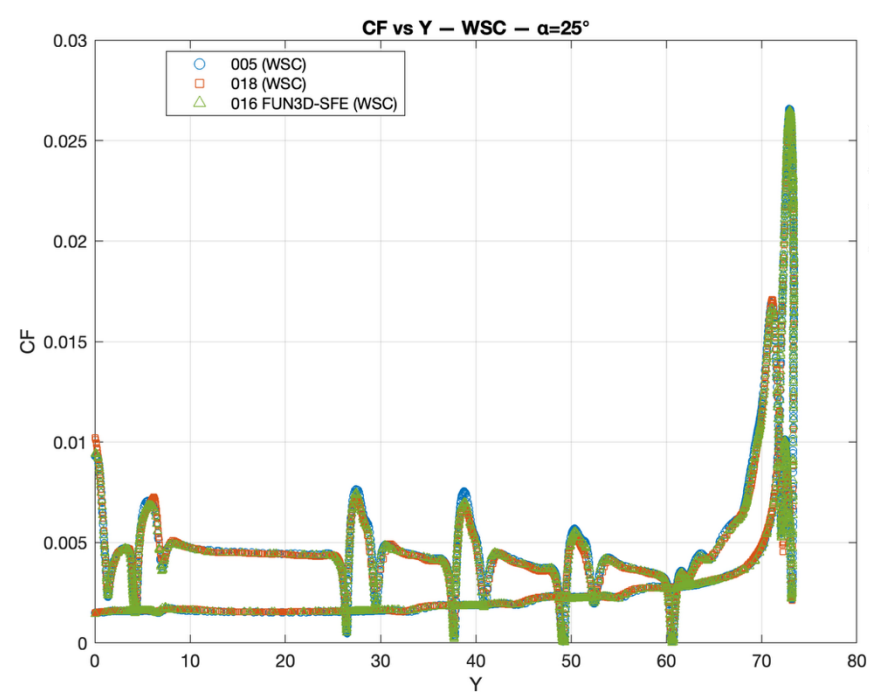
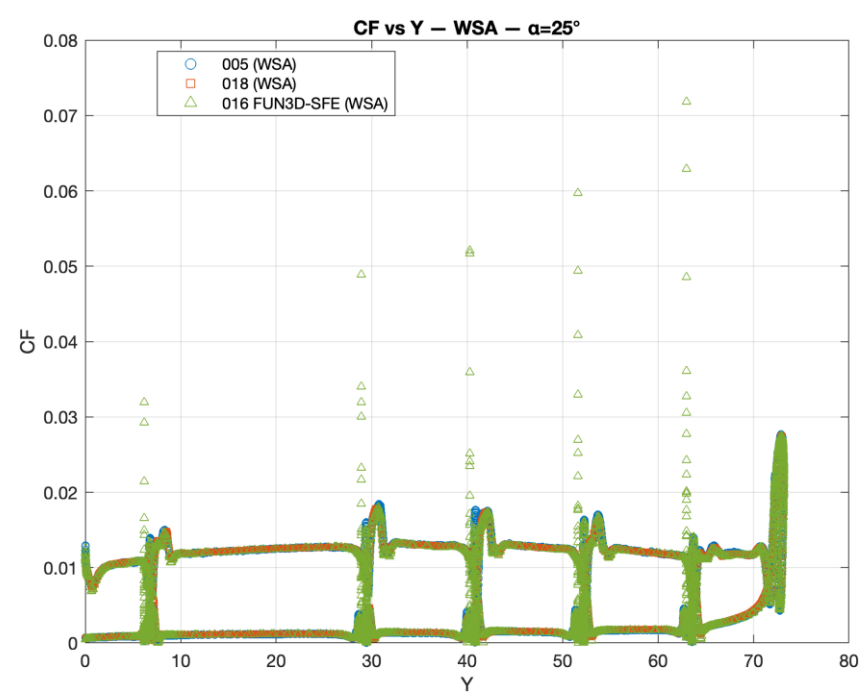












Questions, Comments,
Suggestions?