

QinetiQ



DPW2 results

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A presentation for the AIAA DPW2
June 21st 2003



Background

- QinetiQ Ltd
 - Formed from the Defence Evaluation & Research Agency (DERA) in July 2001
 - Largest physics based research organisation in Western Europe (~8000 scientists/engineers)
- Acknowledgements
 - UK Department of Trade & Industry
 - Airbus UK

CFD methodology

- SAUNA Structured multi-block grid system
 - Case 1 - Automated WB grids with fixed topology
 - Case 2 - Manually generated WB & WBNP grids
- RANSMB Flow Solver
 - Jameson type, Finite Volume, Cell Centred
 - k-g (Kalitzin-Gould) turbulence model
 - 2000 iterations, multi-grid v-cycling
 - 34 cpu hours, Intel Pentium 4 Xeon 2600MHz

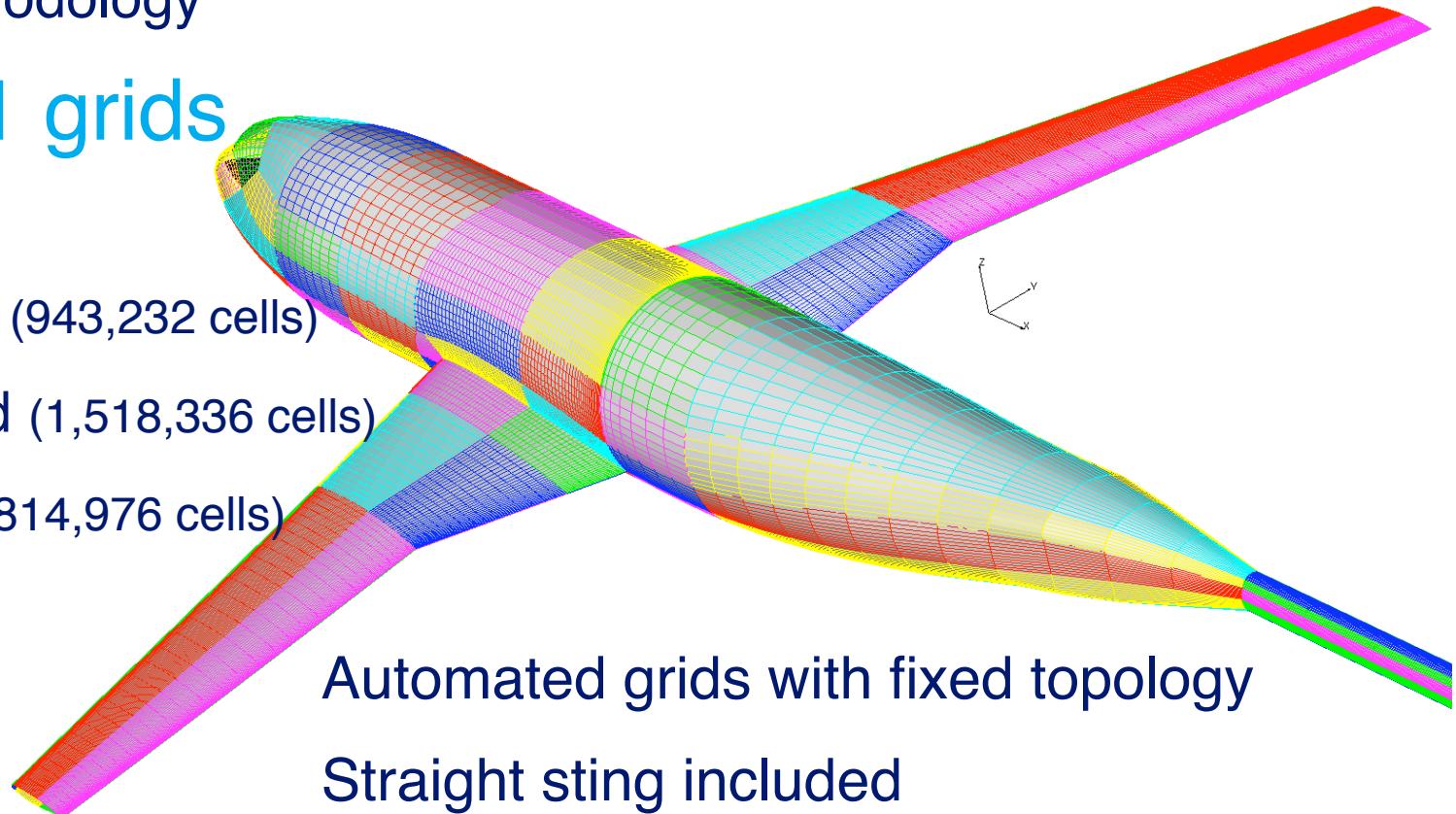
CFD Methodology

Case 1 grids

Coarse grid (943,232 cells)

Medium grid (1,518,336 cells)

Fine grid (2,814,976 cells)



