ISCFDC CFD Results for the HiLiftPW-3

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Denver, CO

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Acknowledgment

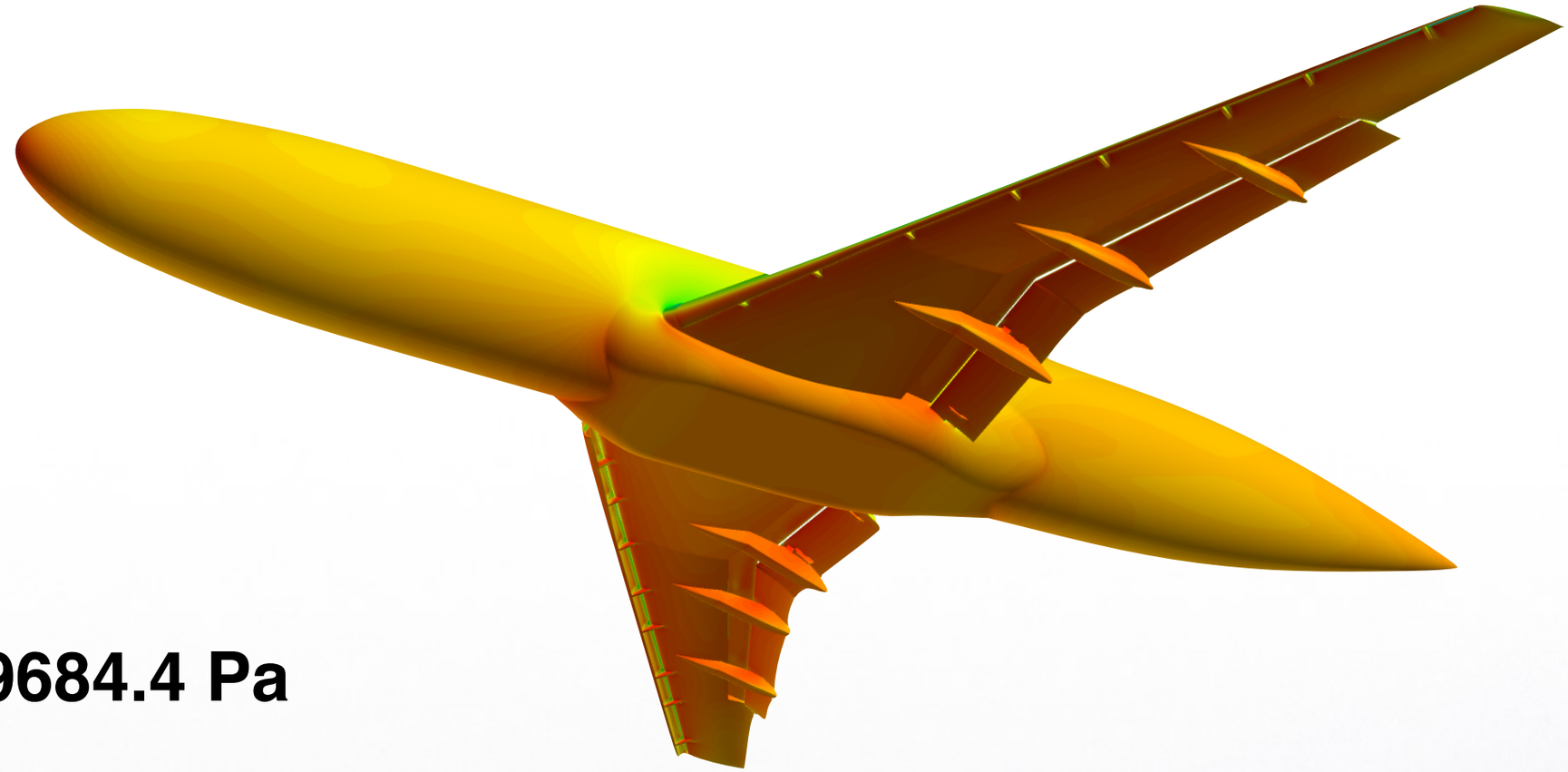
- Ya'eer Kidron - ISCFDC CTO
- Yuval Levy - ISCFDC CEO

