# DPW-8 & AePW-4
# Buffet Working Group Mini Workshop 2

May 20, 2025

Virtual

https://aiaa-dpw.larc.nasa.gov
https://nescacademy.larc.nasa.gov/workshops/AePW4/public

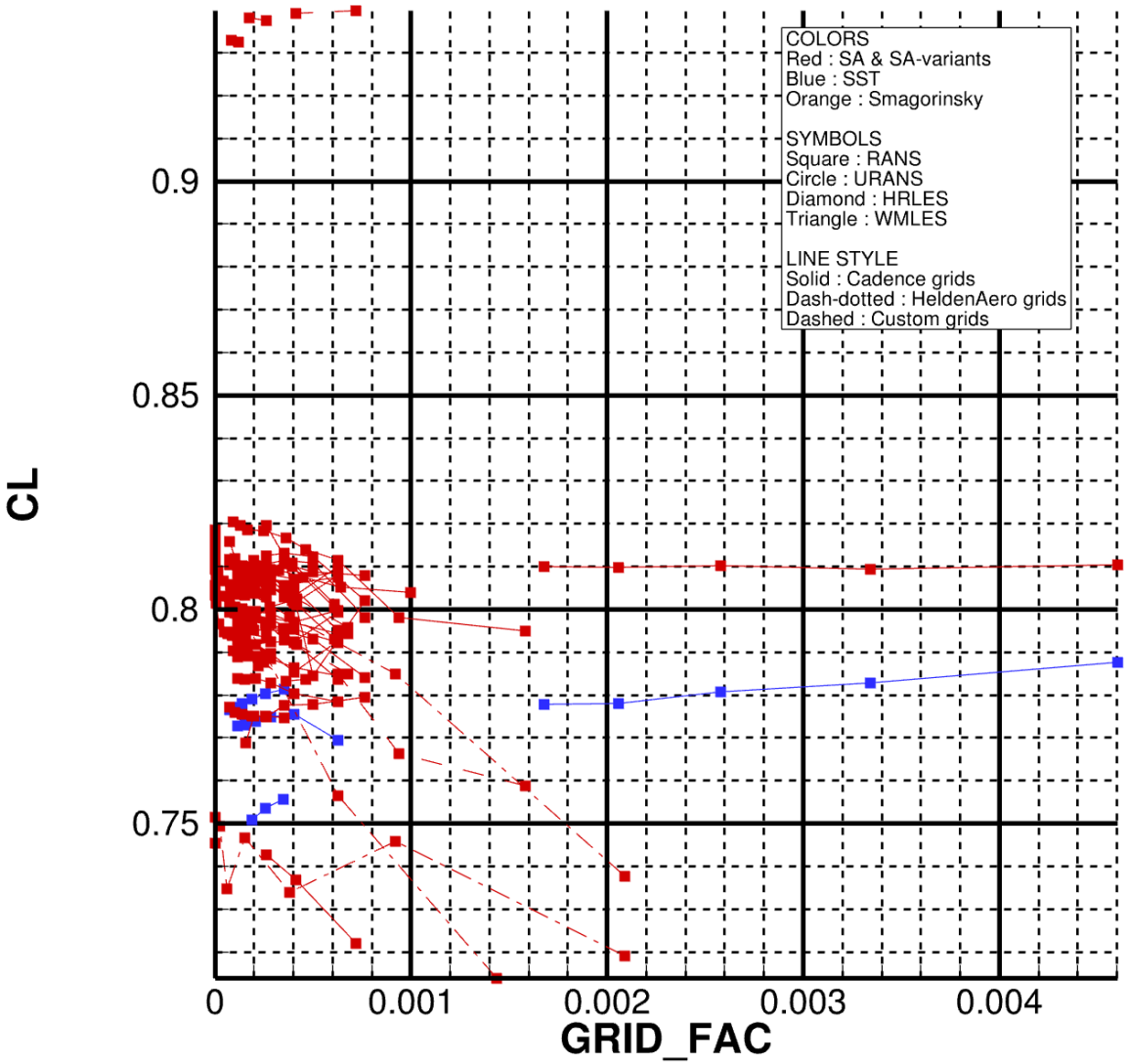
# Mini Workshop Scope

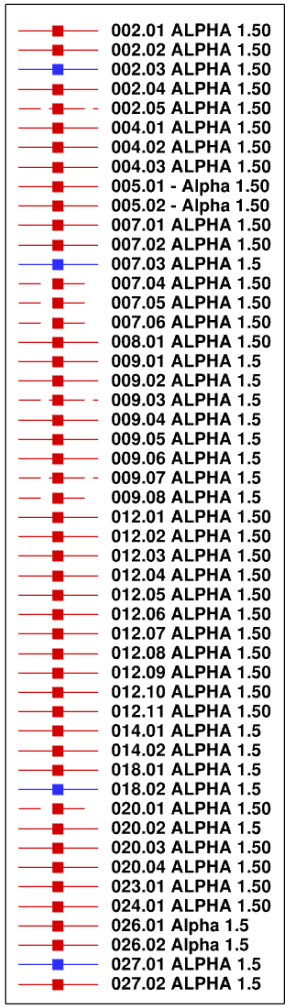
- Check-in for results submitted and lessons learned to date
- Identify opportunities for further improvement
- Establish the foundation for upcoming AVIATION papers
- Additional analysis is coming for AVIATION

# Data Set Summary

- **Many submissions**
  - 74 submissions
  - 18 parties
  - Most full data sets, some partial (e.g., no F&M or sectional cuts)
- **Multiple schemes**
  - RANS (majority)
  - URANS (most common unsteady scheme)
  - HRLES
  - WMLES
  - Adaptive Euler
- **Grids**
  - Cadence (majority)
  - Custom (few provided for posting to the website)
  - Helden