Automated grids with fixed topology

Straight sting included

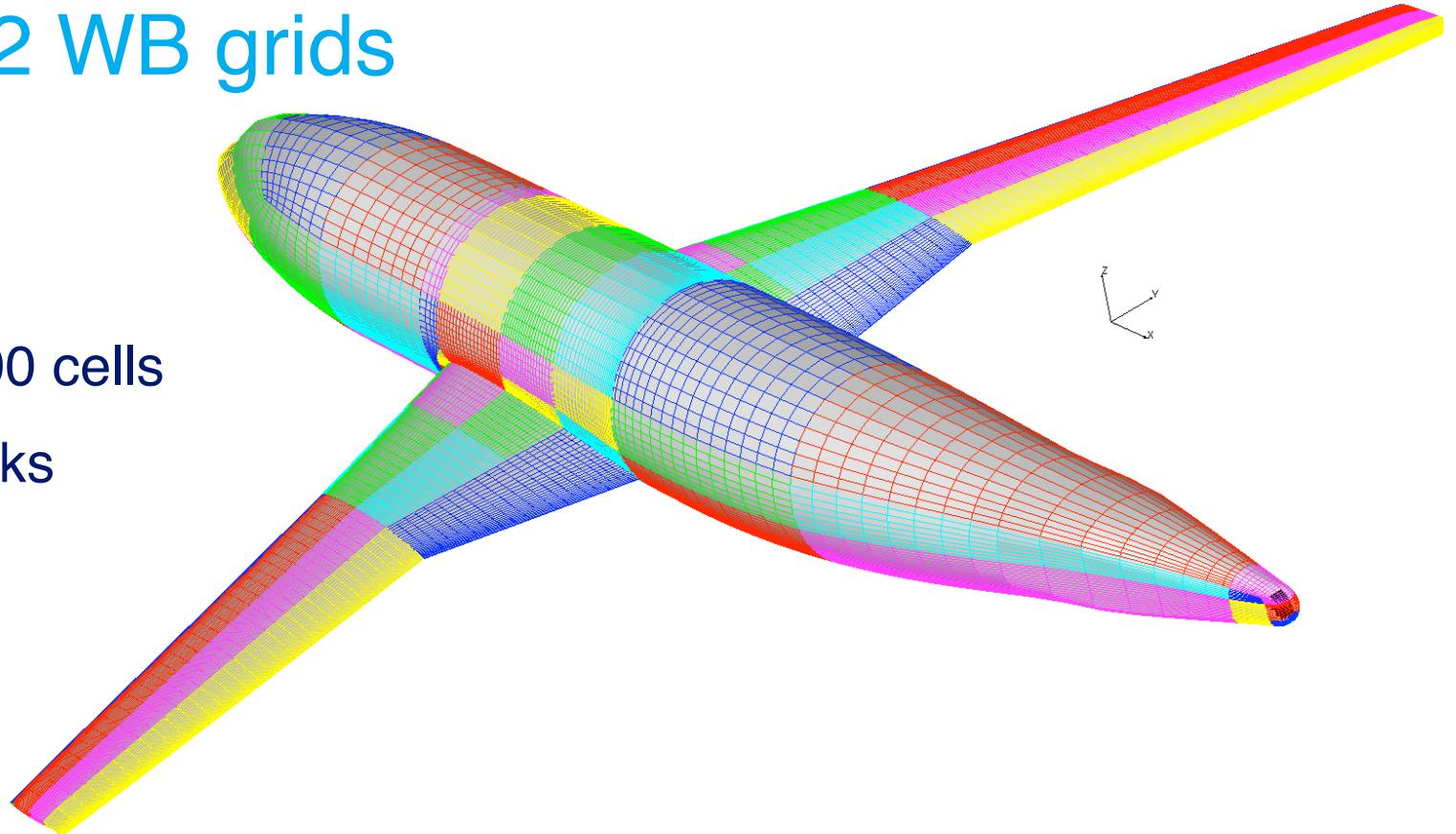
Closed trailing edges

CFD Methodology

Case 2 WB grids

1,632,000 cells

450 blocks

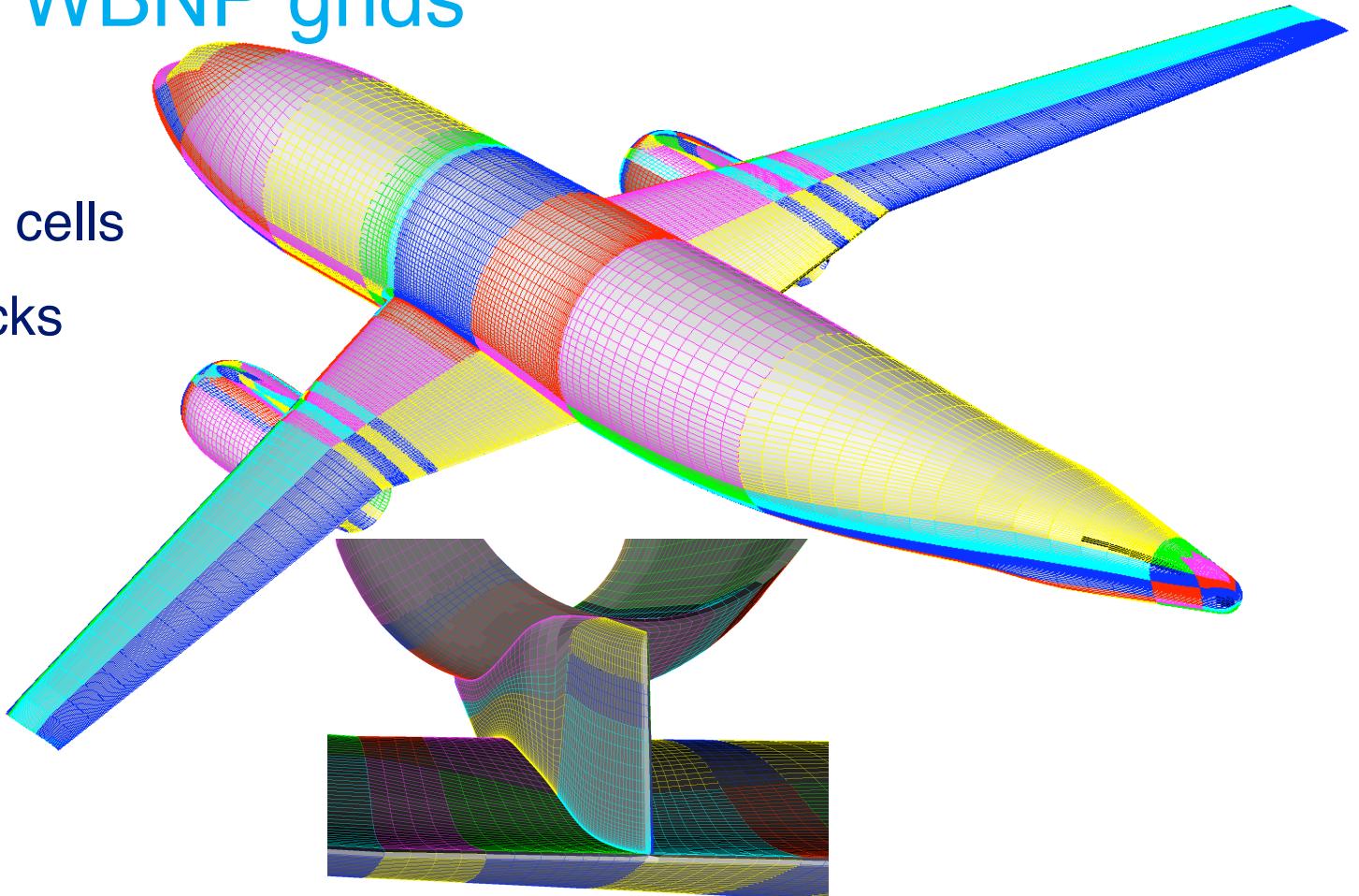