Special thanks are due to HPE for providing us access to their SGI UV 3000 Supercomputer

ISCFDC In-House Codes Description

	Arion/GUNS (FV)
Mesh Type	Unstructured grids (cell-centered)
Convective Flux + Limiter	HLLC (2nd-order GG reconstruction) + MLP-u2 limiter
Diffusive Flux	2nd-order central differencing (Diamond path)
Turbulence model	SST-2003, SSG/LRR-RSM-w2012
Time Integration	Point Block GS (IRK-3,5, B2) + UPC

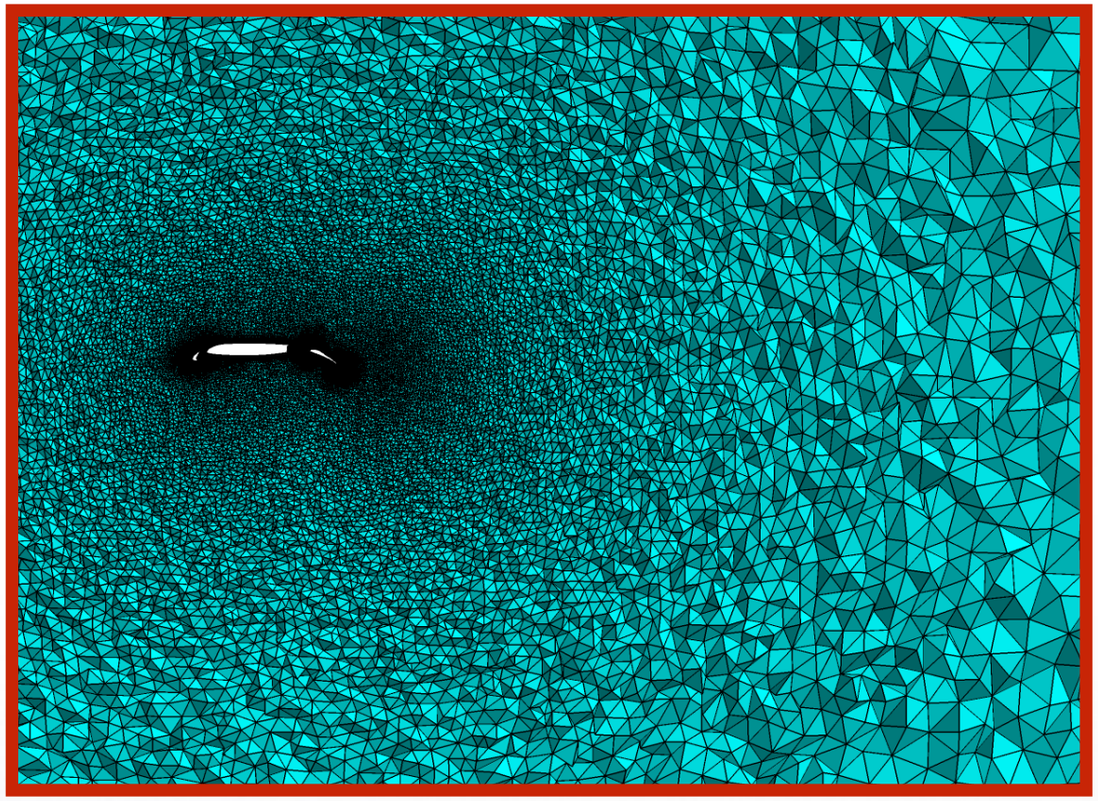
Case 2a (JSM w/o nacelle)



Flow conditions:

