AIAA CFD Drag Prediction Workshop

Data Summary and Comparison

David W. Levy

Overview

- Overall Summary
- Basic drag polar: Case 2
- Grids, turb. models, codes
- Drag rise: Cases 3-4
- Conclusions

Methods and Data Summary

- 18 participants, 14 codes
- 28 Case 2, 10 Case 3, 9 Case 4
- Grid types:

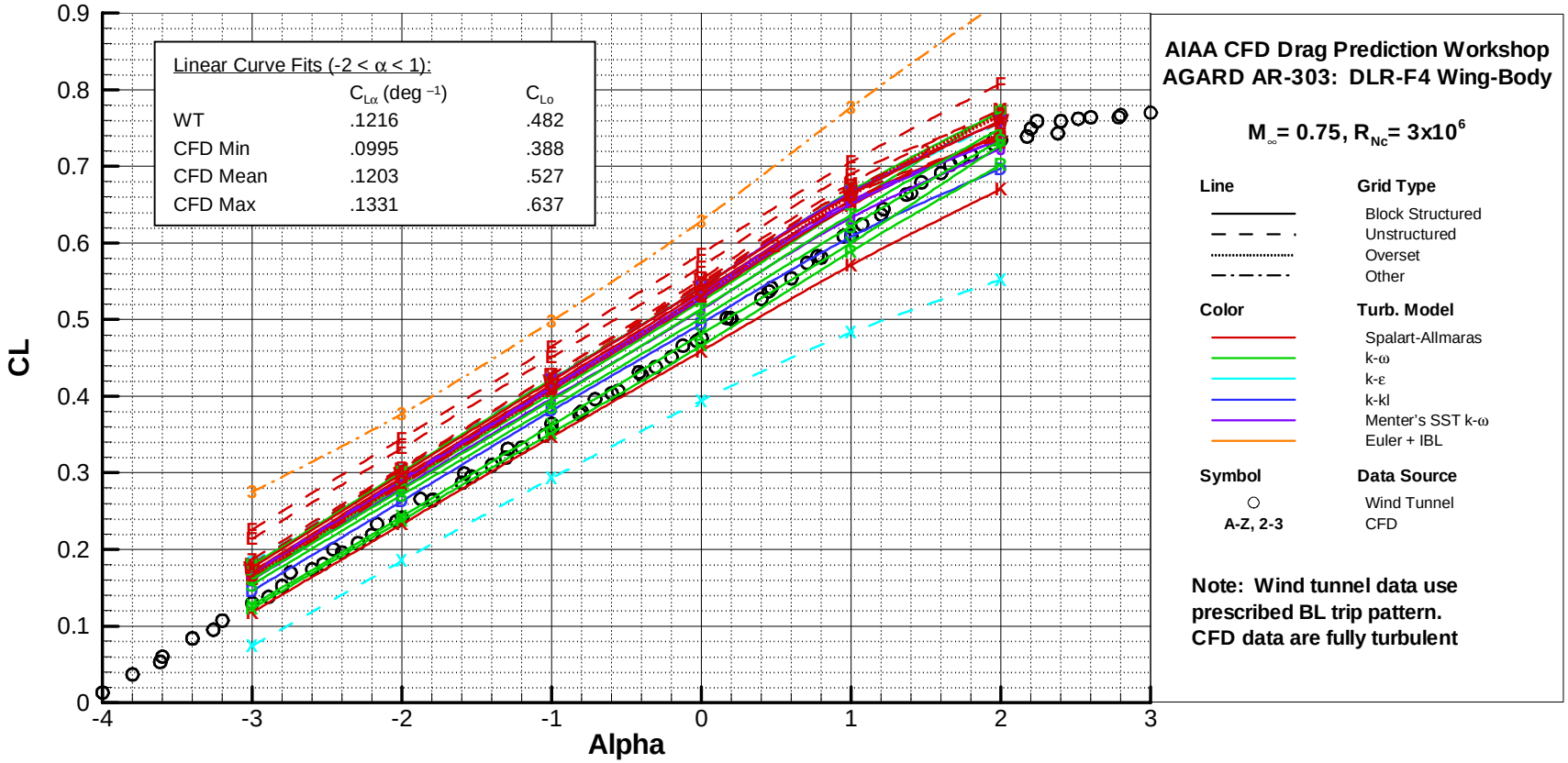
Blk. Str.	Unstructured	Overset	Cartesian
8	7	2	1

- 8 turbulence models (3 main types):