CFD Methodology

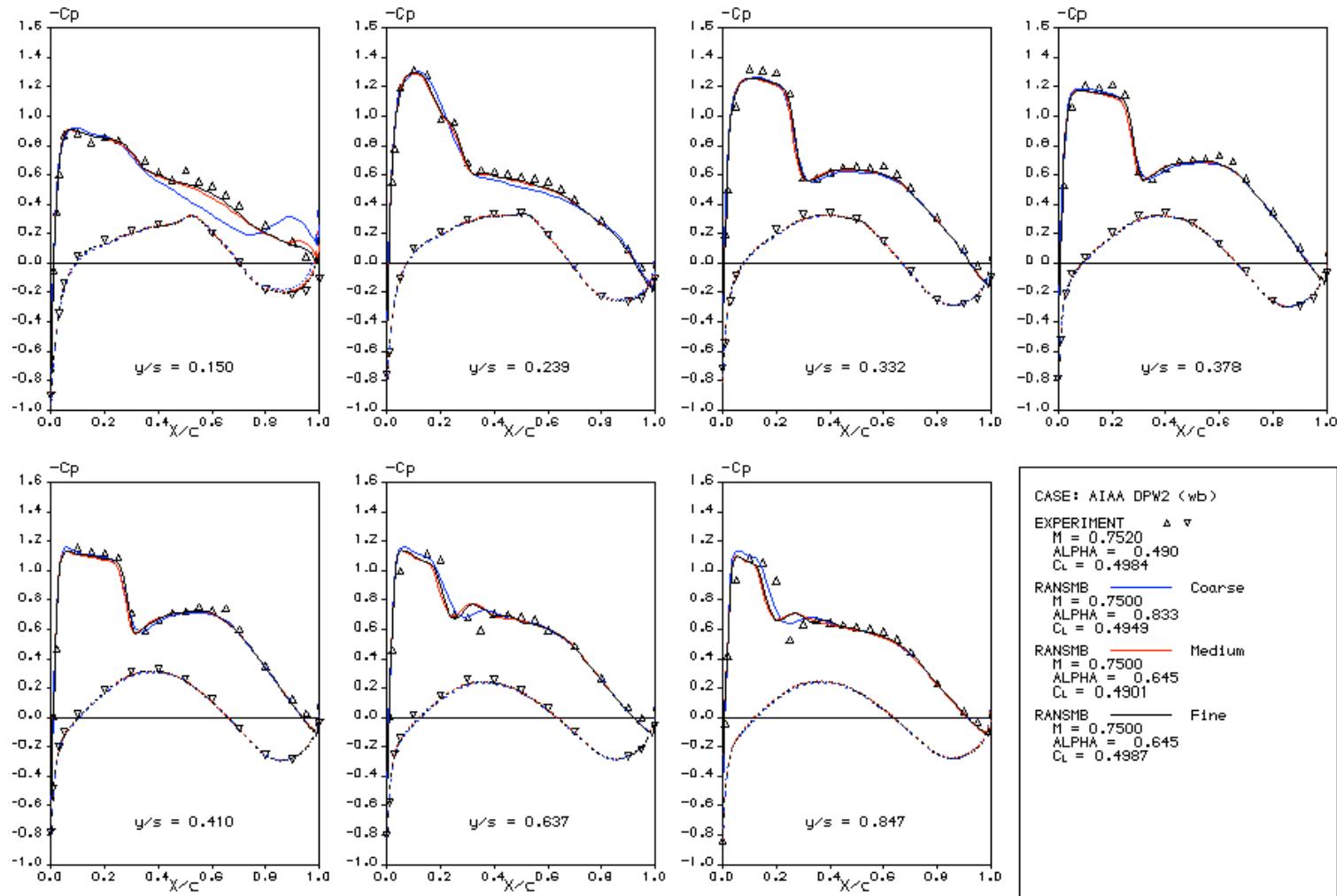
Case 2 WBNP grids

2,855,040 cells

1,360 blocks

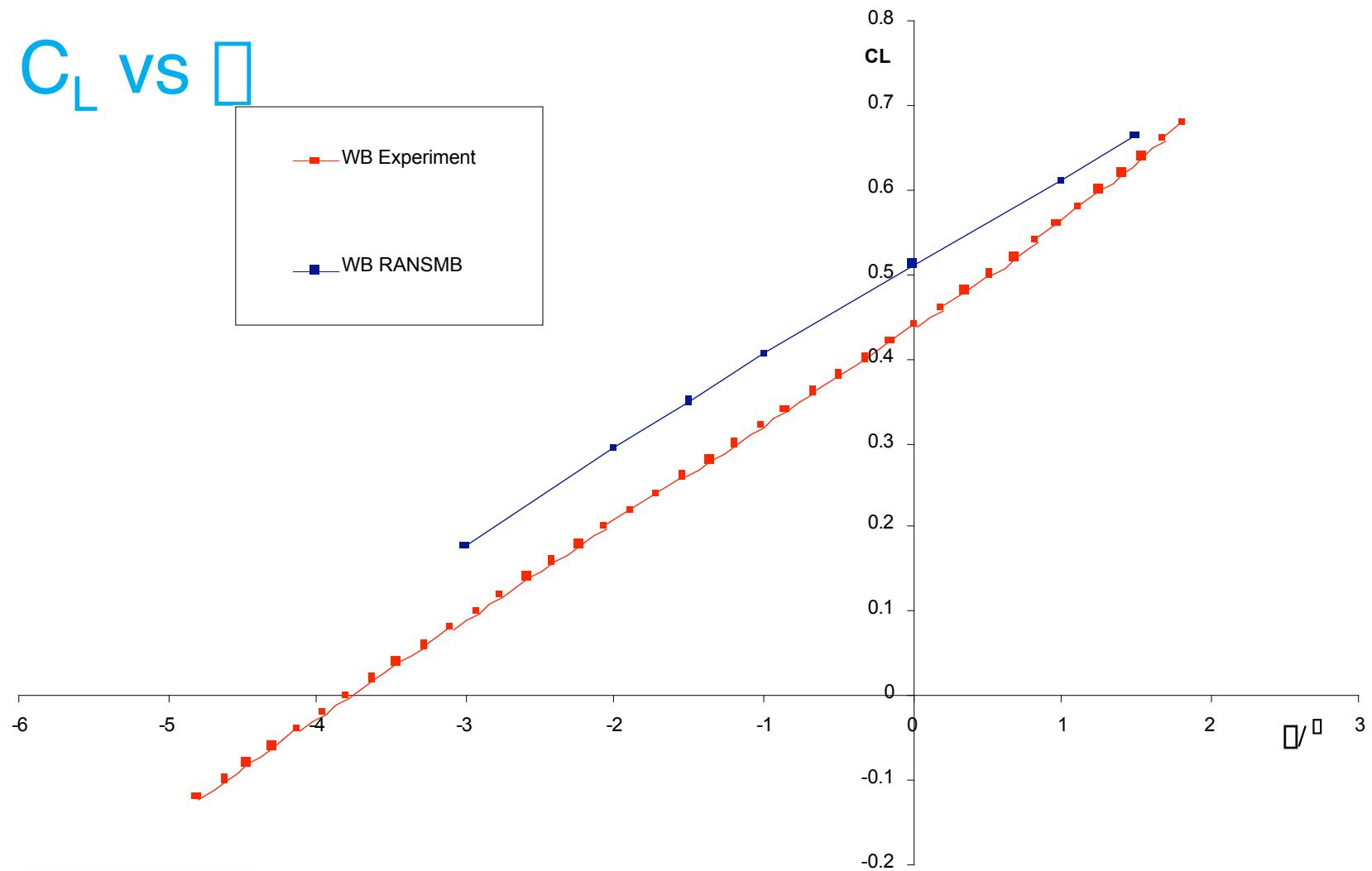


Case 1 results



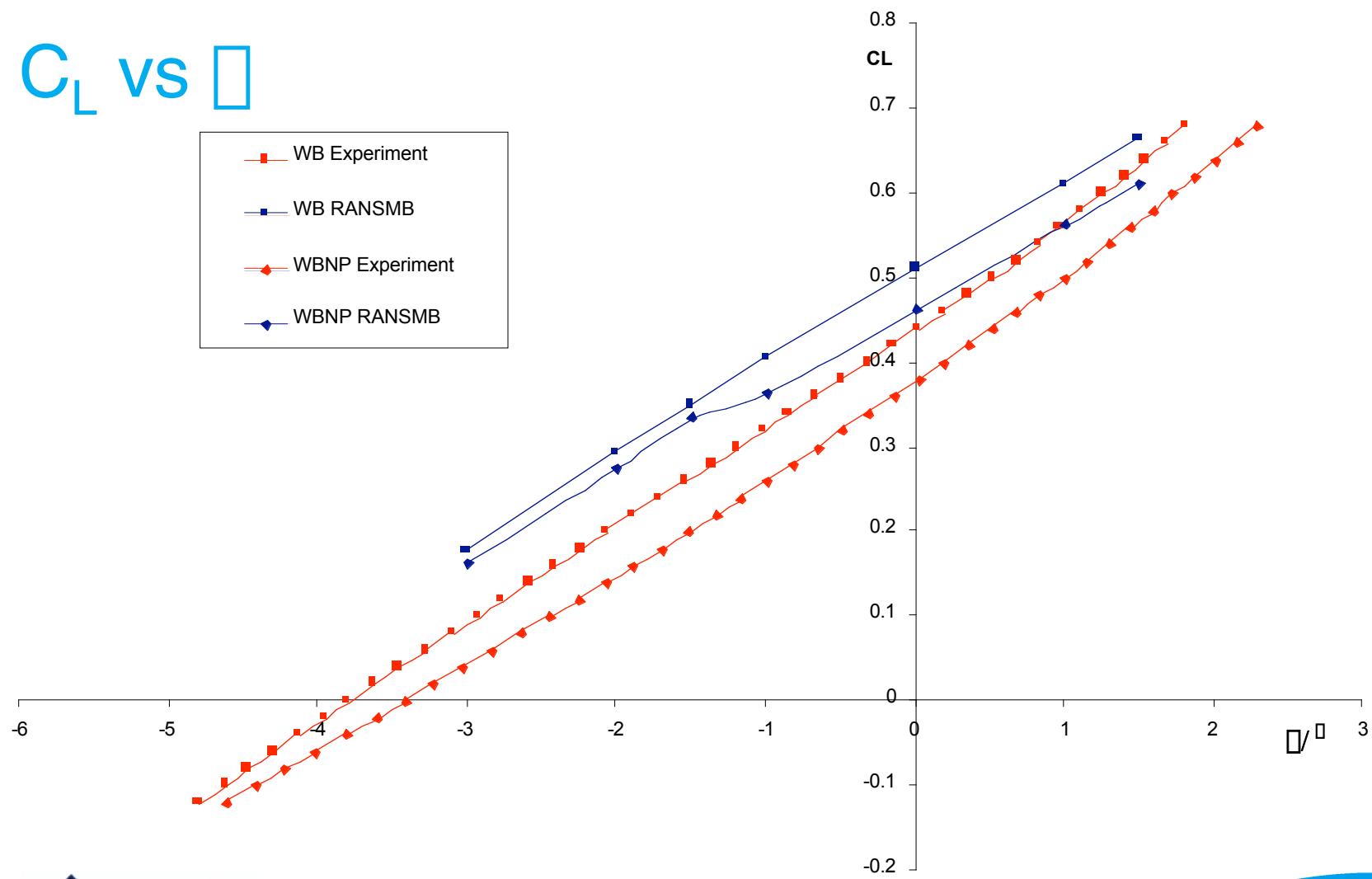