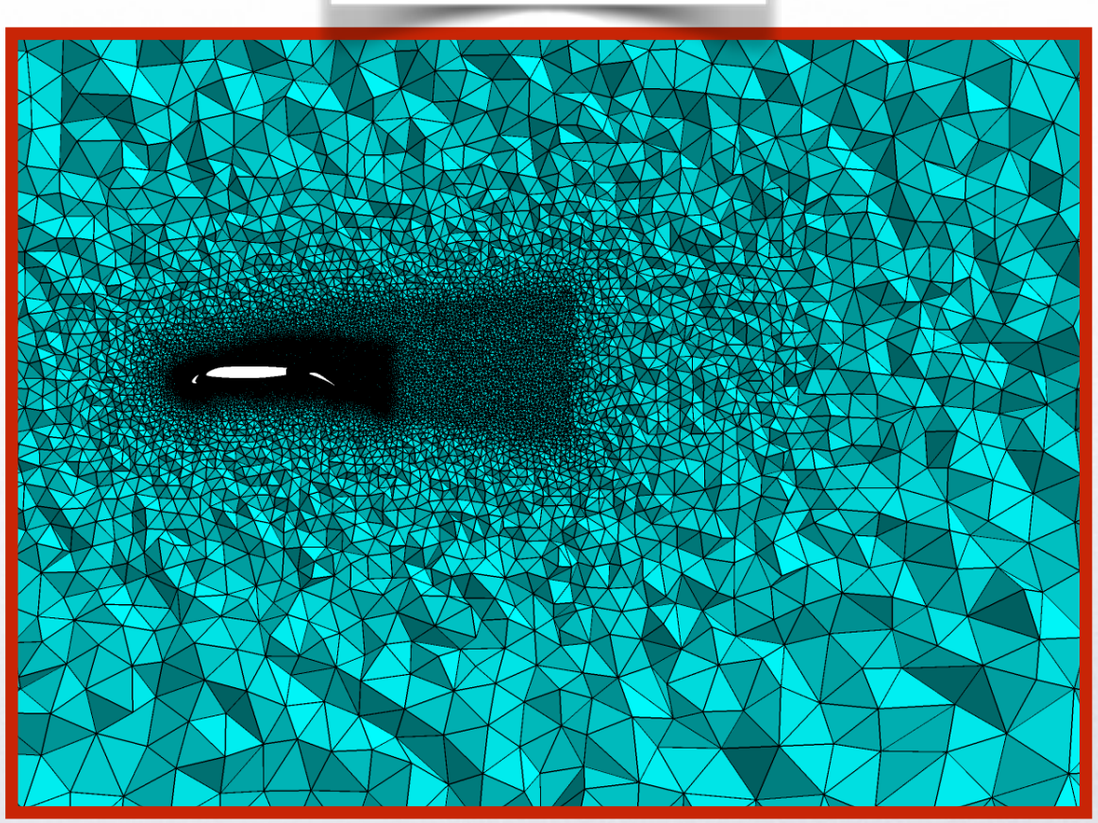
- **Mach = 0.172**
- **Pressure = 99684.4 Pa**
- **Temperature = 306.55 K**
- **α = 4.36°, 10.47°, 18.58°**
- **Fully turbulent**