Spalart-Allmaras	k-ω	k-ε	other
14	10	2	2

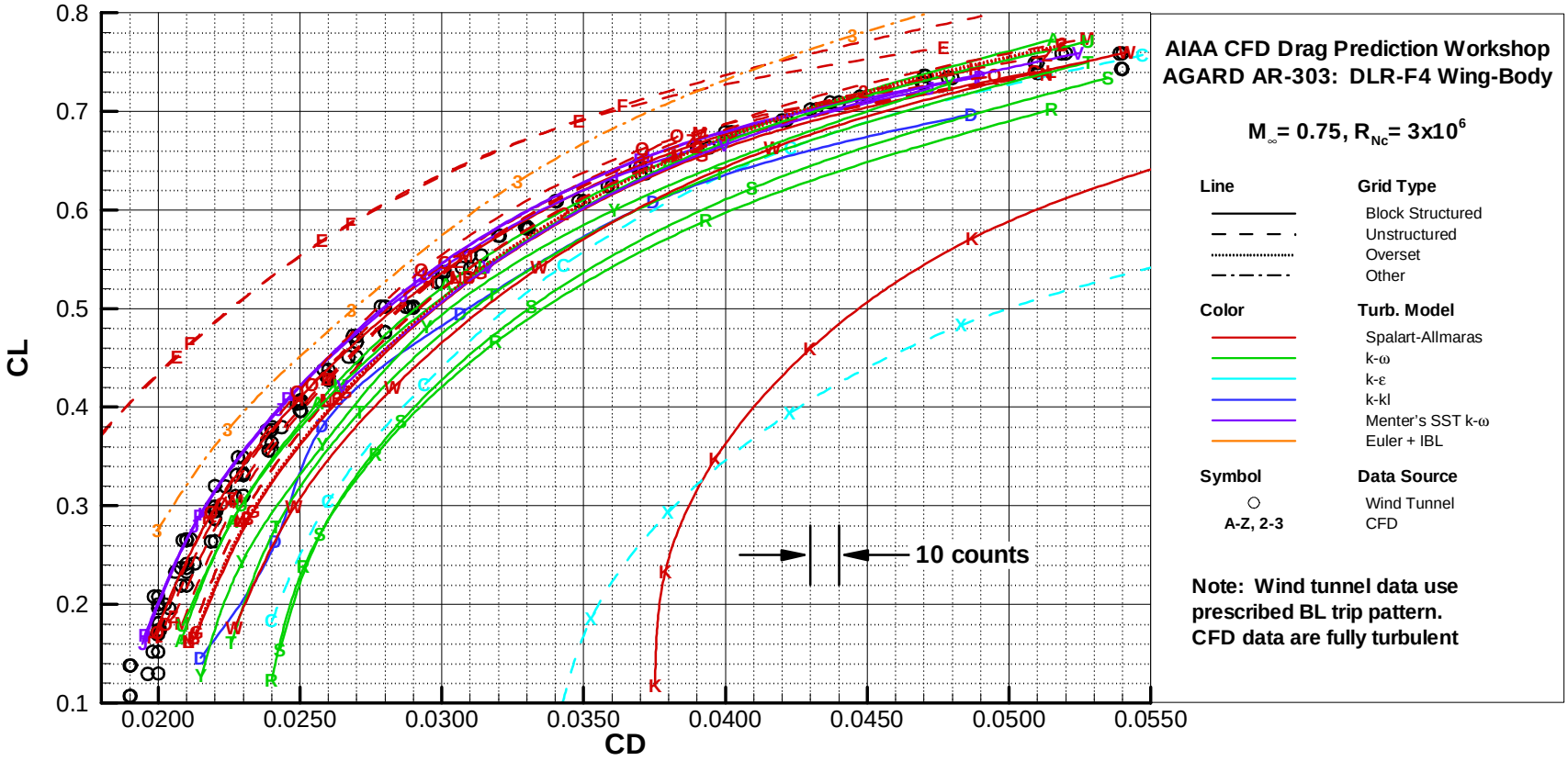
Case 2: Lift Curve

$M_\infty = .75, R_{Nc} = 3x10^6$



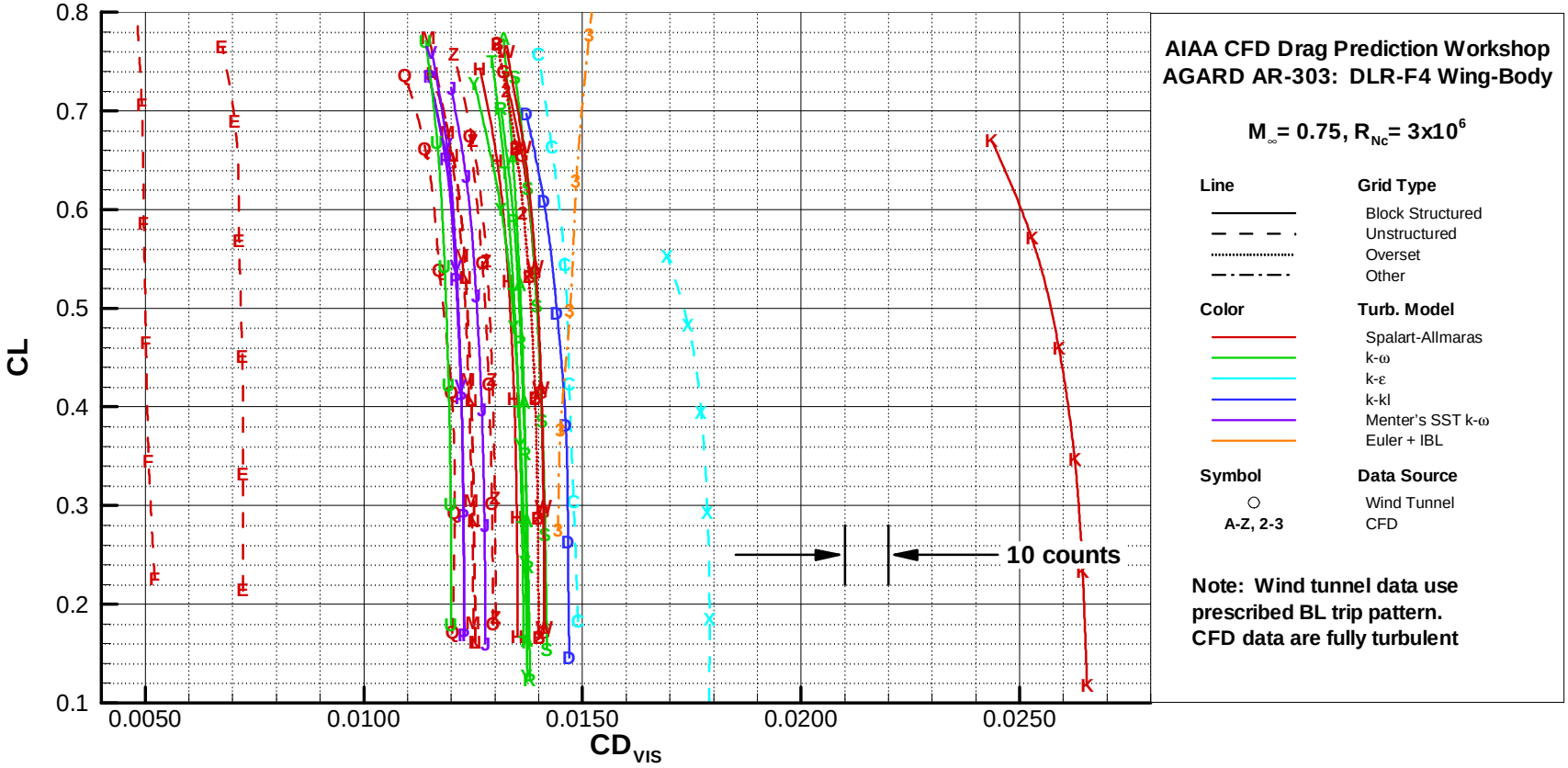
Case 2: Drag Polar

$M_\infty = .75$, $R_{Nc} = 3x10^6$