# Test Case 1a : Grid Study at AoA=1.50deg

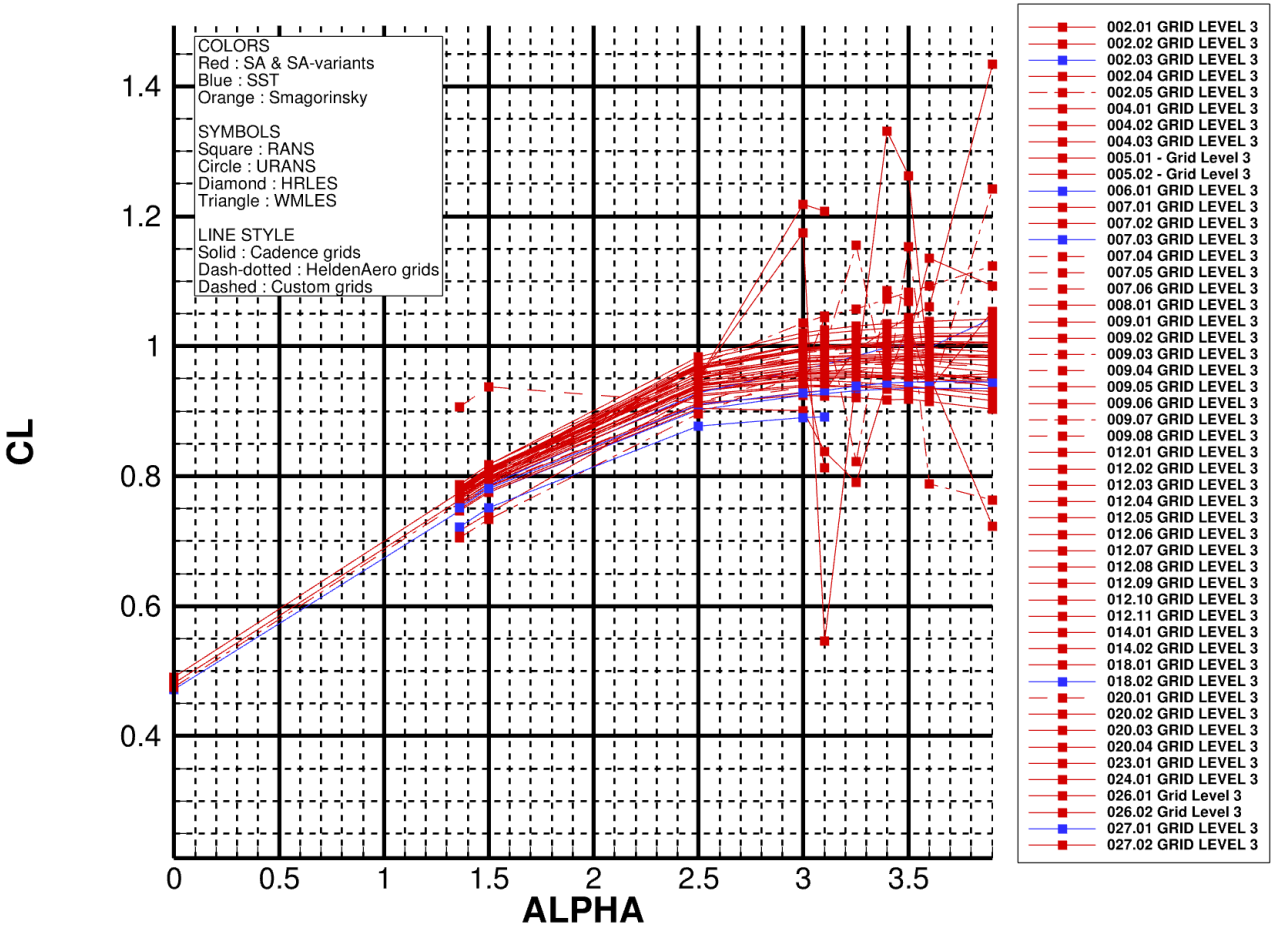


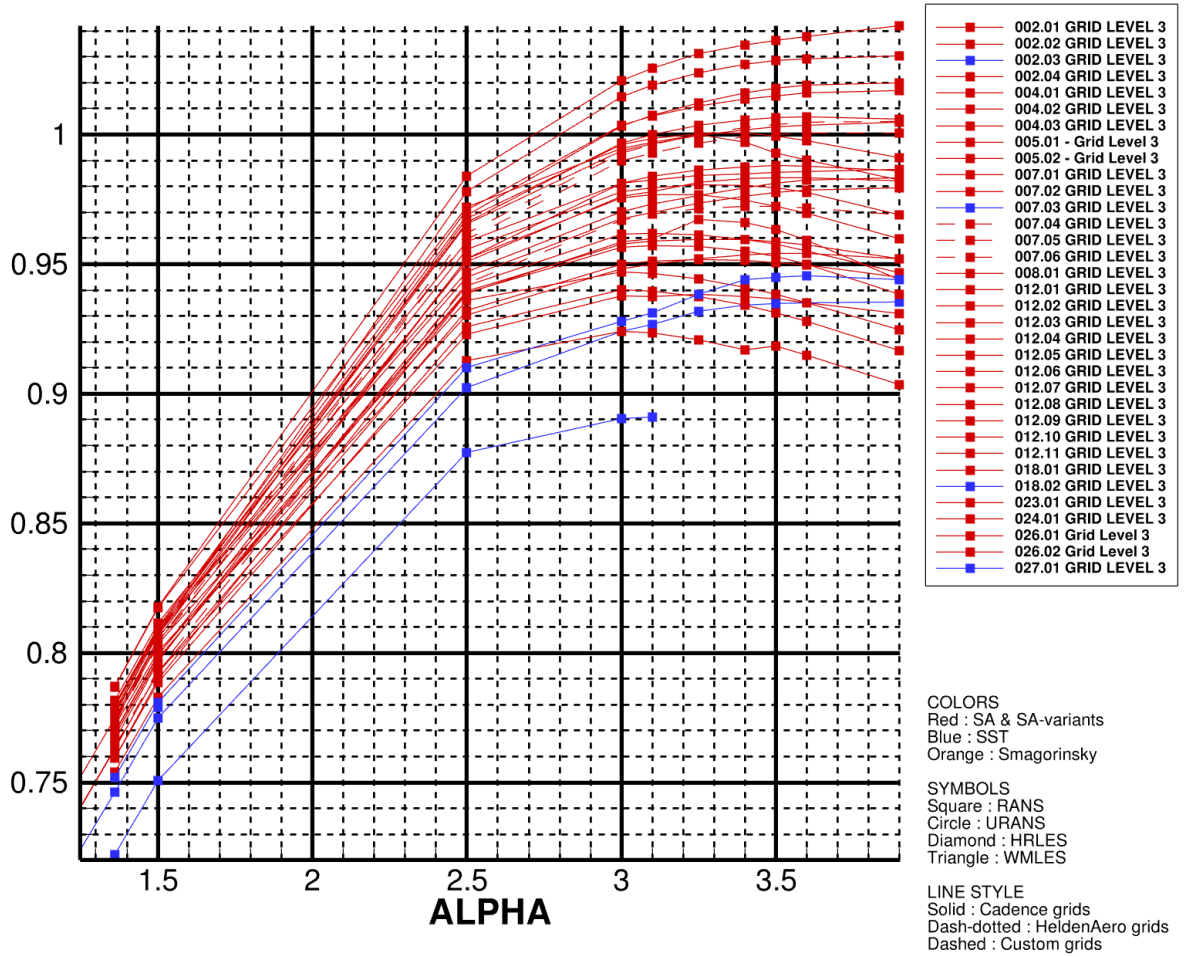

- Will make same plots for CD and CM
- See later, but there are some evident outliers (002, 006, 009, 014, 020, 023, 027)