Case 2a: Grid Overview

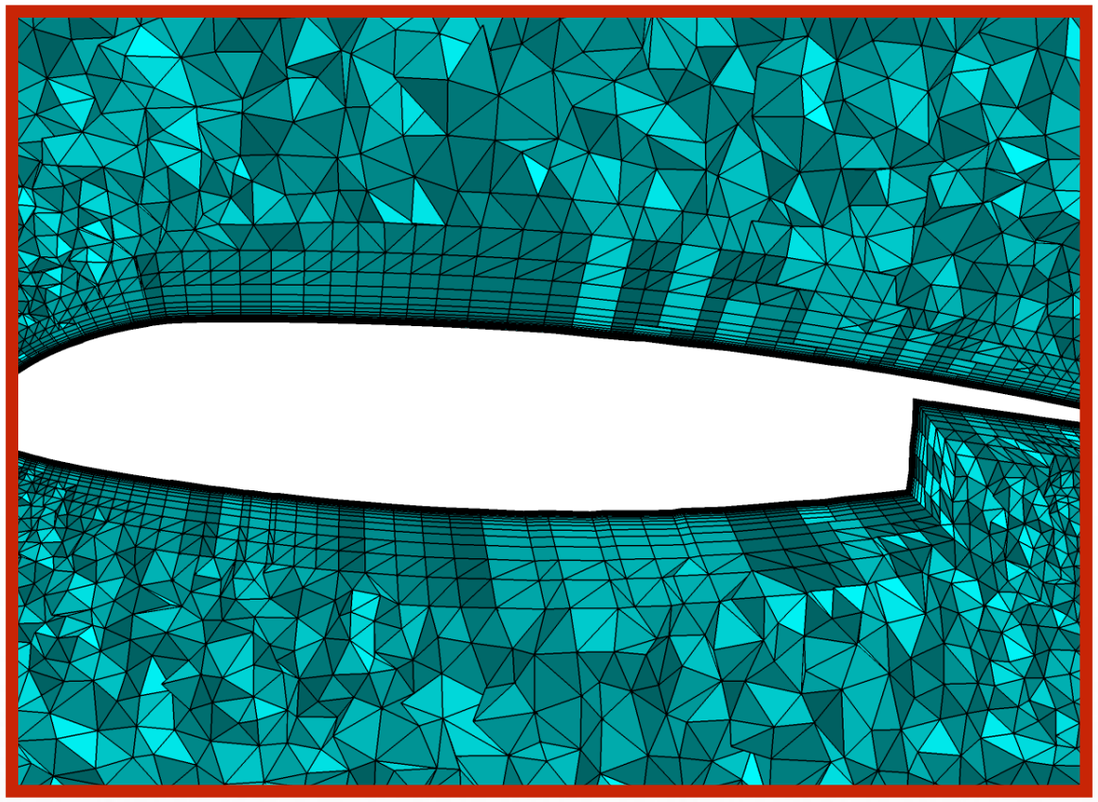


C2-JSM (VGRID)

E-JSM (ANSA)