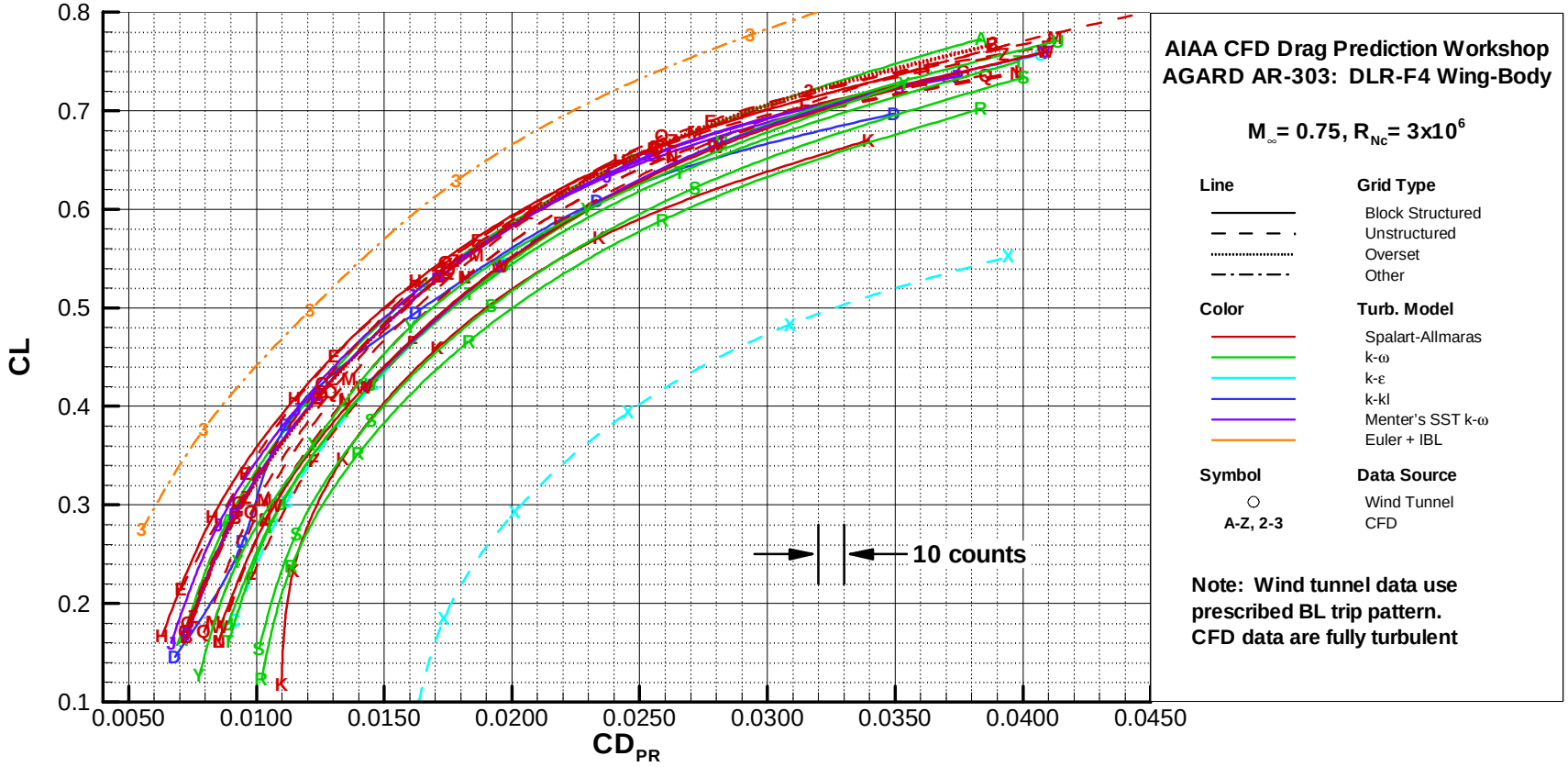
Case 2: Skin Friction Drag

$M_\infty = .75, R_{Nc} = 3x10^6$



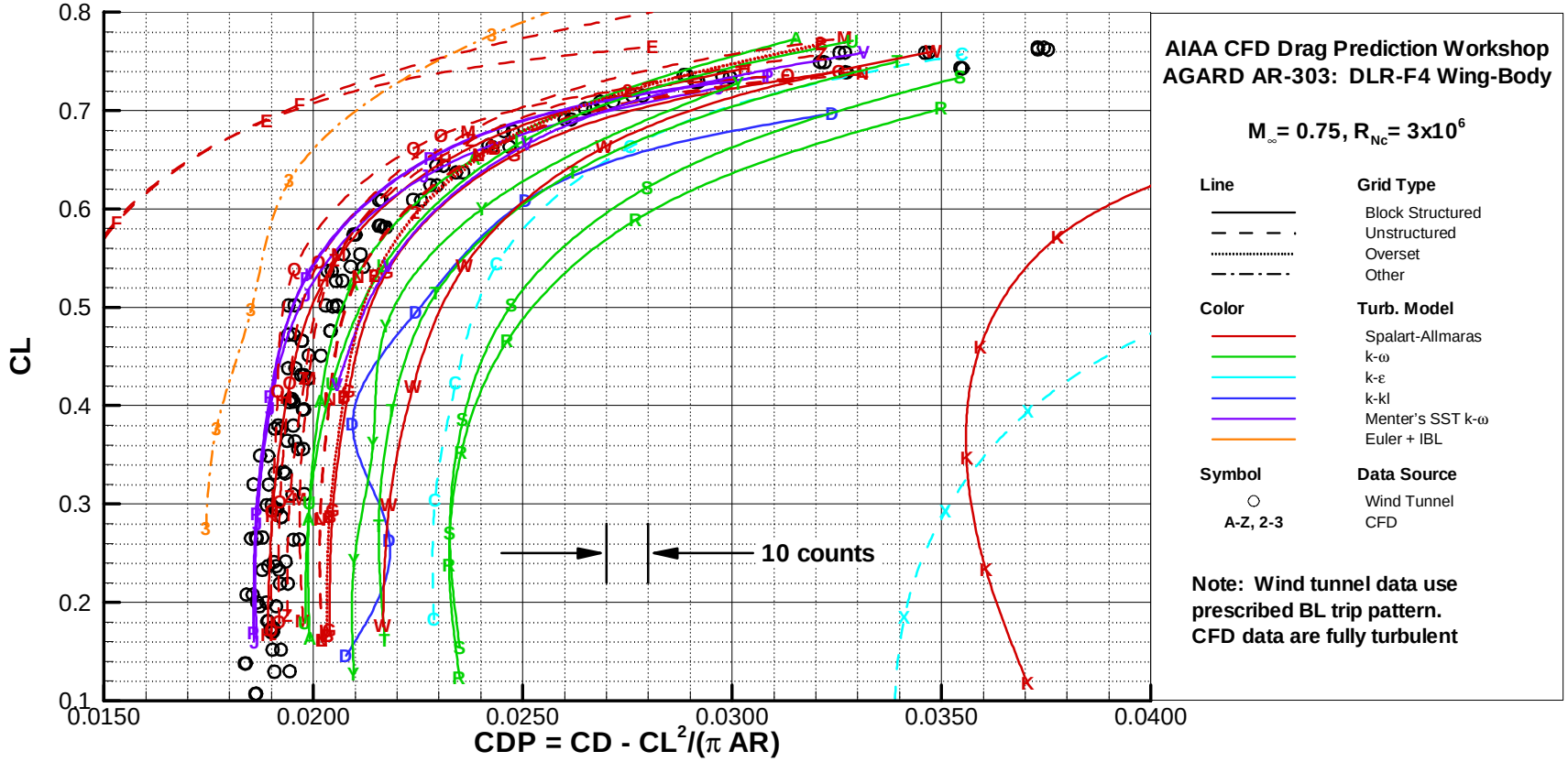
Case 2: Pressure Drag

$M_\infty = .75,\ R_{Nc} = 3x10^6$