# Test Case 1a : Alpha-sweep

ALL test case 1a submissions

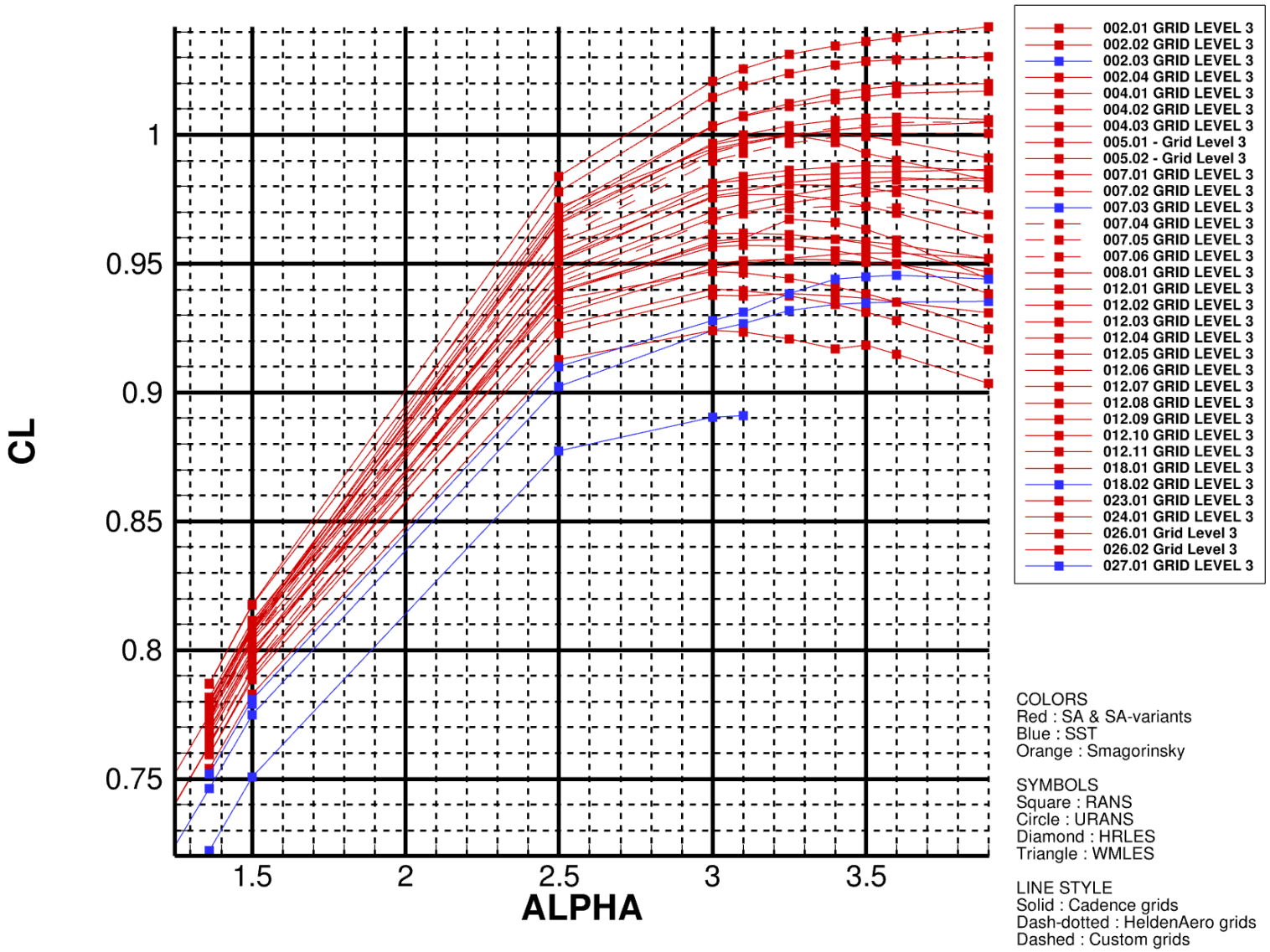



Without outliers



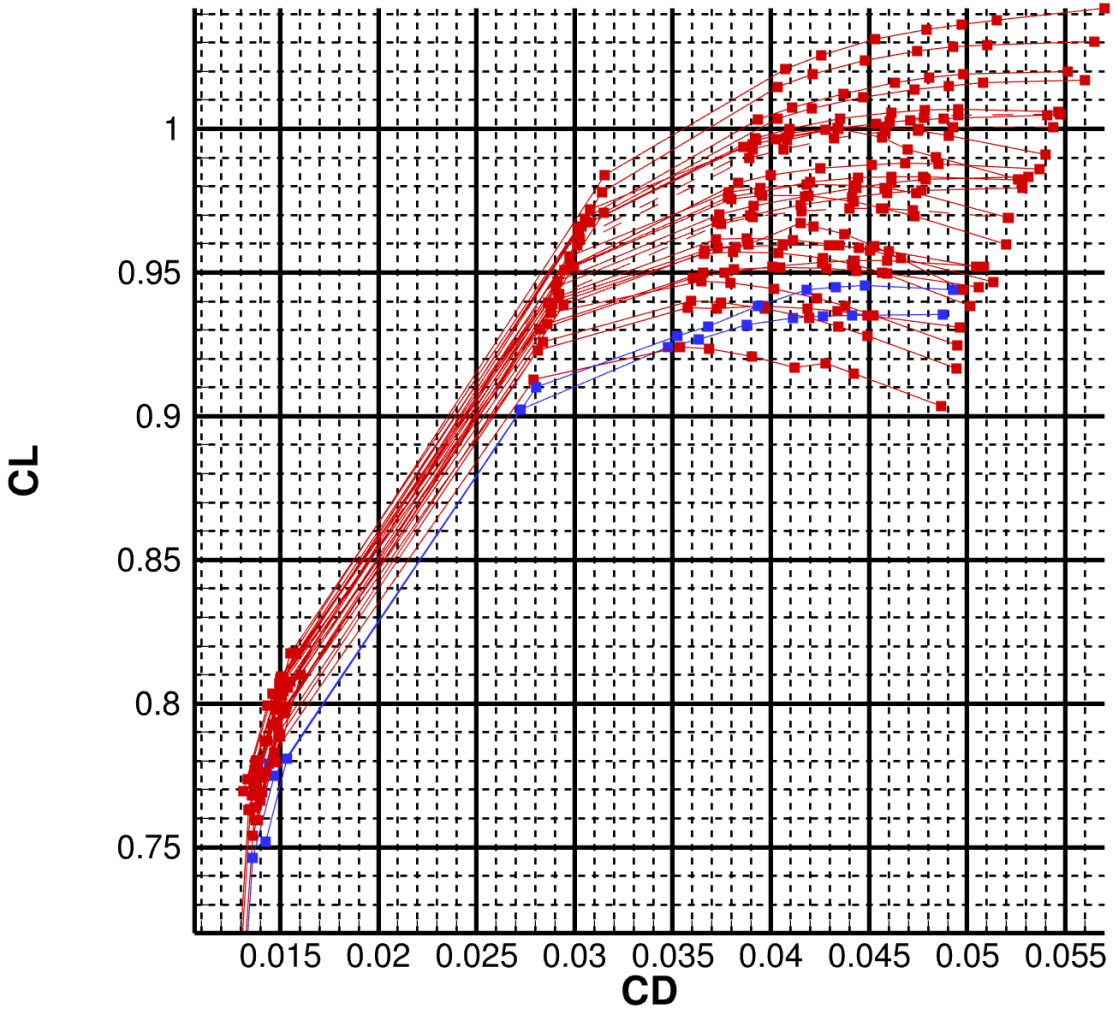

- **Some evident outliers : 002, 006, 009, 014, 020, 023, 027**

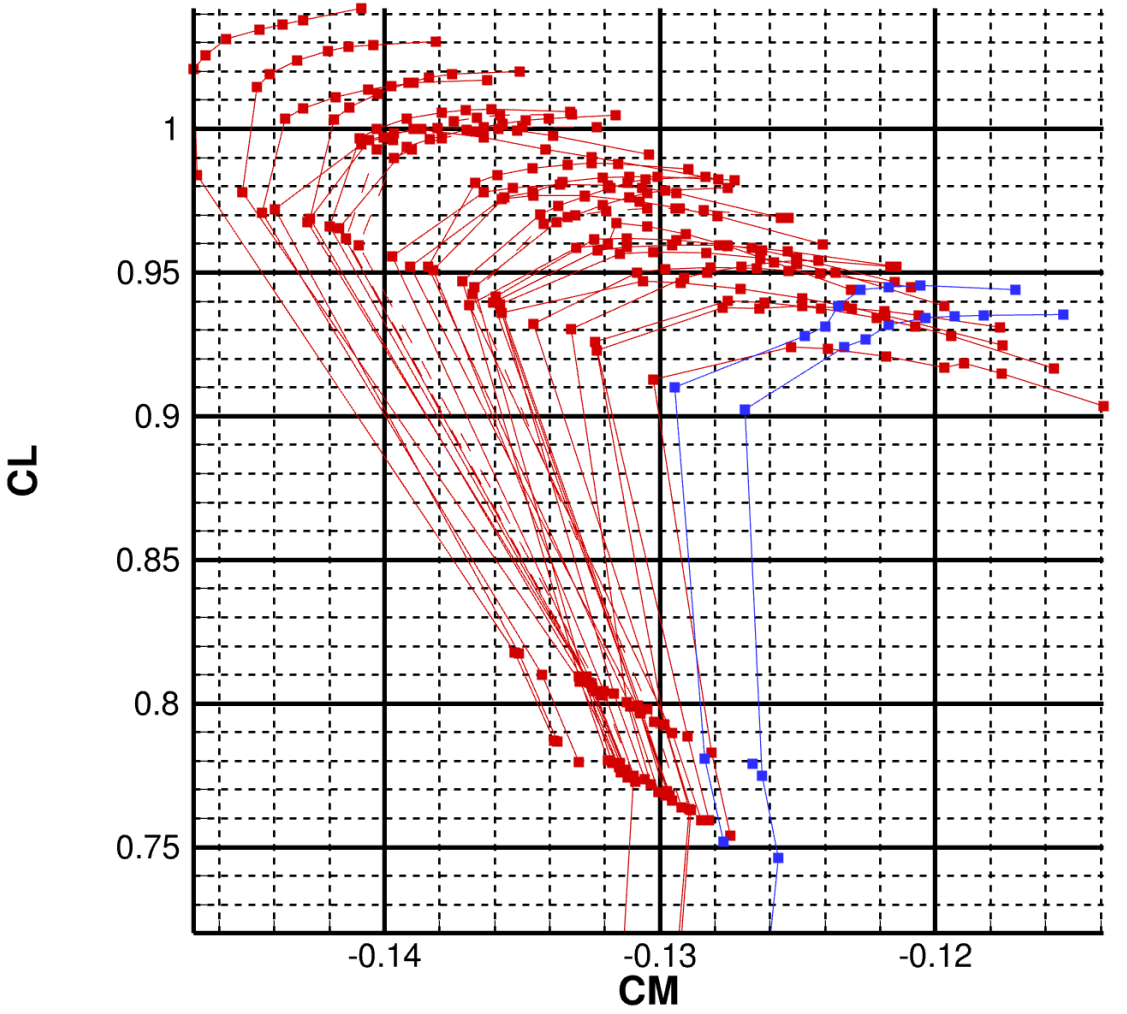
# Test Case 1a : Alpha-sweep (without outliers)




- **Consistent trends but large scatter**
  - ~40 counts at low AoAs
  - ~150 at high AoAs
- **Will make more plots for different SA flavors**

# Test Case 1a : Alpha-sweep (without outliers)



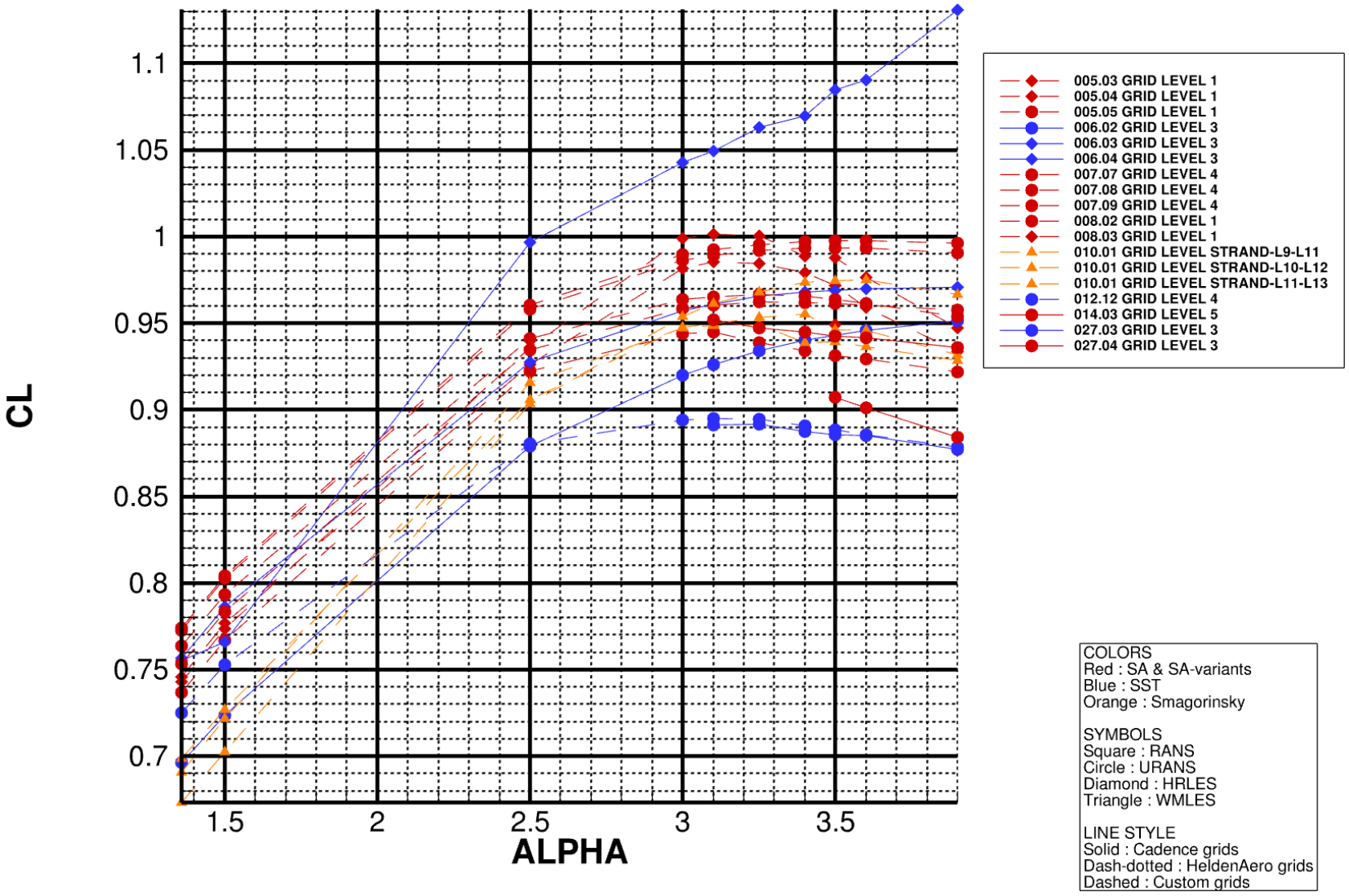

002.01 GRID LEVEL 3
002.02 GRID LEVEL 3
002.03 GRID LEVEL 3
002.04 GRID LEVEL 3
004.01 GRID LEVEL 3
004.02 GRID LEVEL 3
004.03 GRID LEVEL 3
005.01 - Grid Level 3
005.02 - Grid Level 3
007.01 GRID LEVEL 3
007.02 GRID LEVEL 3
007.03 GRID LEVEL 3
007.04 GRID LEVEL 3
007.05 GRID LEVEL 3
007.06 GRID LEVEL 3
008.01 GRID LEVEL 3
012.01 GRID LEVEL 3
012.02 GRID LEVEL 3
012.03 GRID LEVEL 3
012.04 GRID LEVEL 3
012.05 GRID LEVEL 3
012.06 GRID LEVEL 3
012.07 GRID LEVEL 3
012.08 GRID LEVEL 3
012.09 GRID LEVEL 3
012.10 GRID LEVEL 3
012.11 GRID LEVEL 3
018.01 GRID LEVEL 3
018.02 GRID LEVEL 3
024.01 GRID LEVEL 3
026.01 Grid Level 3
026.02 Grid Level 3