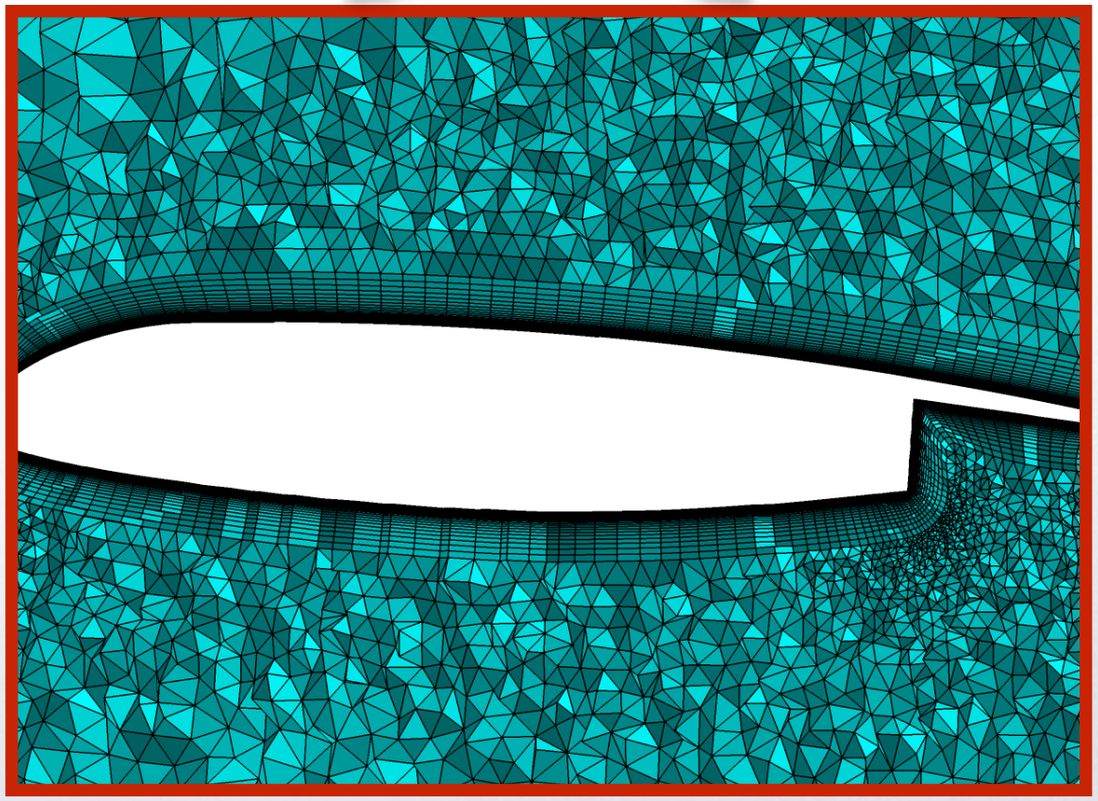


Grid Overview: Wing Section

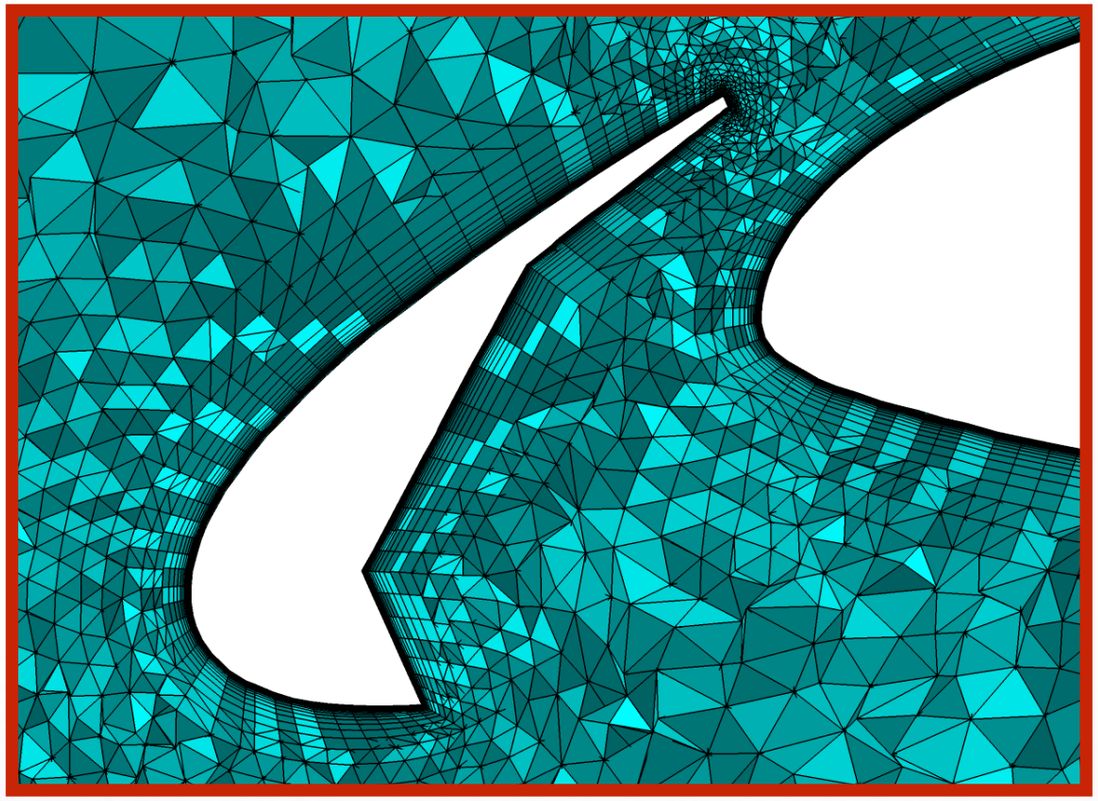