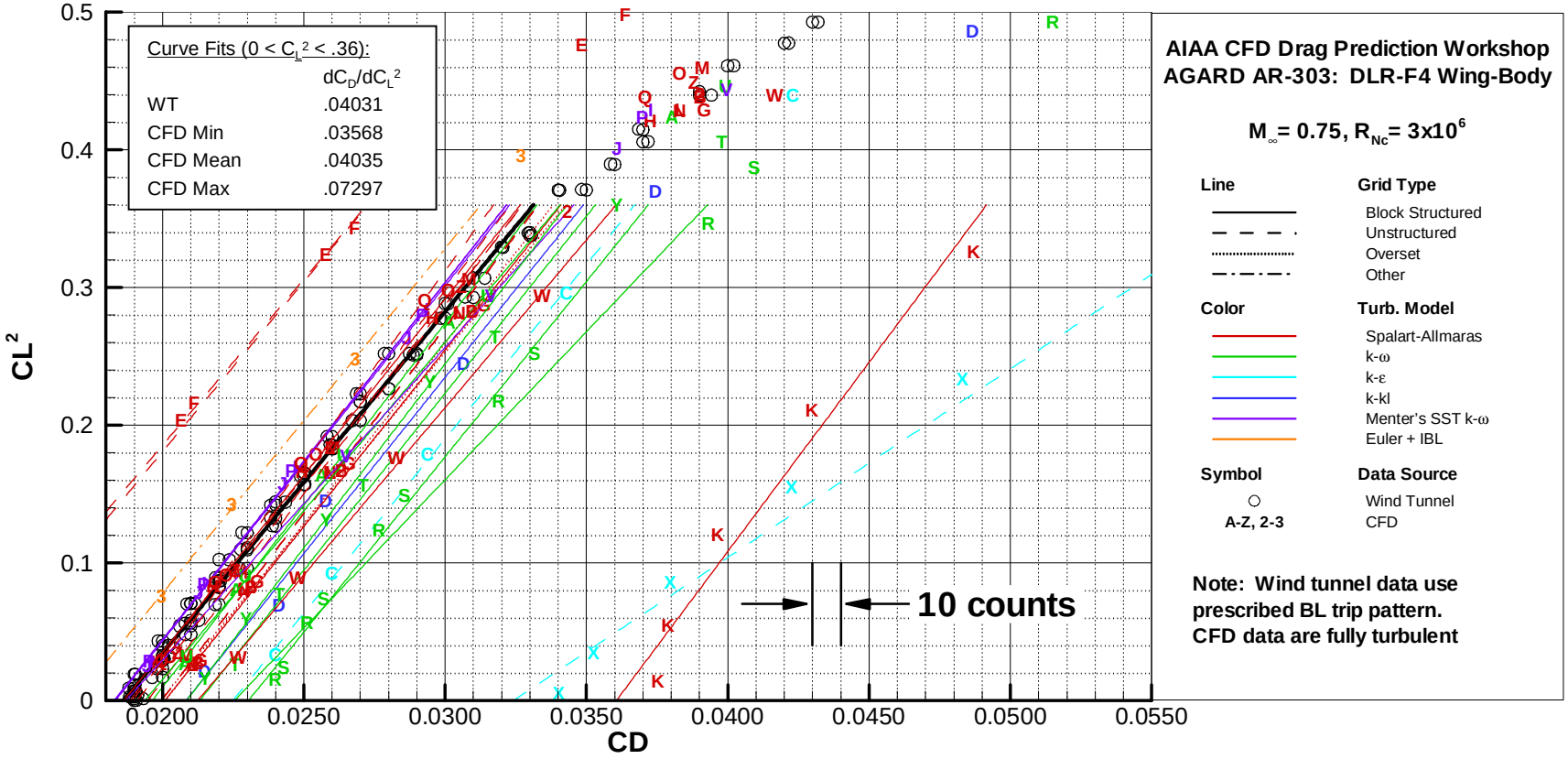
Case 2: Idealized Profile Drag

$M_\infty = .75,\ R_{Nc} = 3x10^6$



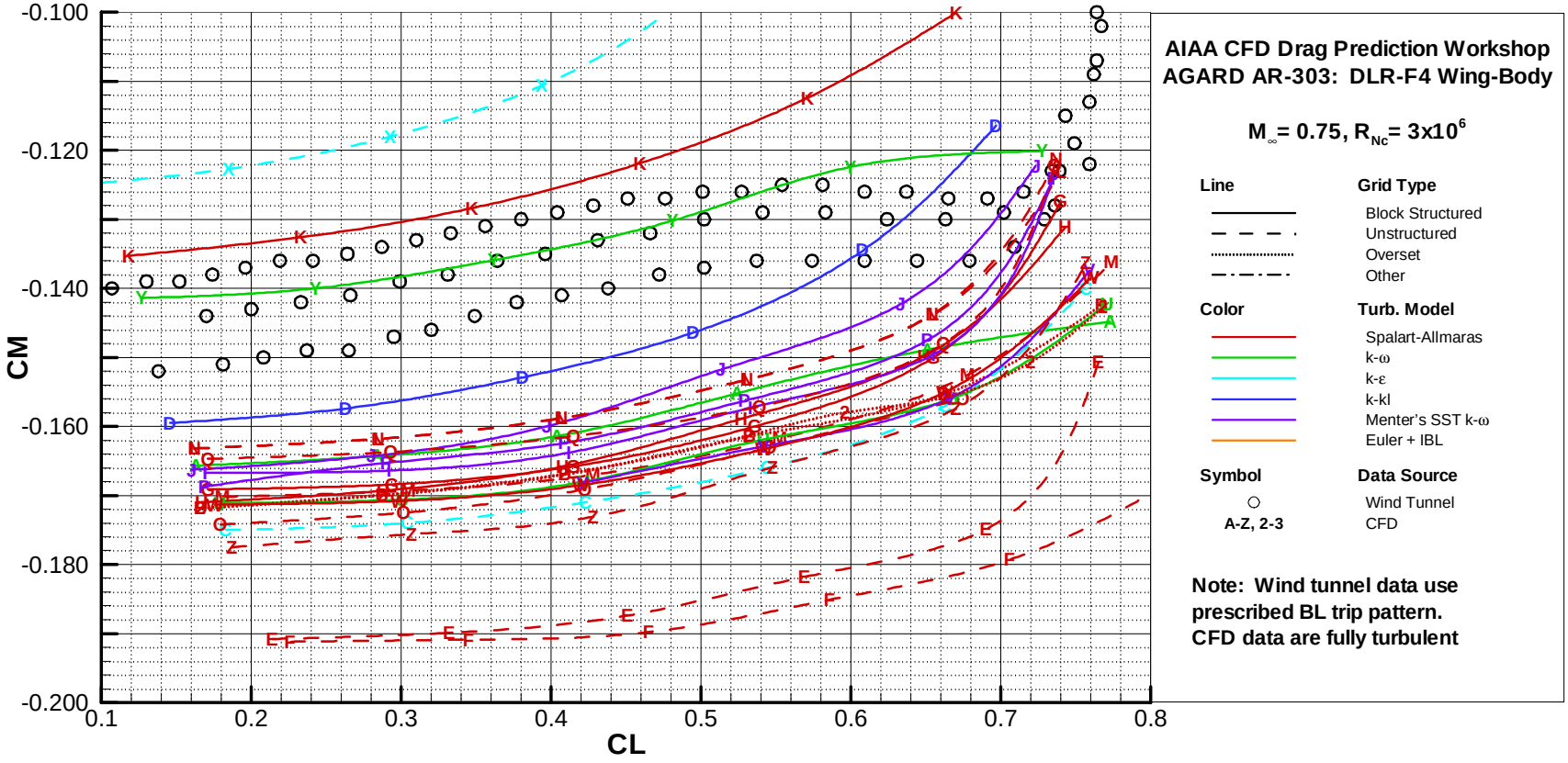
Case 2: Induced Drag Factor

$M_\infty = .75$, $R_{Nc} = 3x10^6$



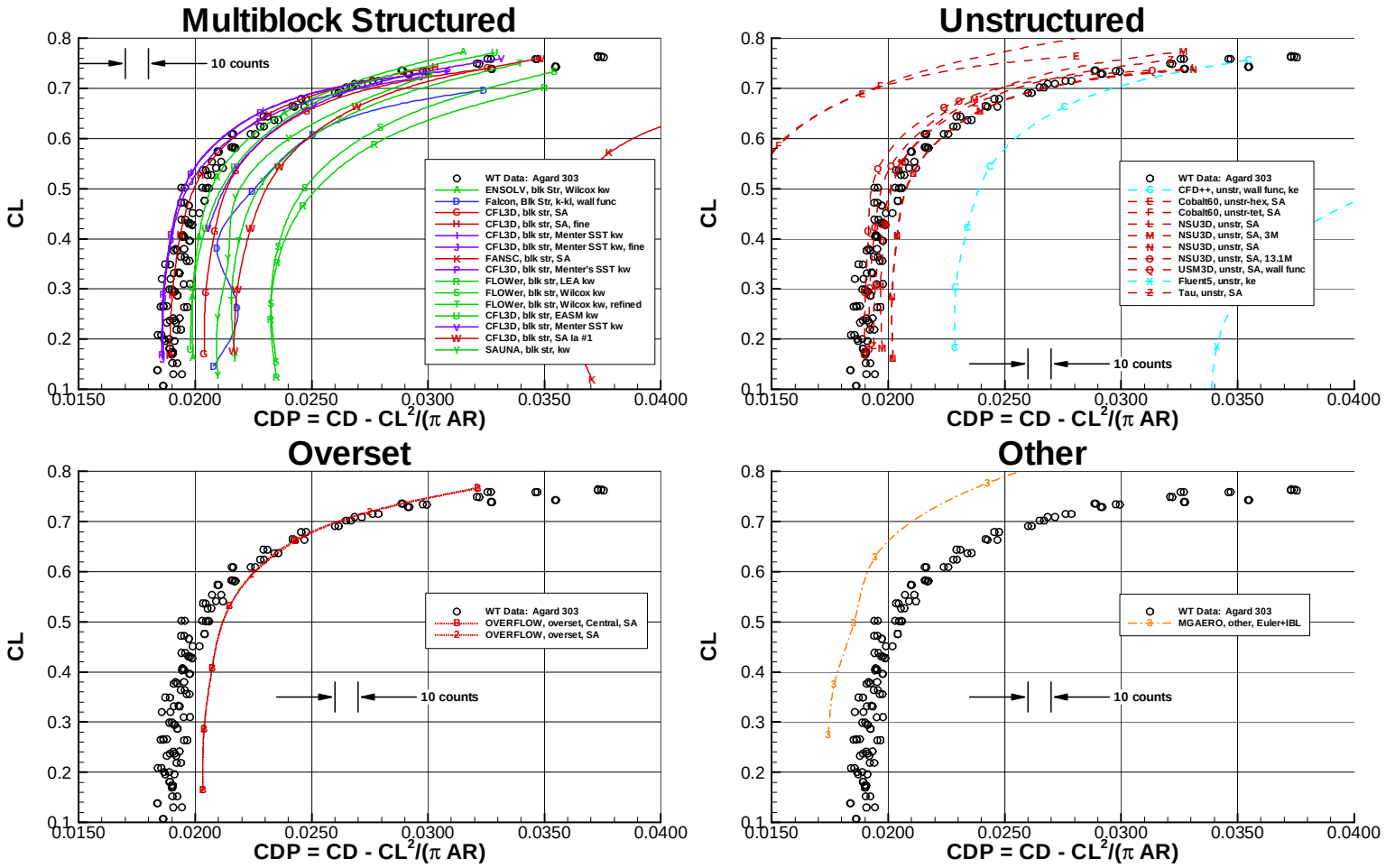