COLORS
Red : SA & SA-variants
Blue : SST
Orange : Smagorinsky

SYMBOLS
Square : RANS
Circle : URANS
Diamond : HRLES
Triangle : WMLES

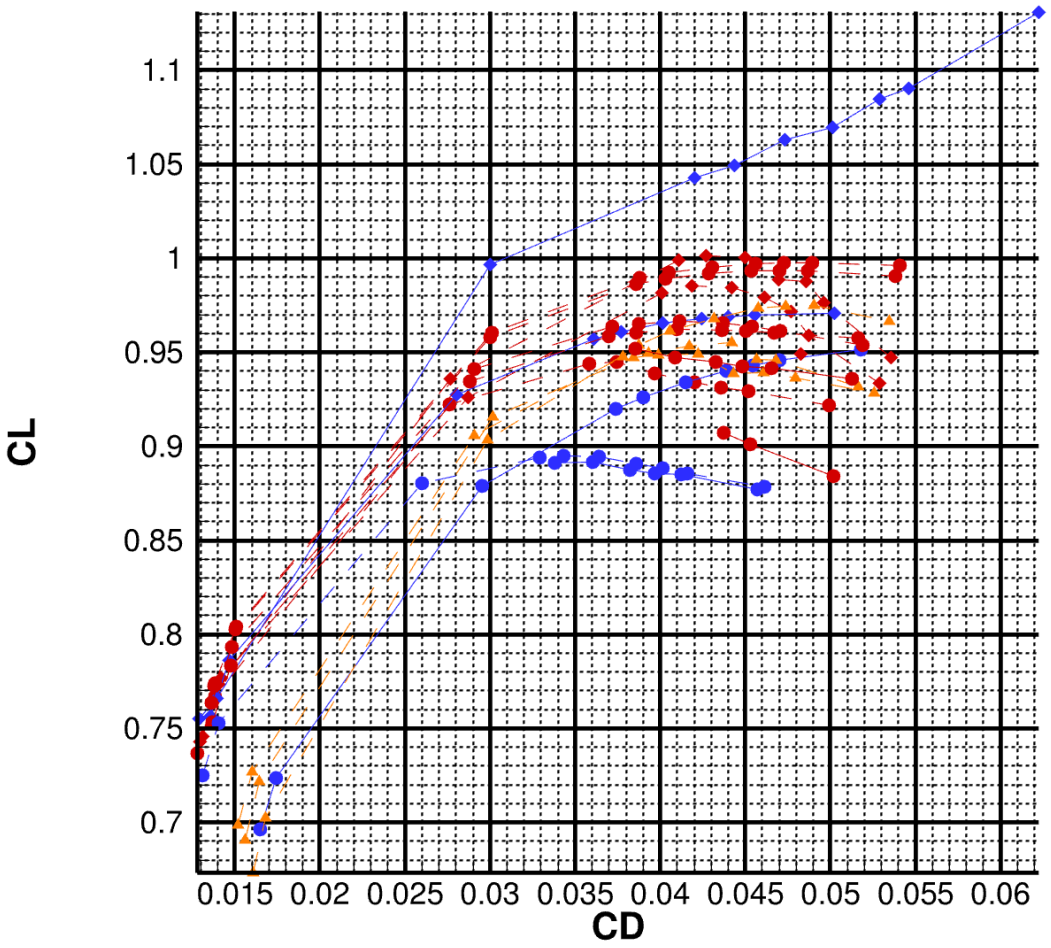
LINE STYLE
Solid : Cadence grids
Dash-dotted : HeldenAero grids
Dashed : Custom grids

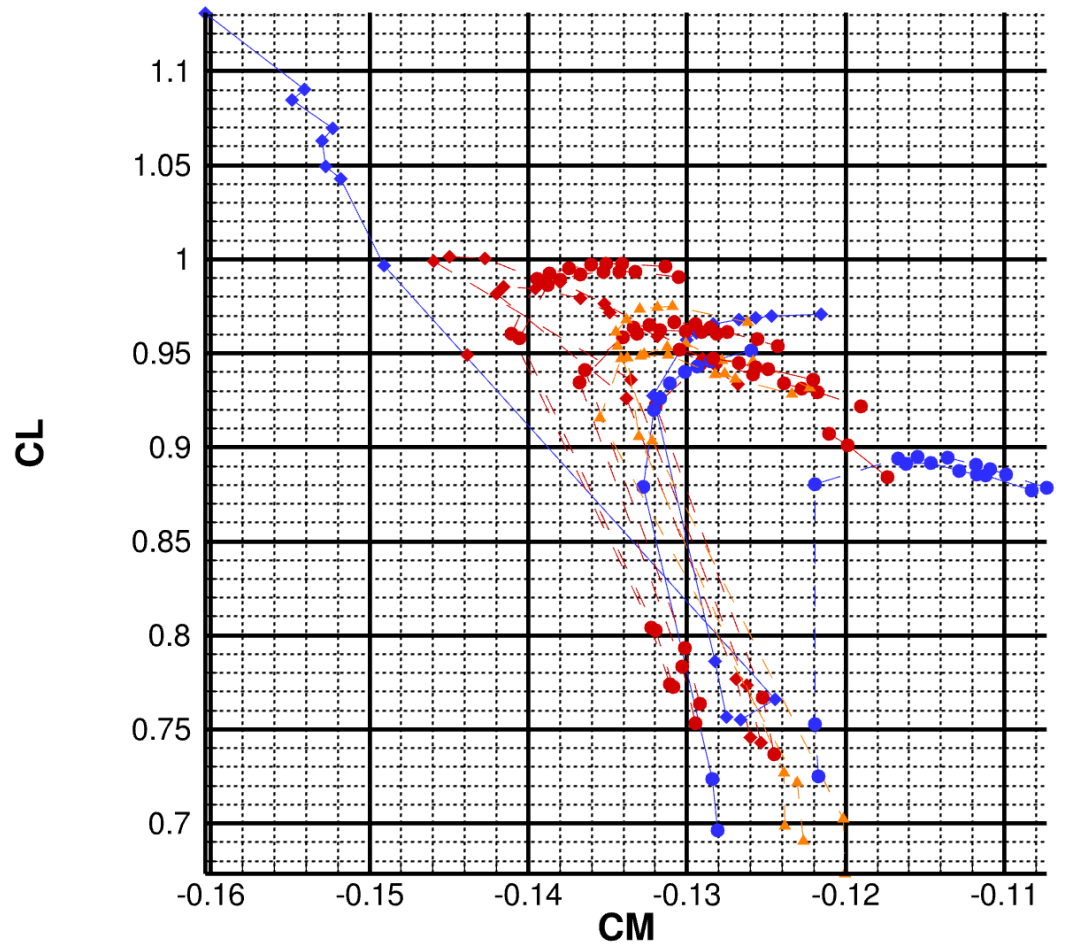
# Test Case 1b : Alpha-sweep (with outliers)




- Some outliers again

# Test Case 1b : Alpha-sweep (with outliers)




005.03 GRID LEVEL 1
005.04 GRID LEVEL 1
005.05 GRID LEVEL 1
006.02 GRID LEVEL 3
006.03 GRID LEVEL 3
006.04 GRID LEVEL 3
007.07 GRID LEVEL 4
007.08 GRID LEVEL 4
007.09 GRID LEVEL 4
008.02 GRID LEVEL 1
008.03 GRID LEVEL 1
010.01 GRID LEVEL STRAND-L9-L11
010.01 GRID LEVEL STRAND-L10-L12
010.01 GRID LEVEL STRAND-L11-L13
012.12 GRID LEVEL 4
014.03 GRID LEVEL 5
027.03 GRID LEVEL 3
027.04 GRID LEVEL 3

COLORS
Red : SA & SA-variants
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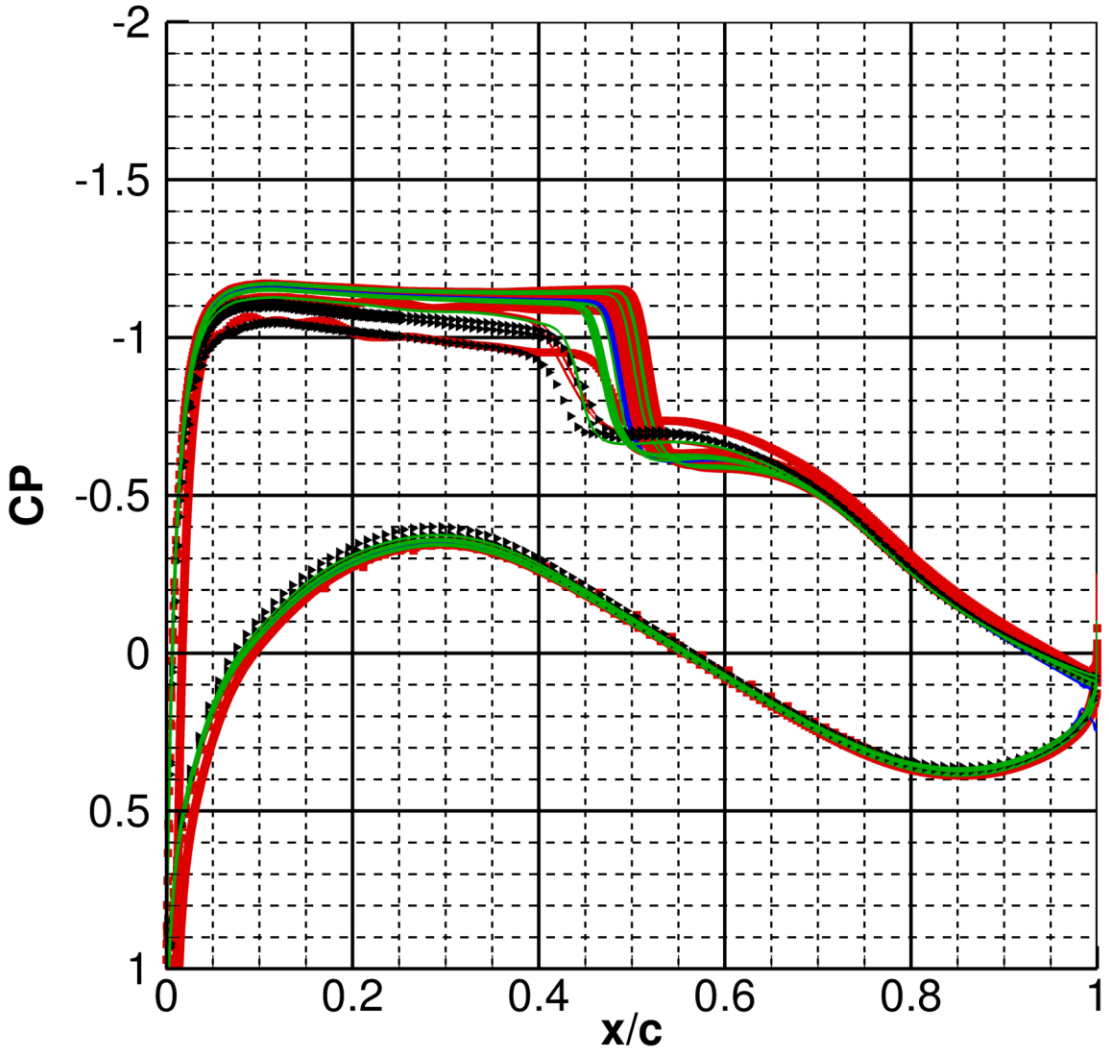
Triangle : WMLES