C2-JSM

E-JSM

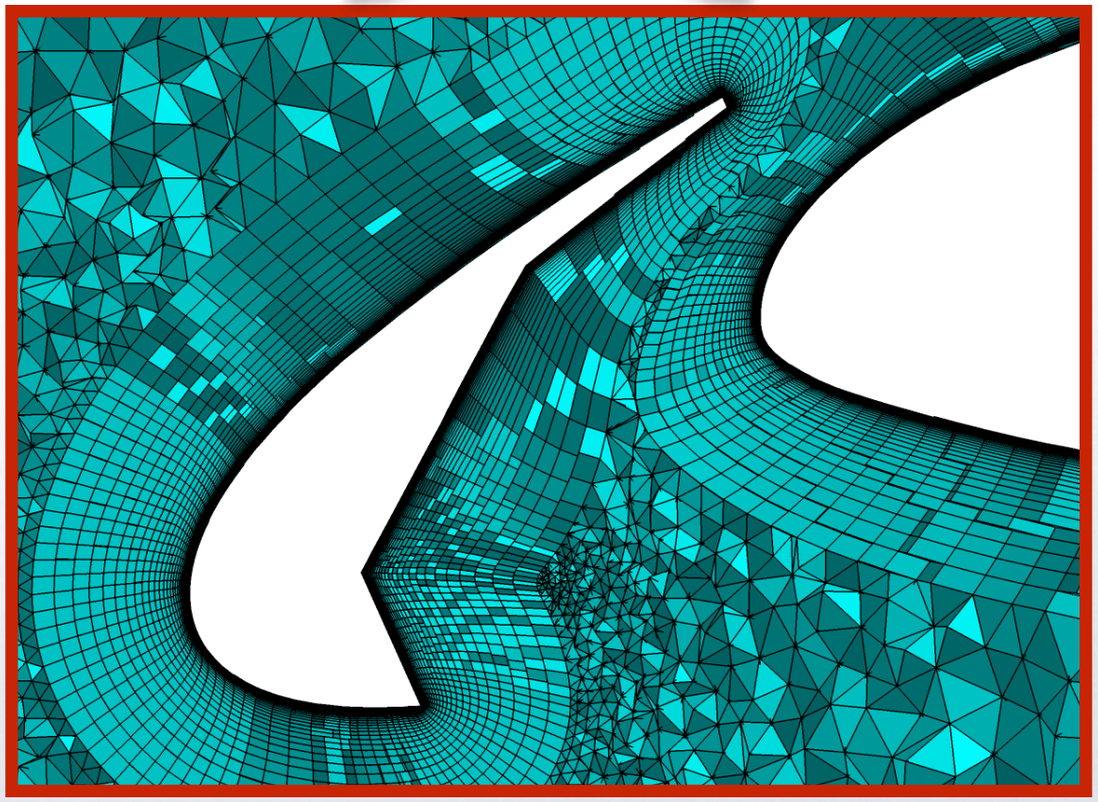


Grid Overview: Slat Section

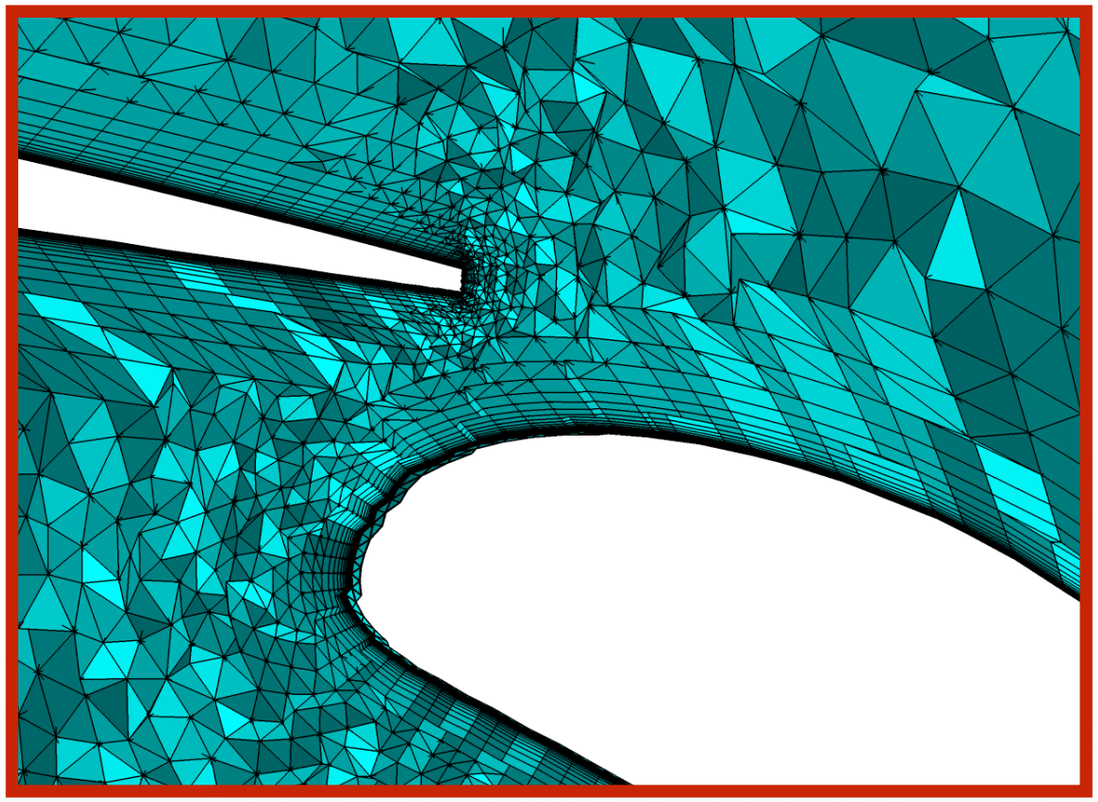