Case 2: Pitching Moment

$M_\infty = .75$, $R_{Nc} = 3x10^6$



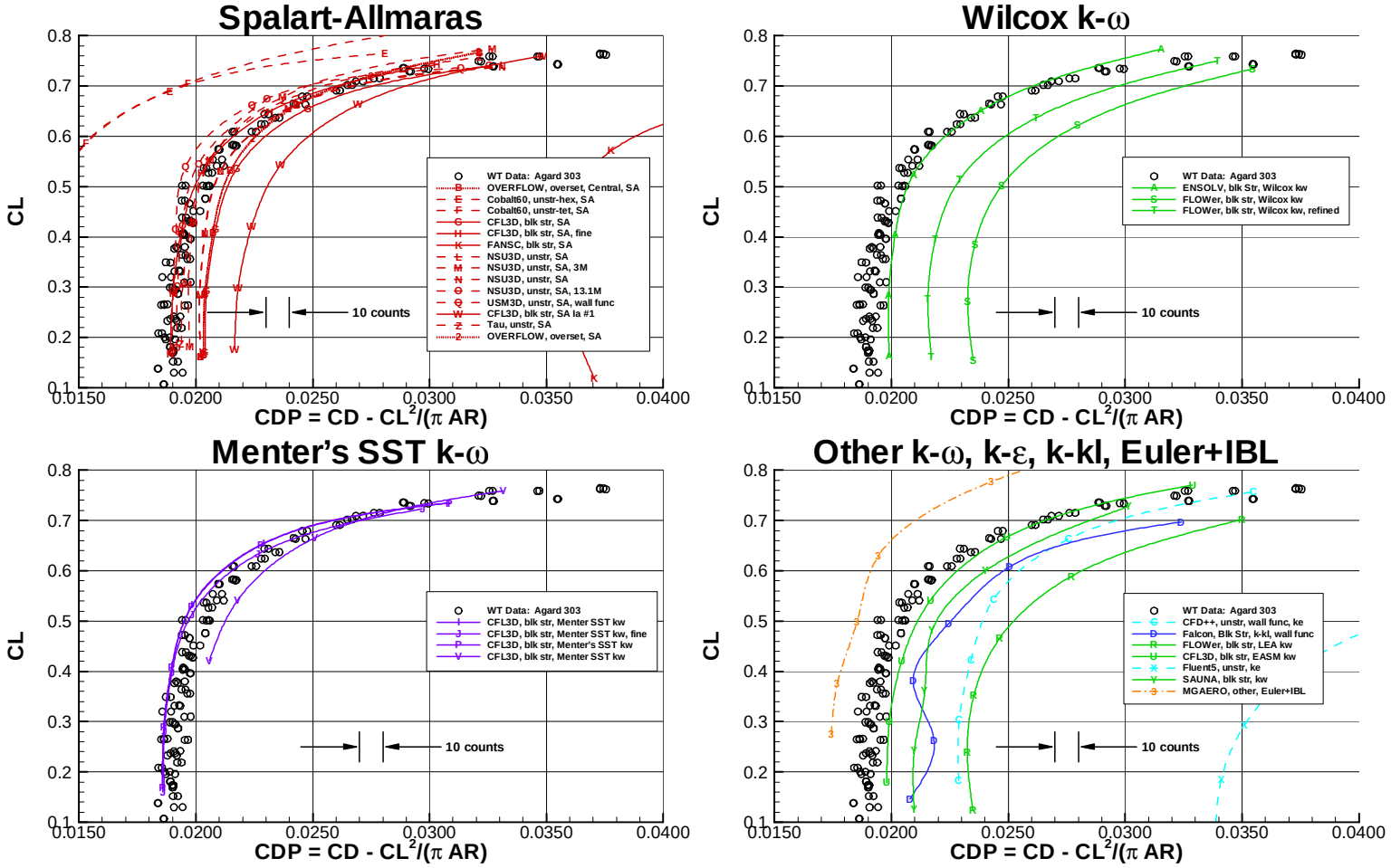
Trends by Grid Type

$M_\infty = .75$, $R_{Nc} = 3x10^6$



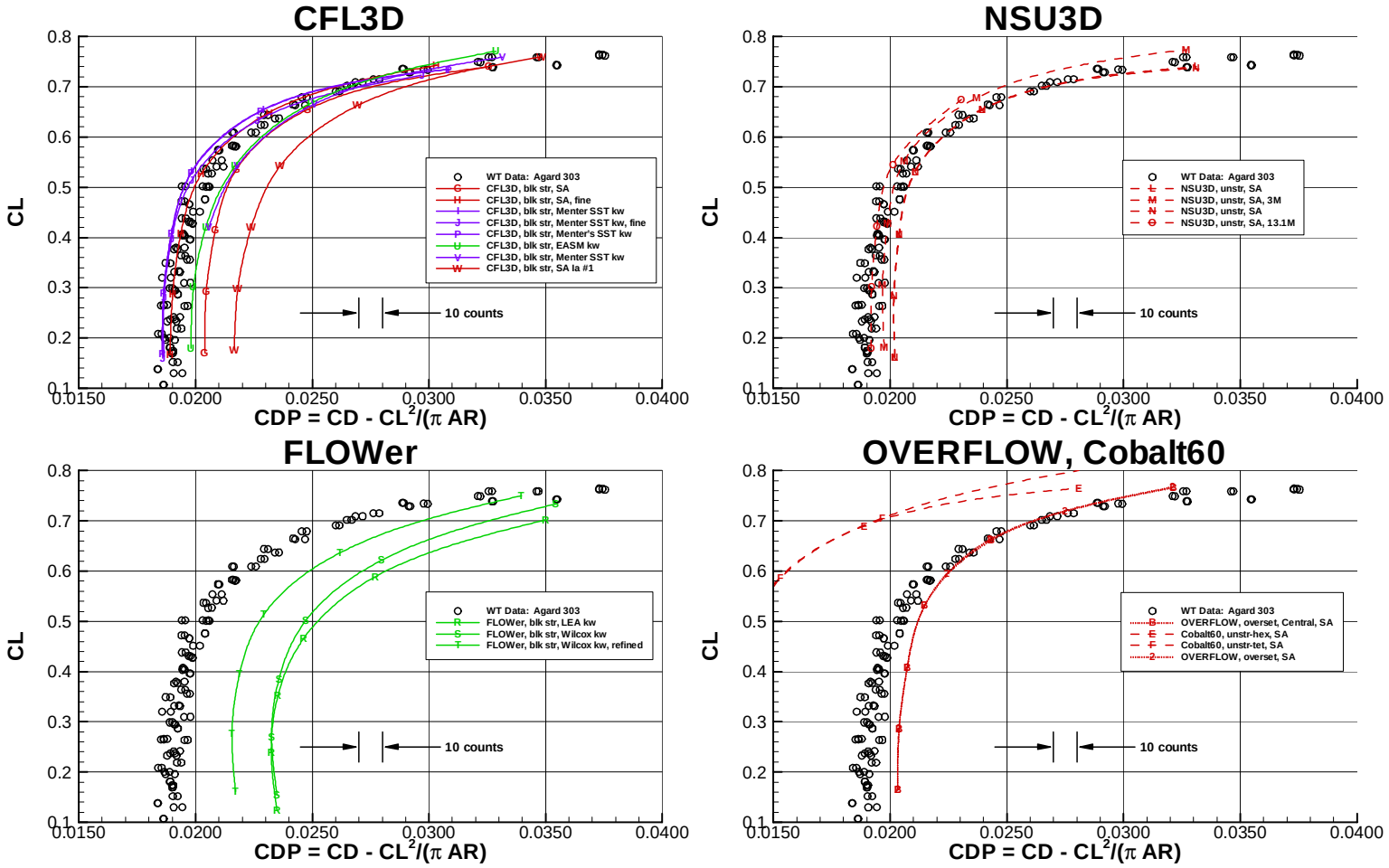