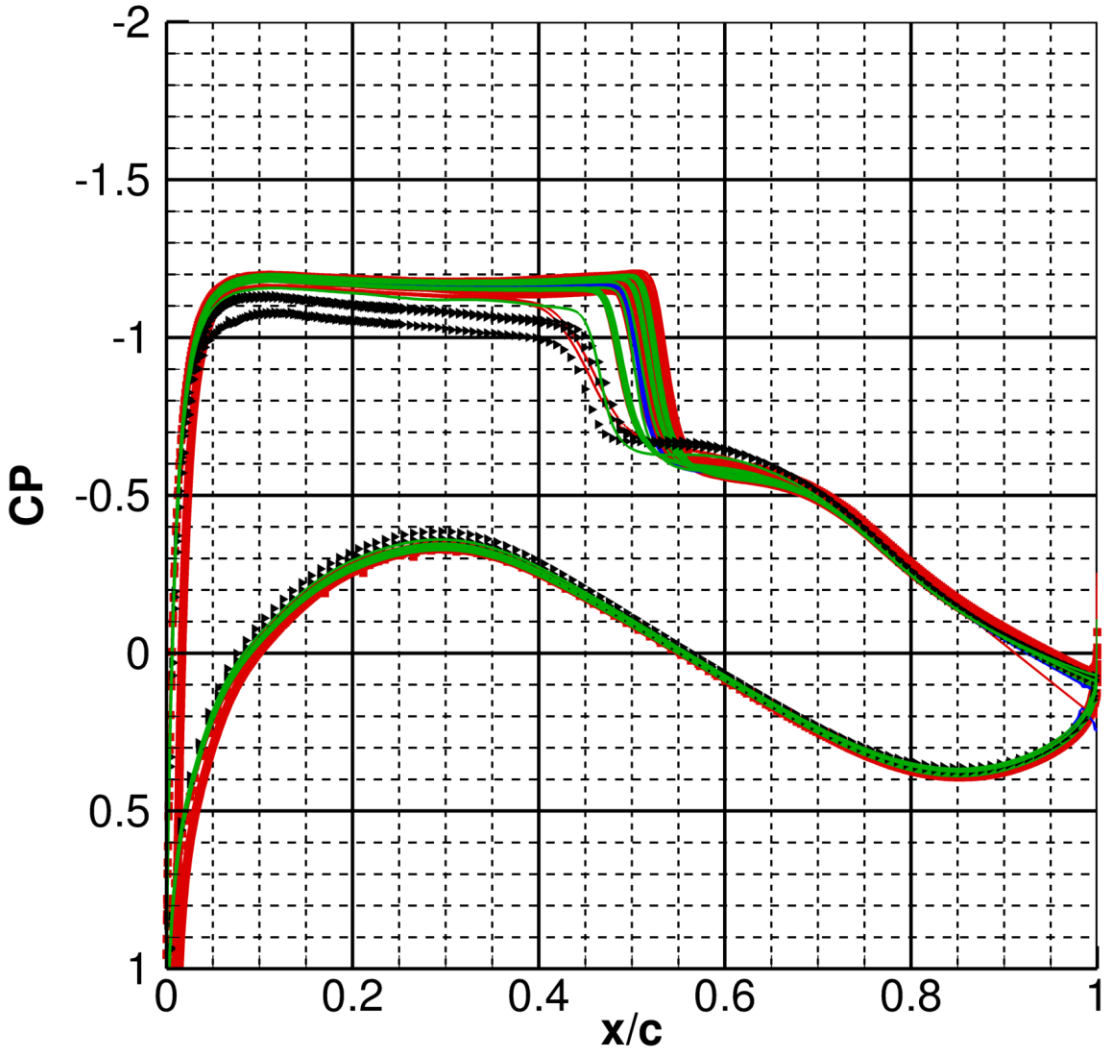
LINE STYLE
Solid : Cadence grids
Dash-dotted : HeldenAero grids
Dashed : Custom grids