Case 2 results

C_L vs α

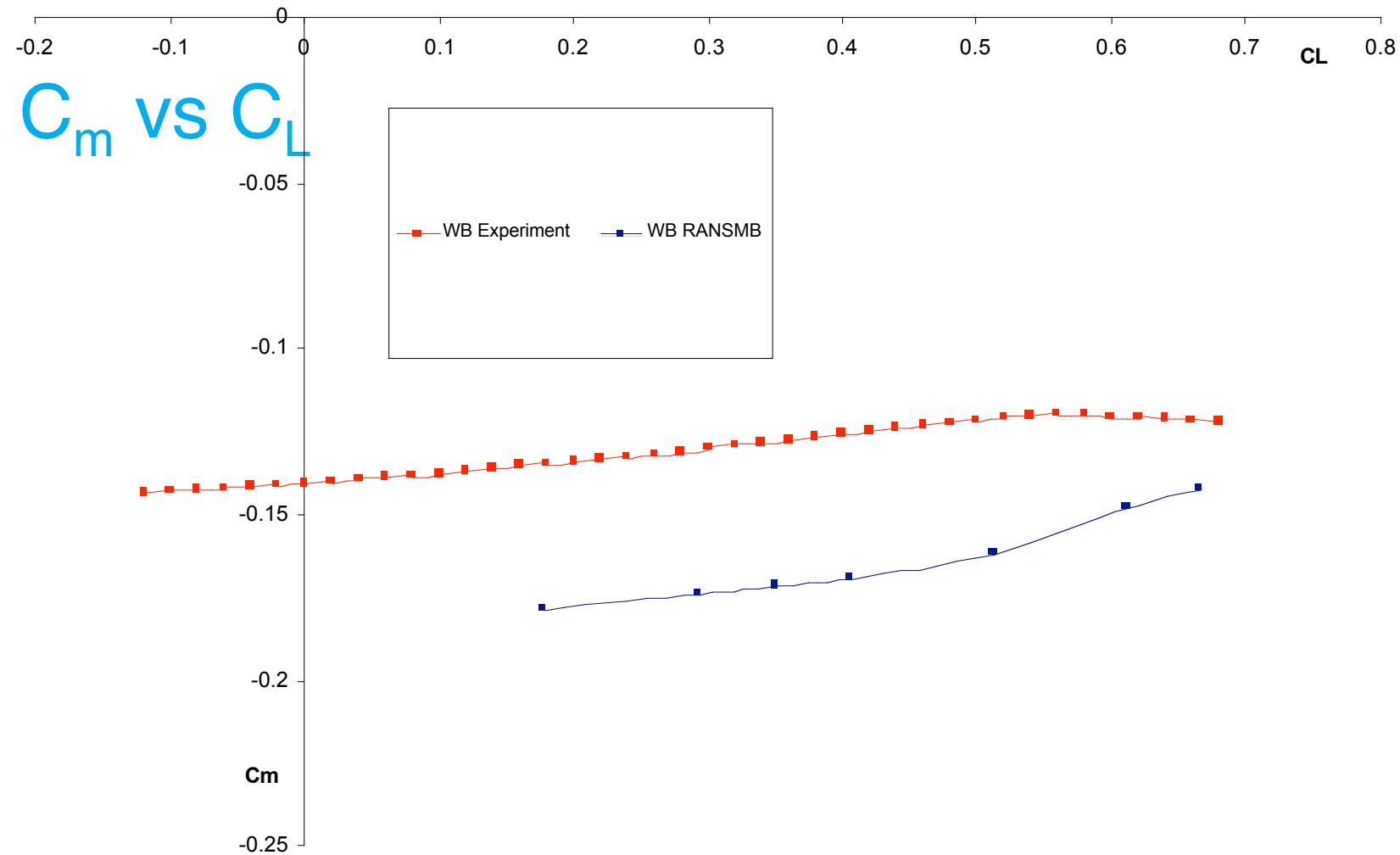


Case 2 results

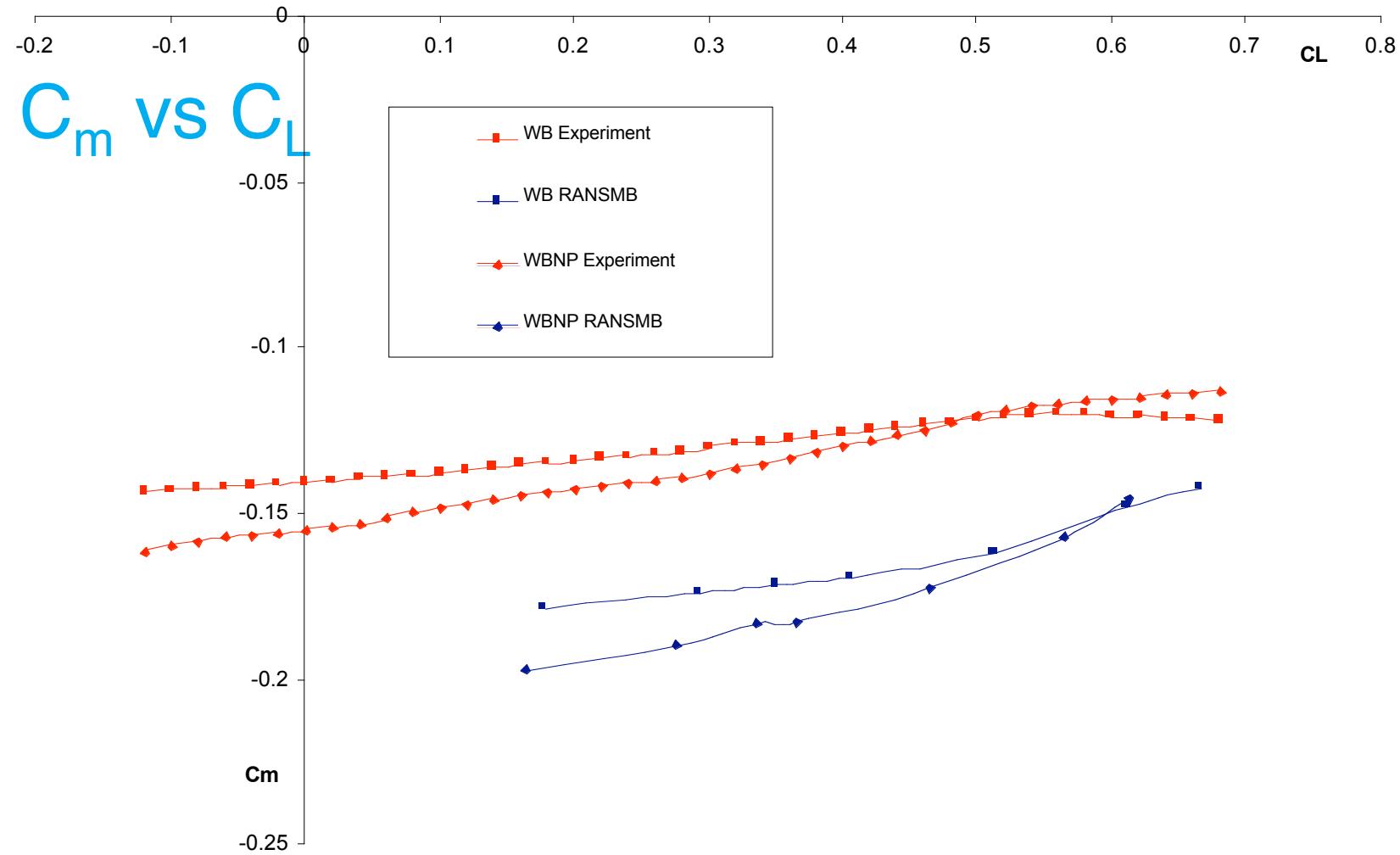
C_L vs $\frac{V}{U}$



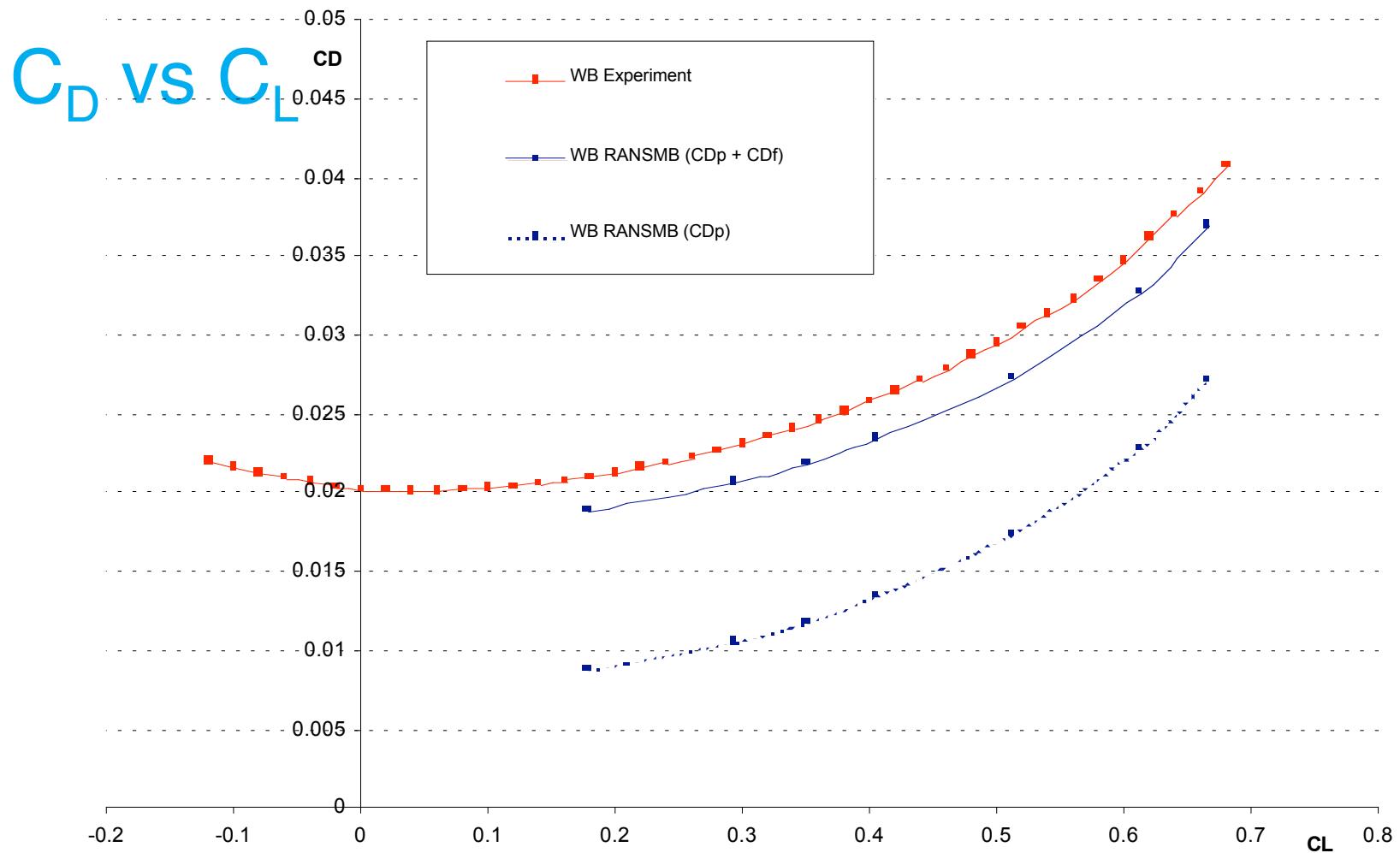
Case 2 results