Trends by Turbulence Model

$M_\infty = .75$, $R_{Nc} = 3x10^6$



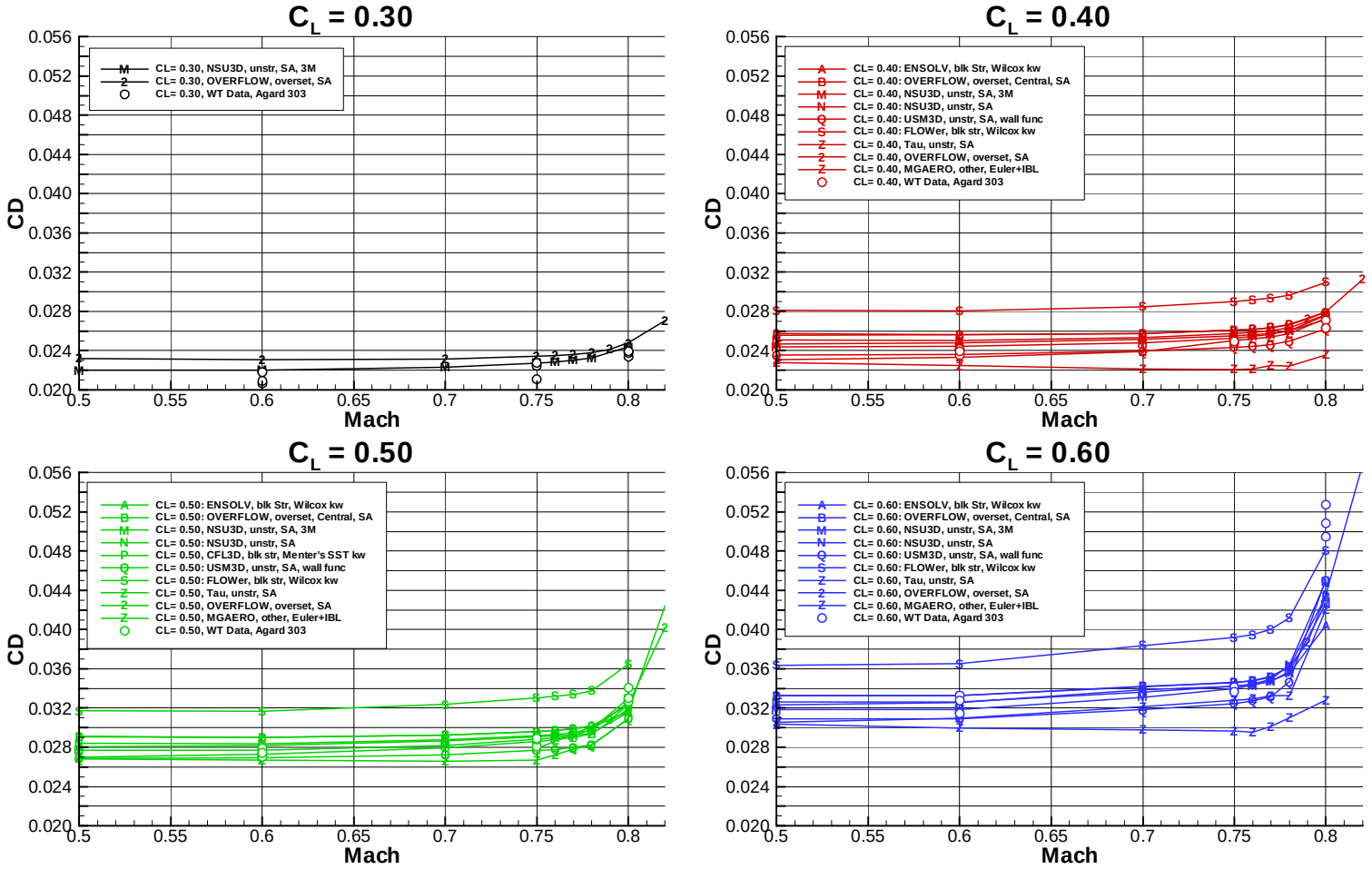
Trends by Code

$M_\infty = .75, R_{Nc} = 3x10^6$



Cases 3-4: Drag Rise Plot

$R_{Nc} = 3x10^6$



Conclusions

- Comparison with experiment pretty good.
- Minimum drag generally higher than expmt.
- Induced drag generally lower than expmt.
- High Mach/α too low (separation).
- No grid type had clear advantage.
- Turbulence model effects.

Recommendations

- Look at more complex configurations (juncture drag).
- Visualization, (weak) feature detection.
- 3D laminar/turbulent transition prediction.
- Induced drag and separation.
- Extrapolation to flight.
- High lift, hinge moments.