# 1.36



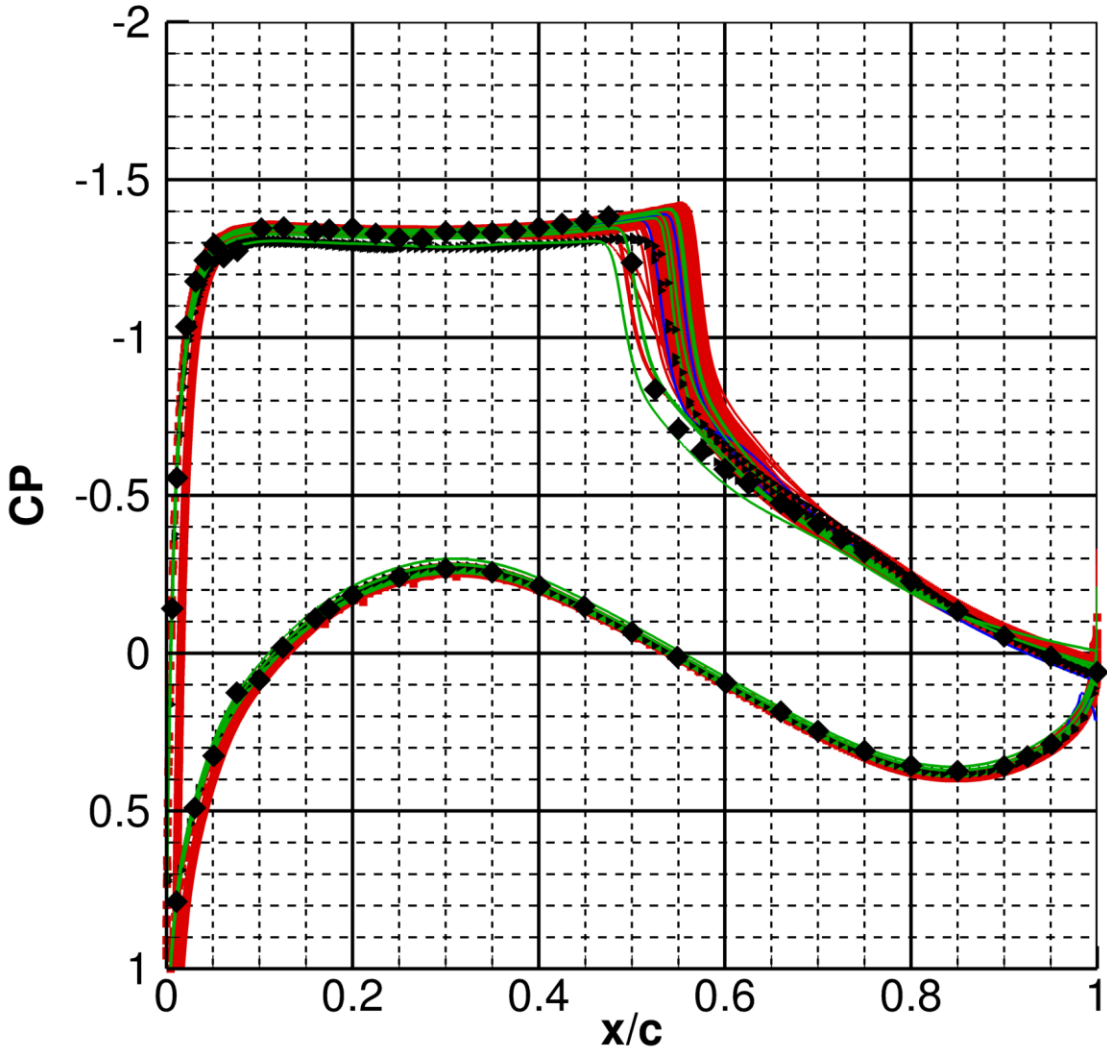

Red: RANS
Green: URANS
Blue: HRLES
Black Triangles: WMLES

# 1.50



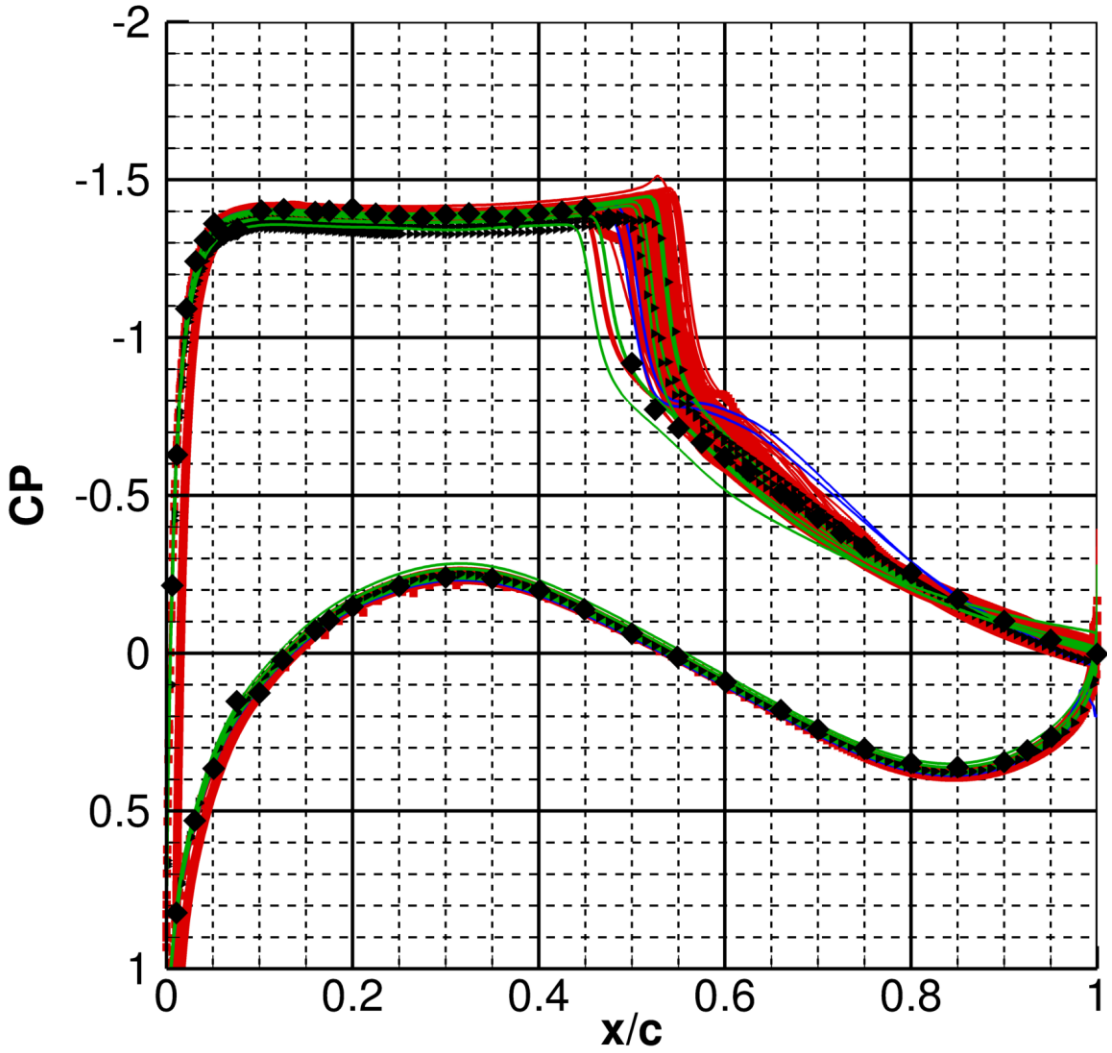

Red: RANS
Green: URANS
Blue: HRLES
Black Triangles: WMLES

# 2.50



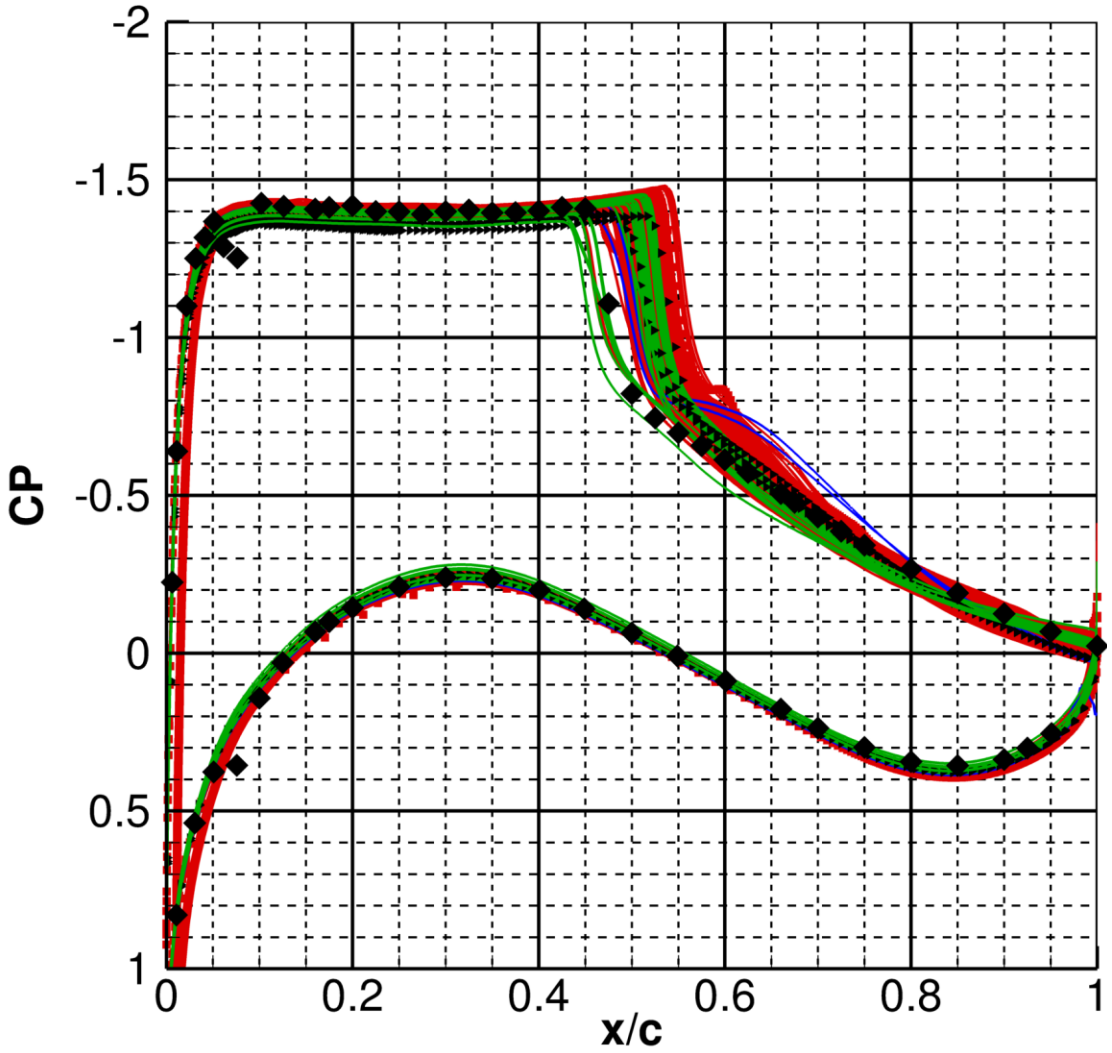

Red: RANS
Green: URANS
Blue: HRLES
Black Triangles: WMLES

# 3.00



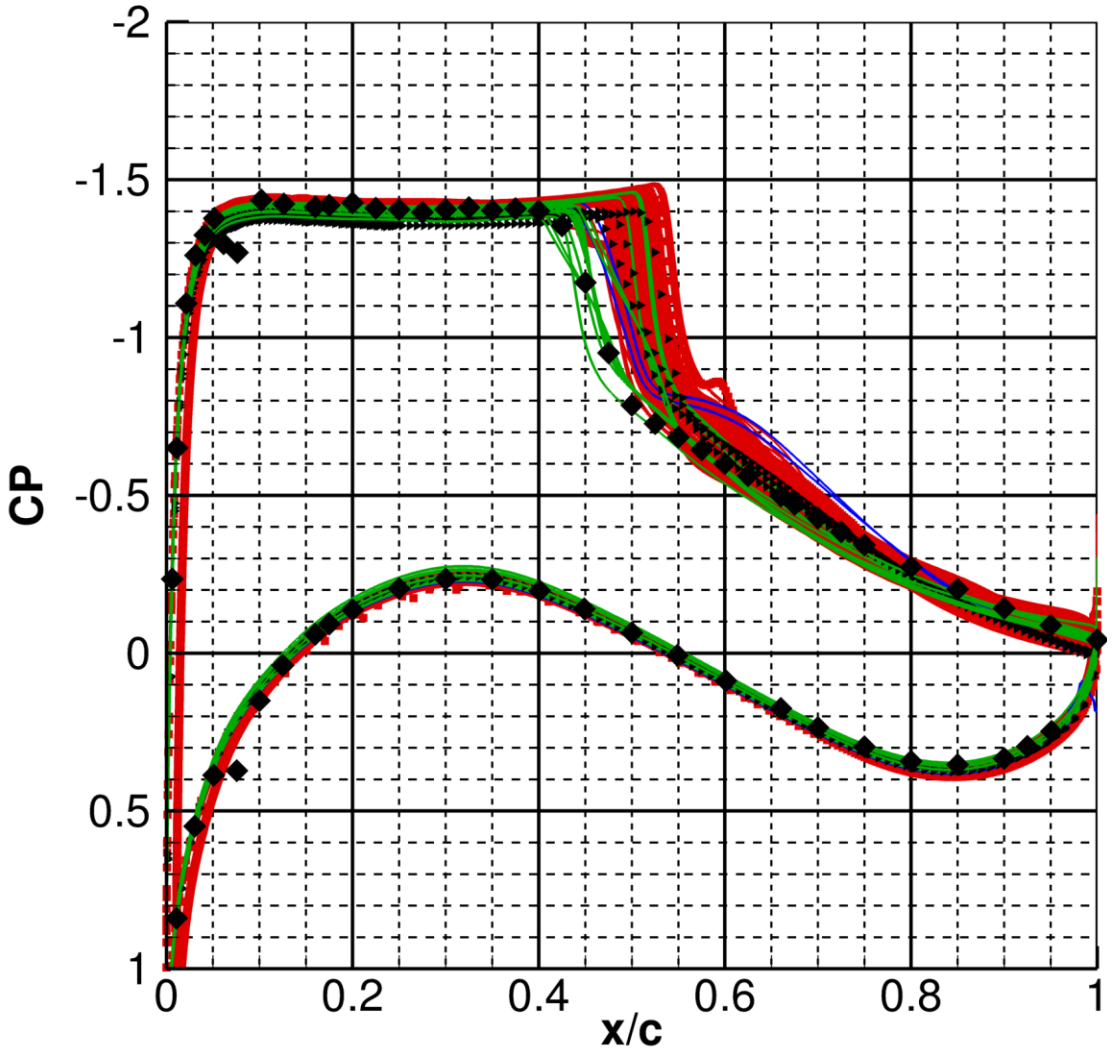

Red: RANS
Green: URANS
Blue: HRLES
Black Triangles: WMLES

# 3.10



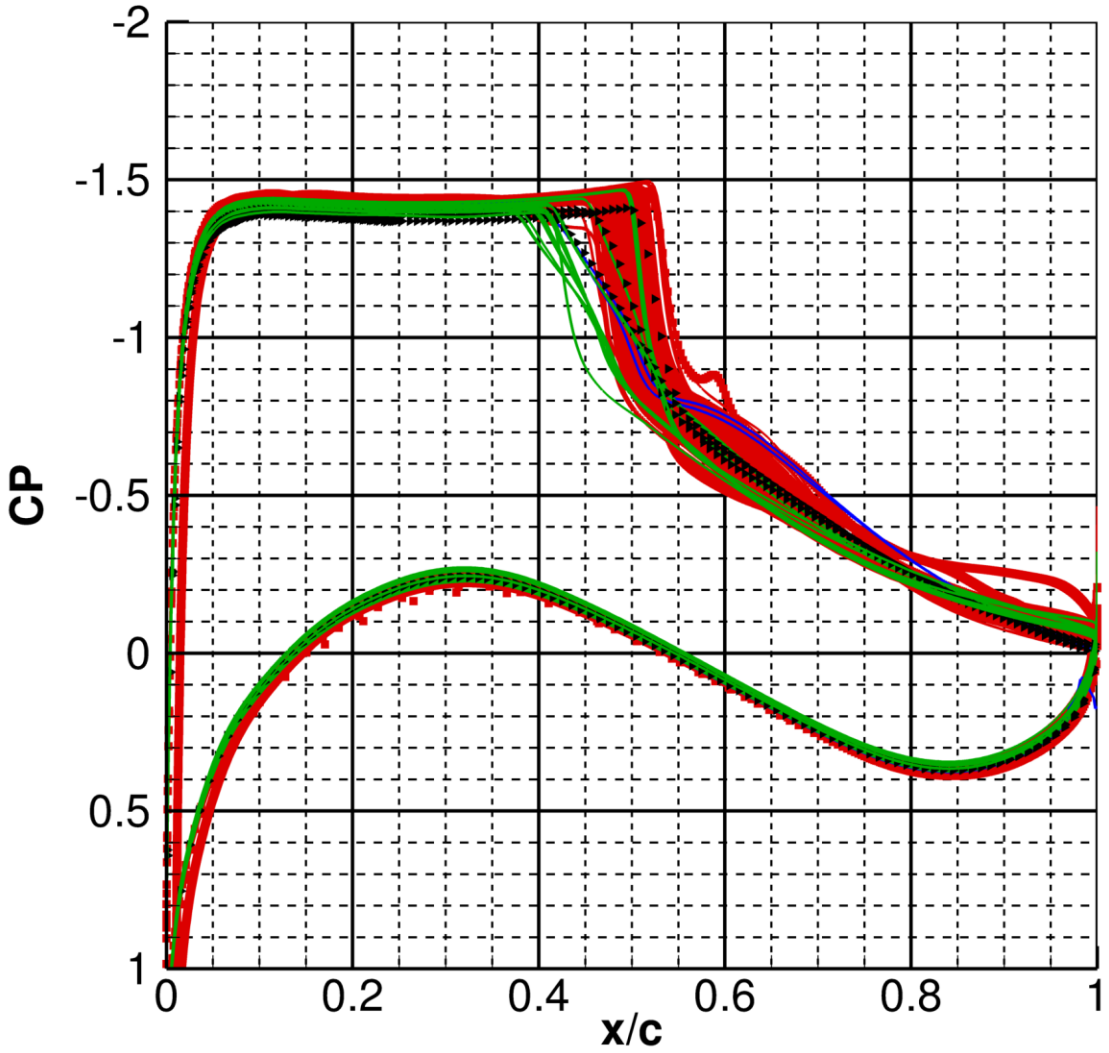

Red: RANS
Green: URANS
Blue: HRLES
Black Triangles: WMLES

# 3.25



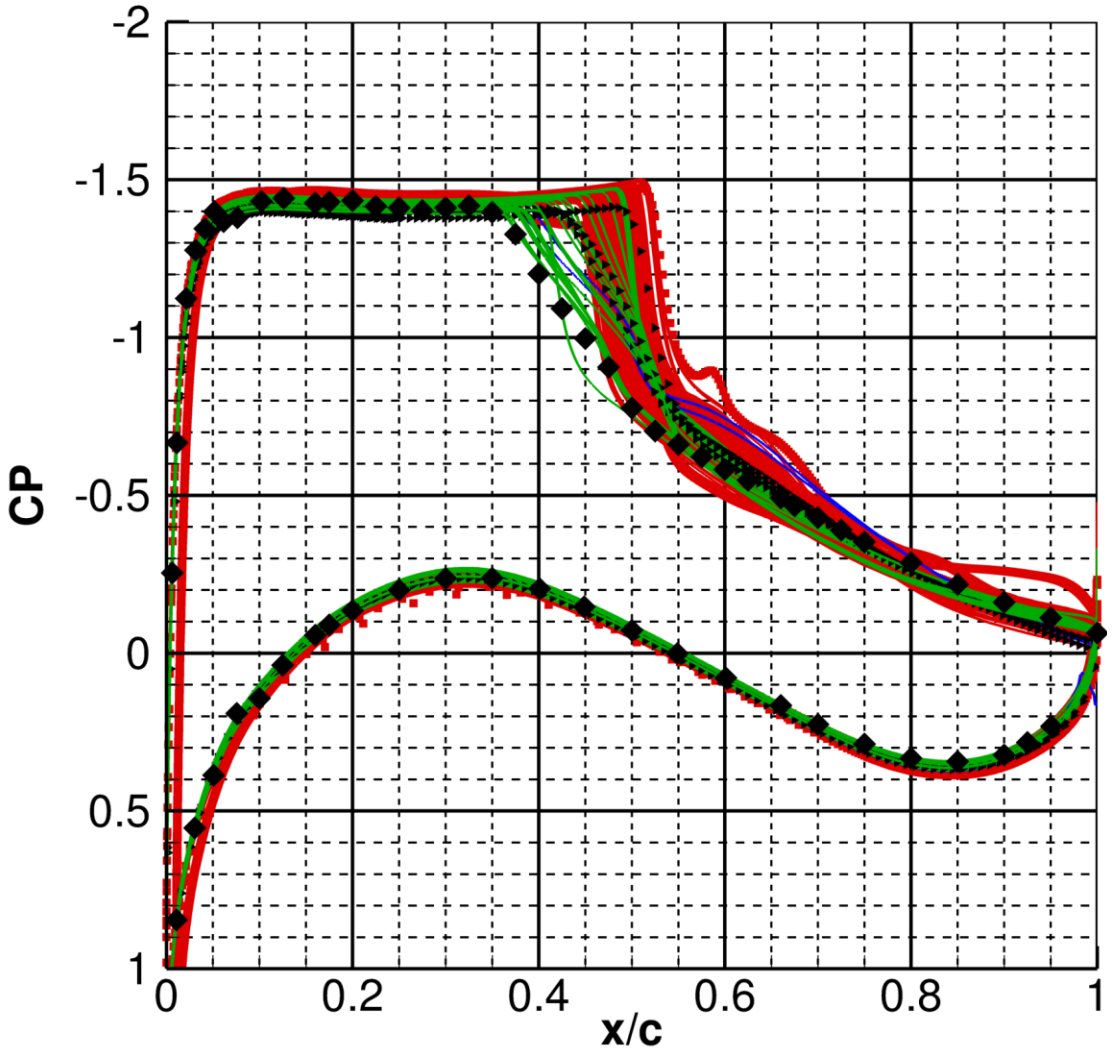

Red: RANS
Green: URANS
Blue: HRLES
Black Triangles: WMLES

# 3.40



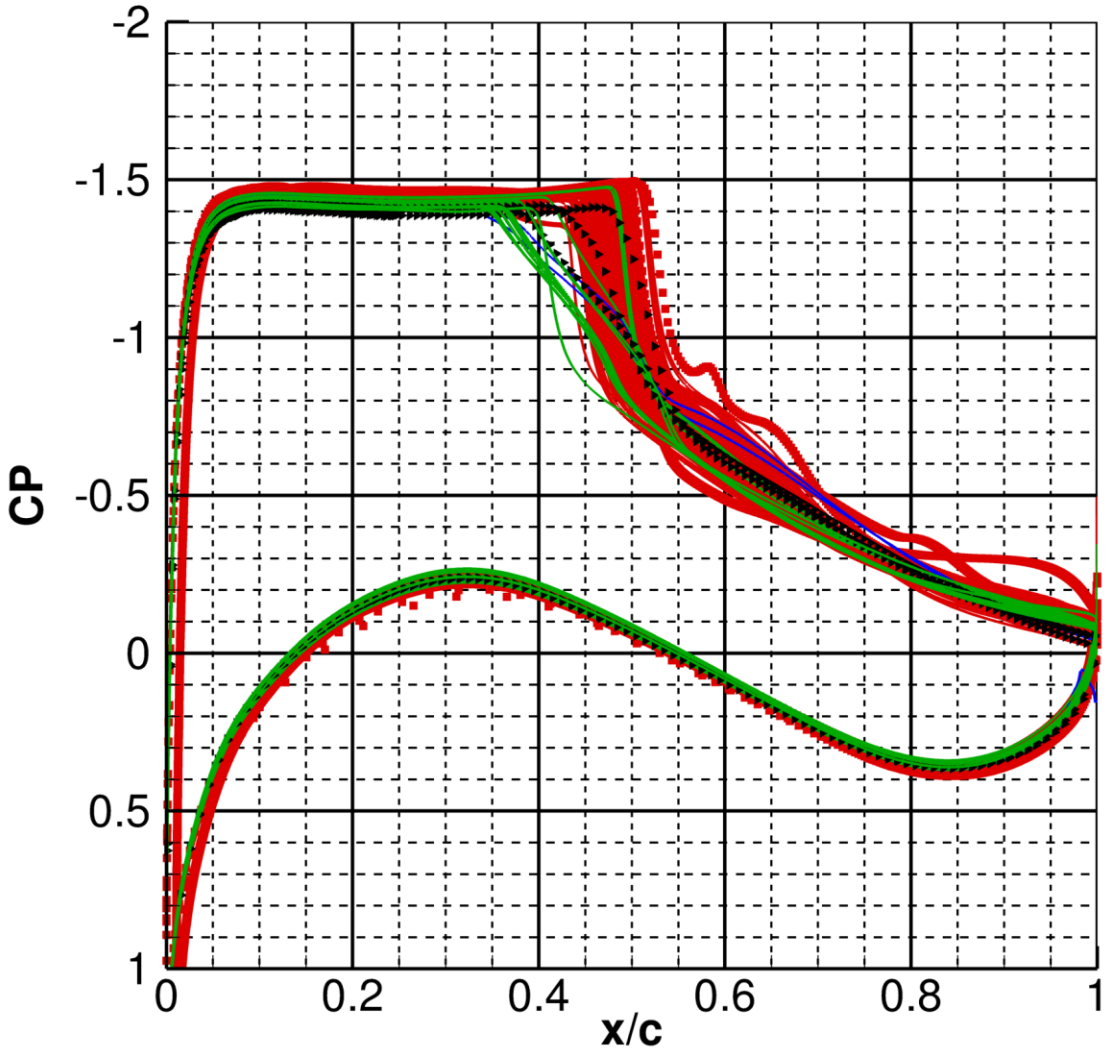

Red: RANS