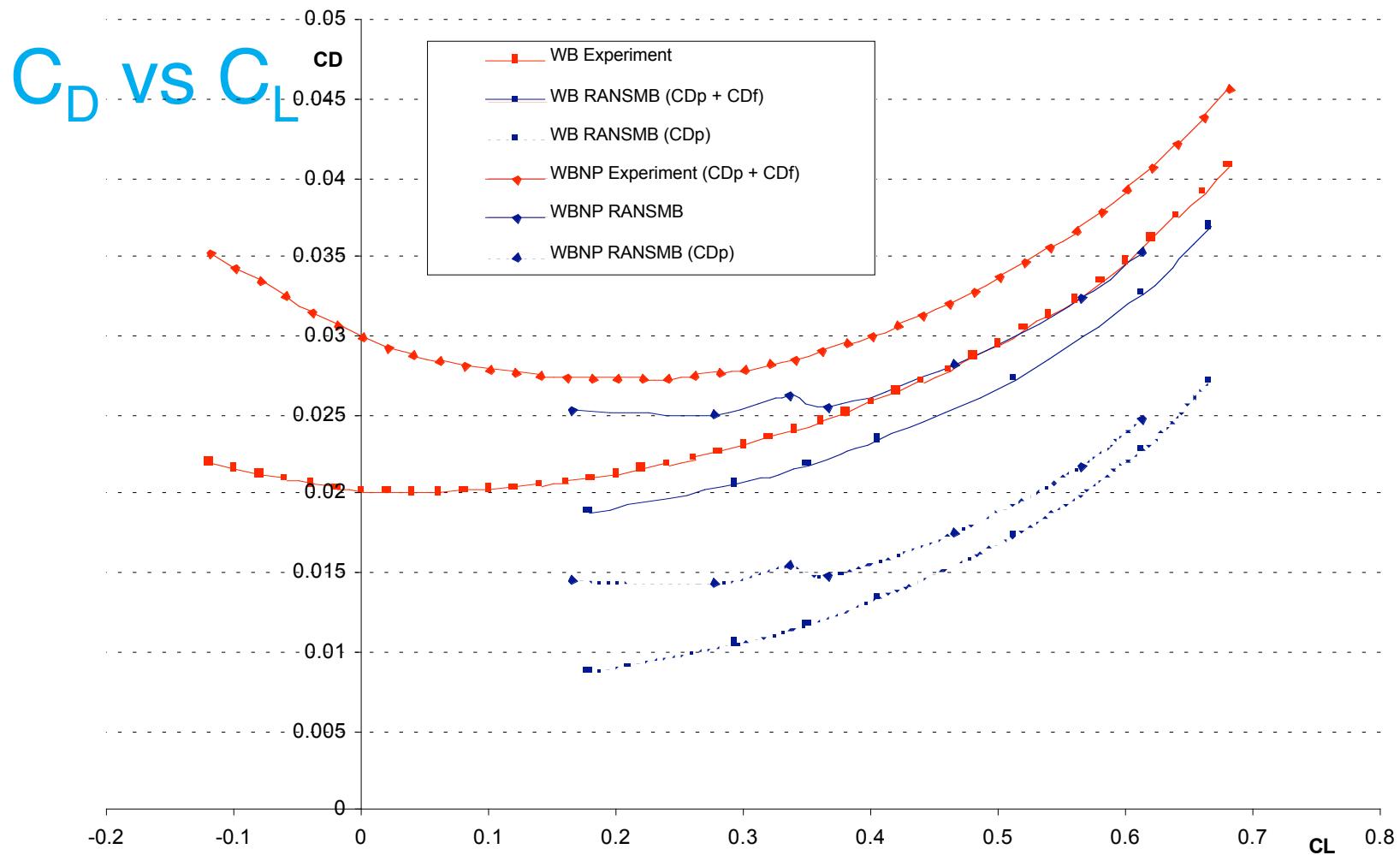
Case 2 results



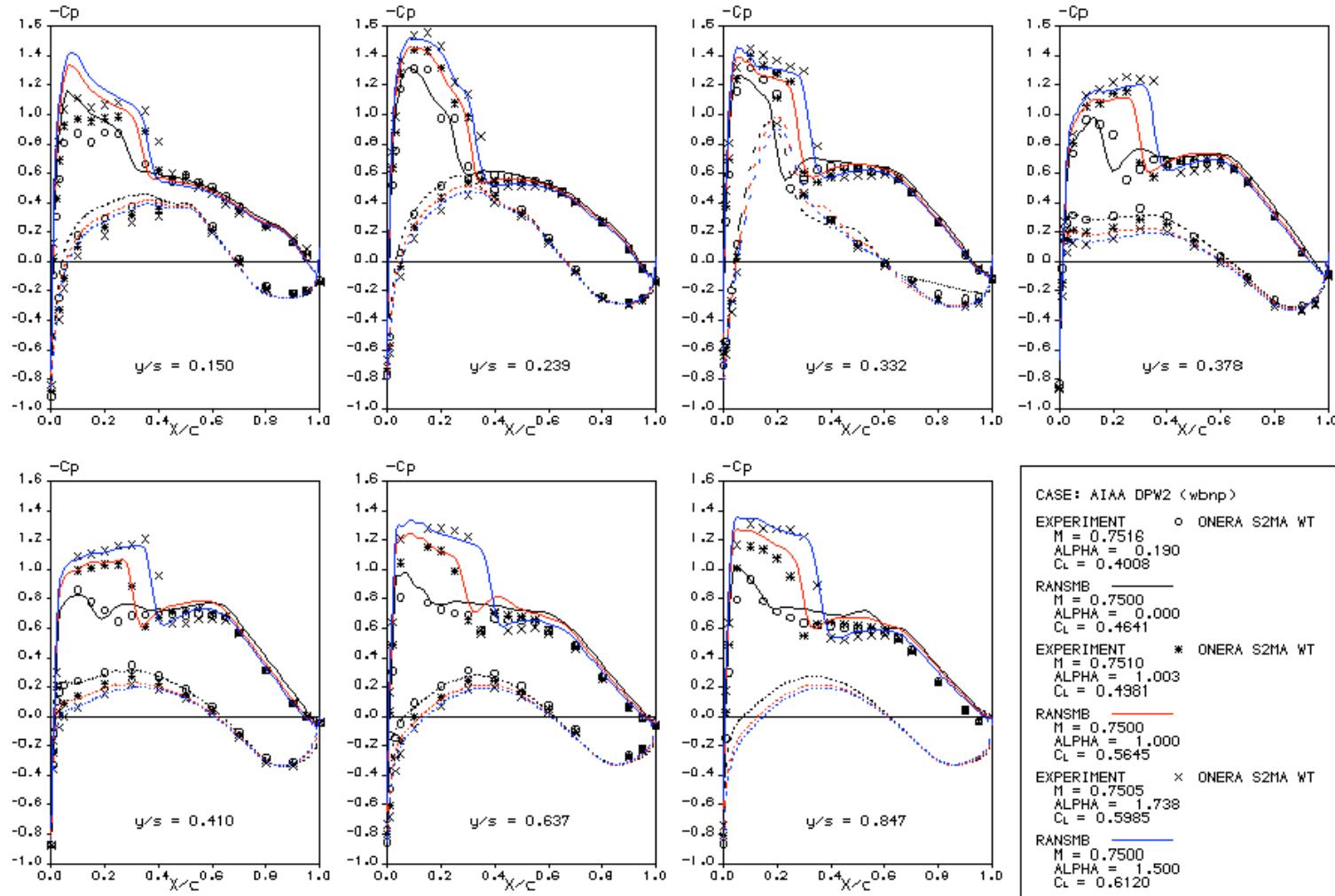
Case 2 results



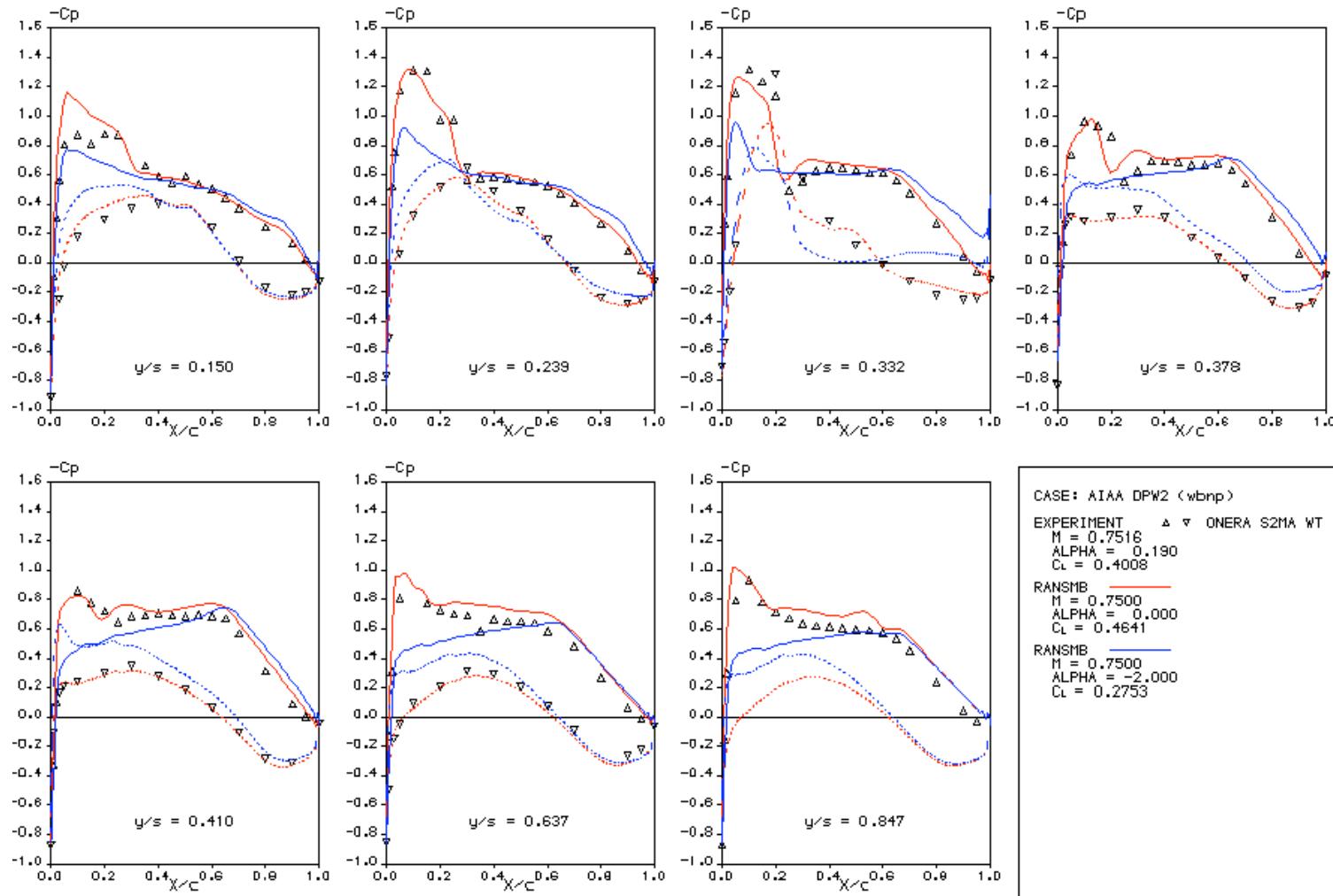
Case 2 results



Case 2 results

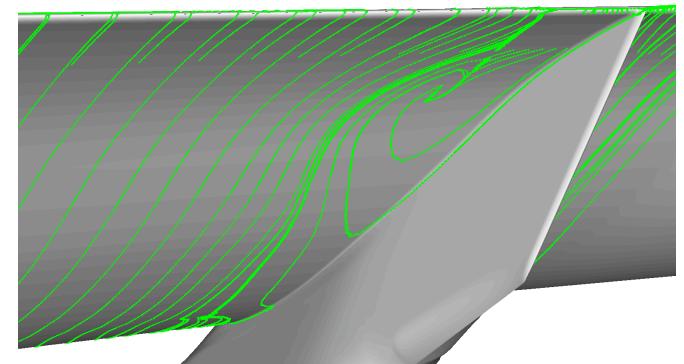