Green: URANS
Blue: HRLES
Black Triangles: WMLES

# 3.50



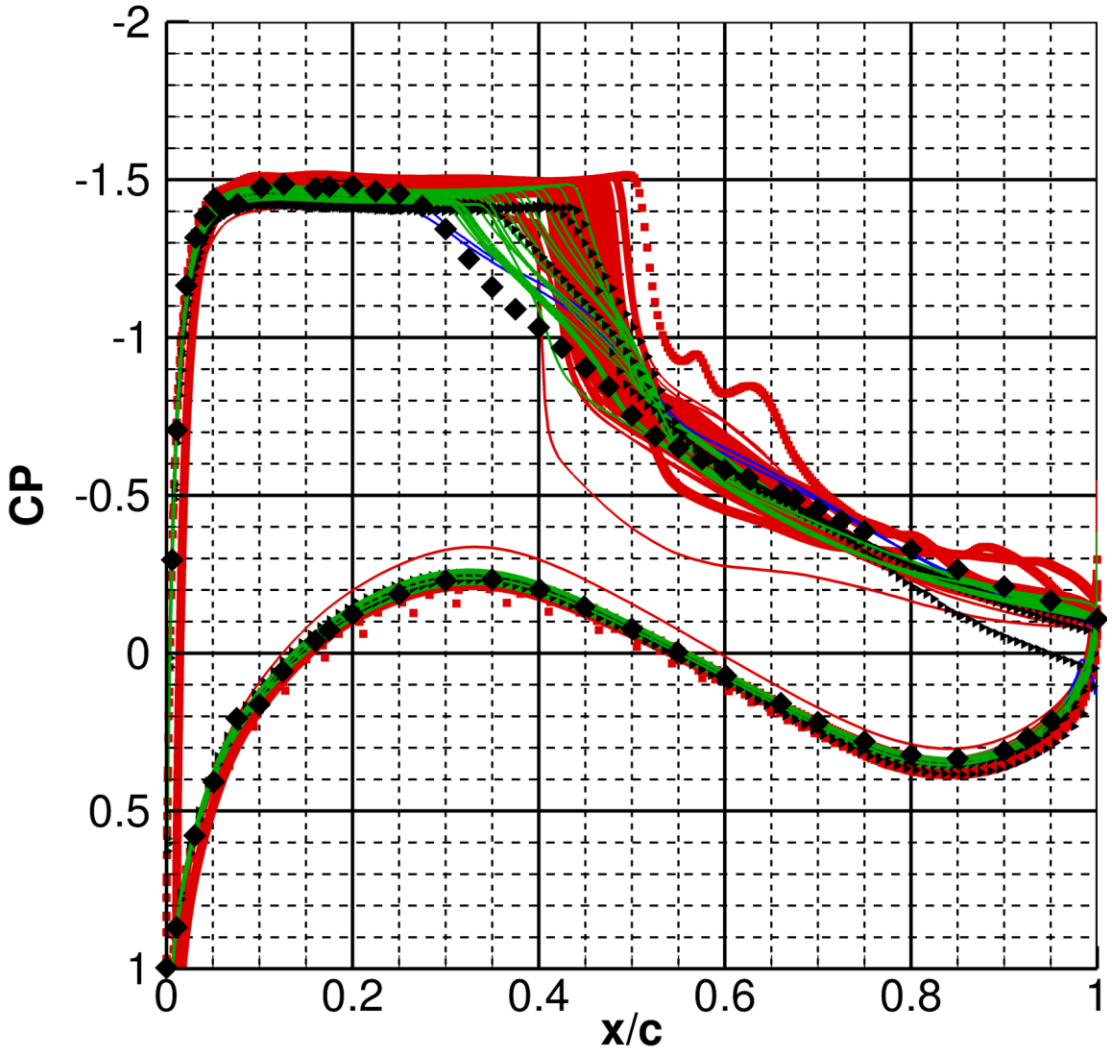

Red: RANS
Green: URANS
Blue: HRLES
Black Triangles: WMLES

# 3.60



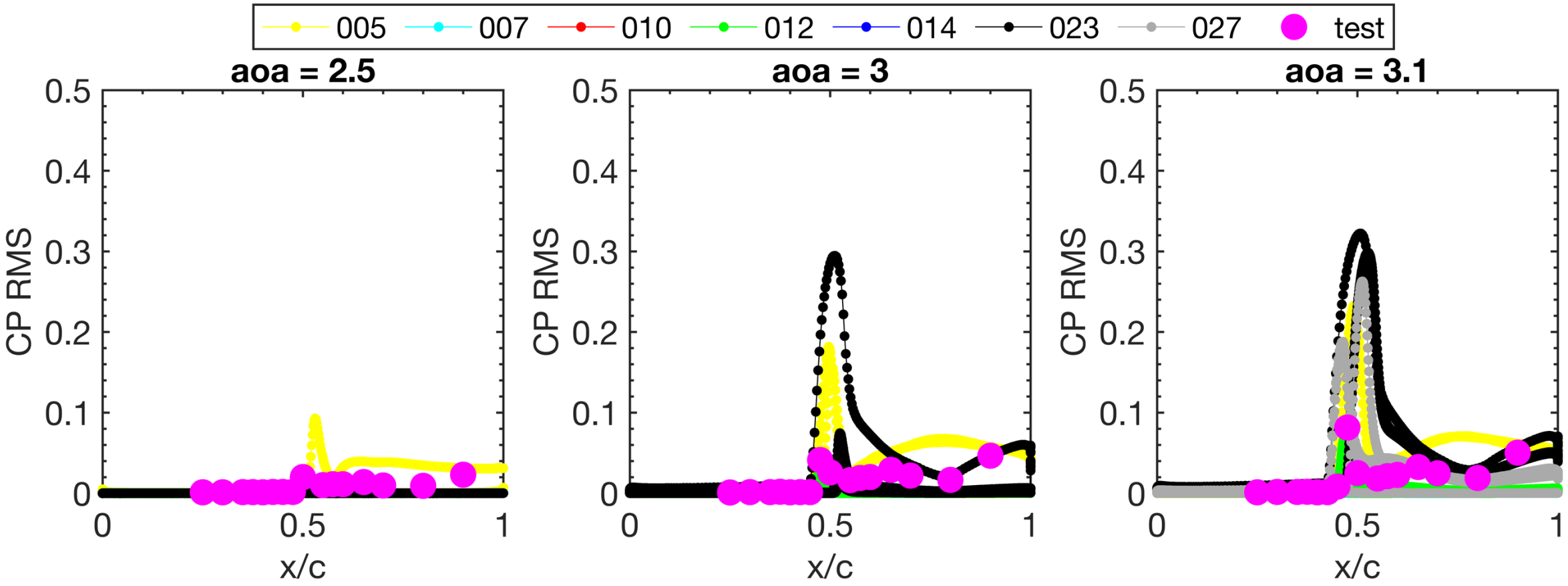

Red: RANS
Green: URANS
Blue: HRLES
Black Triangles: WMLES

# 3.90

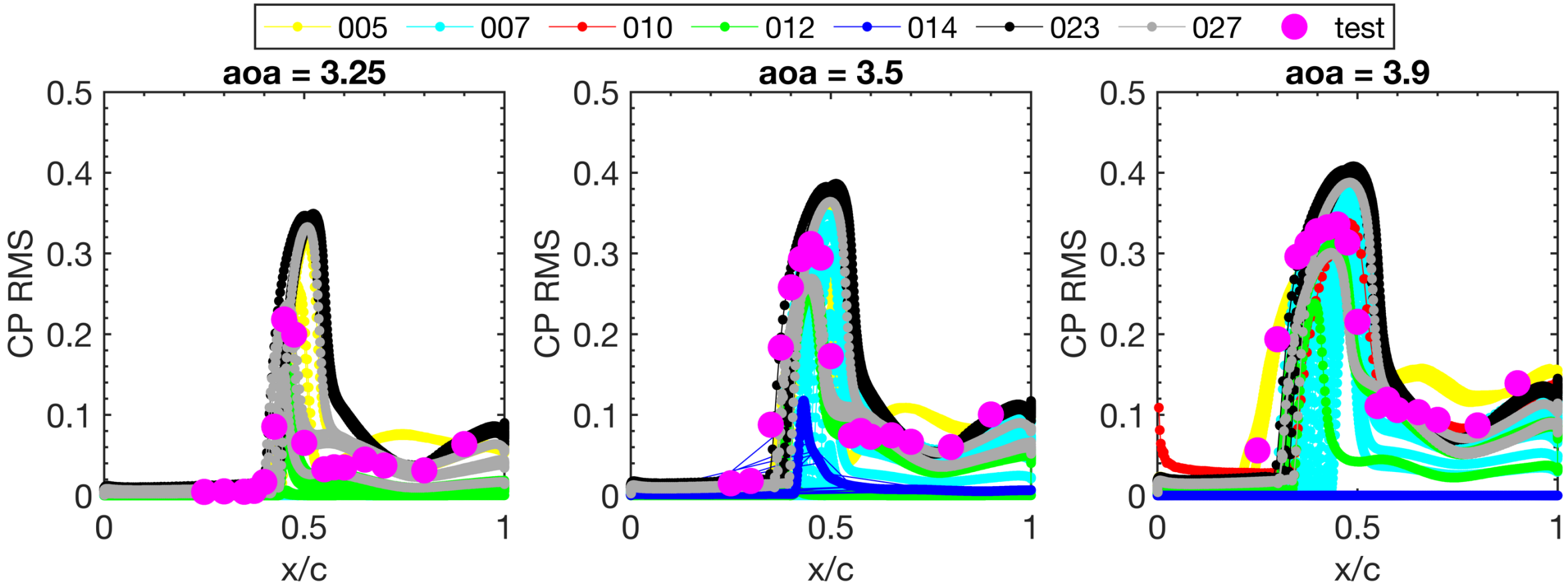



Red: RANS
Green: URANS
Blue: HRLES
Black Triangles: WMLES

# CP RMS Section Cuts



# CP RMS Section Cuts (2)



# Planned Plots

- **Test case 1a**
  - Grid study: CL/CD/CM vs GRID_FACT for alpha=1.50, 2.50, 3.10, 3.50, 3.90 deg
  - Alpha sweep: CL-alpha, CL-CD, CL-CM, average CL-alpha
  - Sectional Cp (vs EXP): Cp for alpha=2.50, 3.10, 3.50, 3.90 deg
  - Histogram of average CL/CD/CM vs each participant
- **Test case 1b :**
  - Grid study: CL/CD/CM vs GRID_FACT for alpha=1.50, 2.50, 3.10, 3.50, 3.90 deg
  - Alpha sweep: CL-alpha, CL-CD, CL-CM, average CL-alpha
  - Sectional Cp (vs EXP): Cp-mean and Cp-rms for alpha=2.50, 3.10, 3.50, 3.90 deg
  - PSD plots for 2.50, 3.10, 3.50, 3.90 deg
- **Test case 1a vs Test case 1b:**
  - CL-alpha, CL-CD, CL-CM from case 1a and 1b

# CP RMS Section Cuts: To-Do

- **Need to classify data and re-plot based on grid-density of each result**
  - Most participants used their own grids, and so apples-to-apples comparisons will be tricky
- **Need to classify data and re-plot based on turbulence model, time step, etc.**
- **Plan for similar plots of the PSD data, also**


aiaabuffet@gmail.com

# Backup