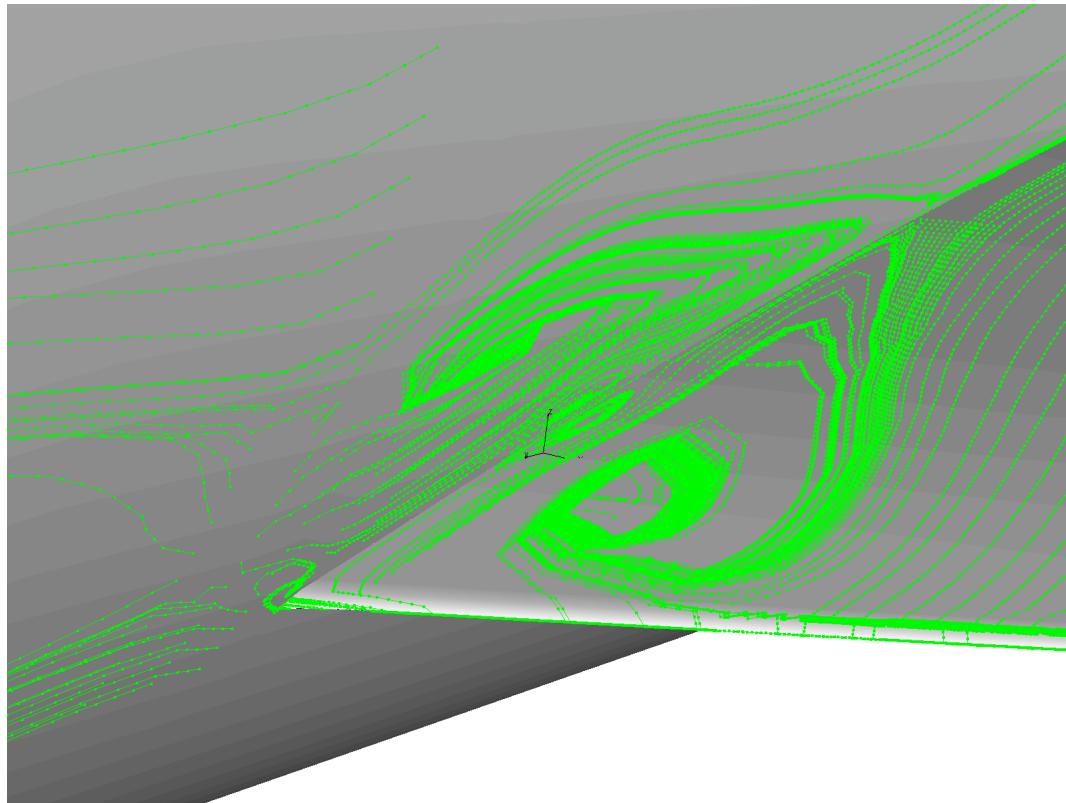


Case 2 results



Case 2 results

WBNP separation characteristics



Summary

- Grid sensitivity using ‘automated’ grids indicates that WB medium grid (1,518,336 cells) captures the flow features
- good agreement between predicted and experimental pressure distributions, lift curve slopes, and pitching moment gradients
- some discrepancies at high lift for WB and WBNP and at low lift for WBNP
- drag trends are well represented, with predicted drag approximately 20 counts lower than experiment for WB and 40 counts lower for WBNP
- Flow separation mechanisms are well represented

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