C2-JSM

E-JSM

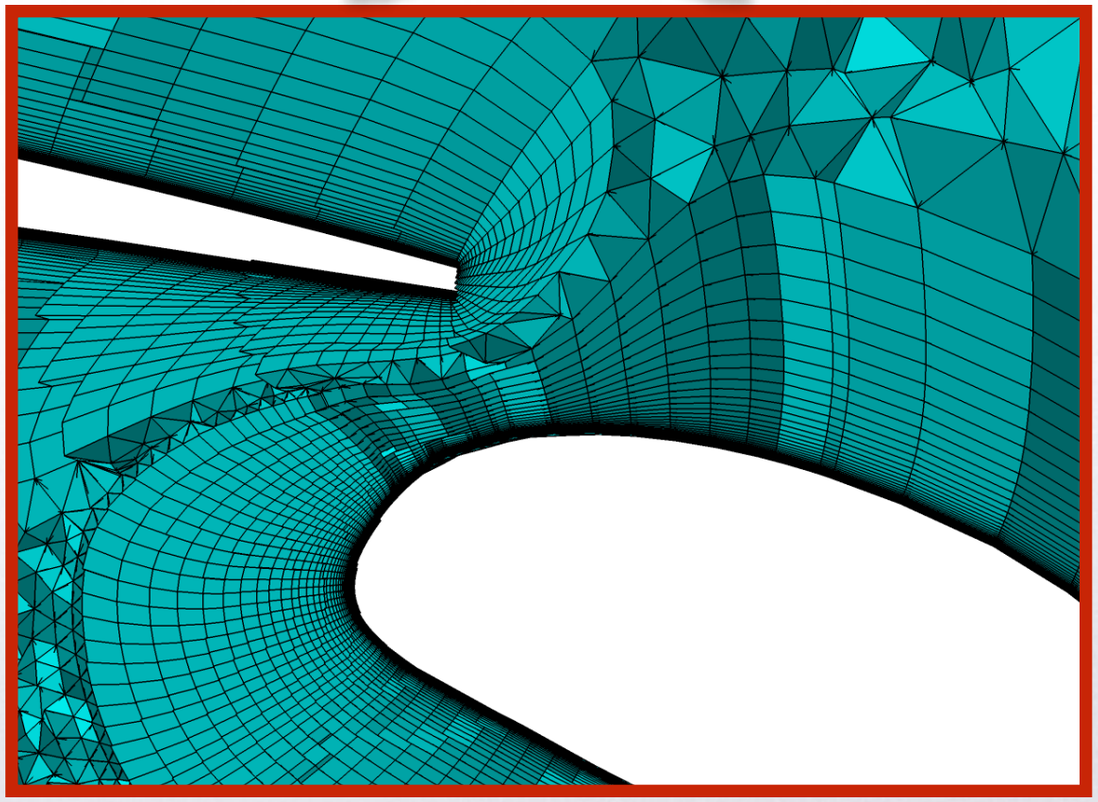


Grid Overview: Wing-Flap Section

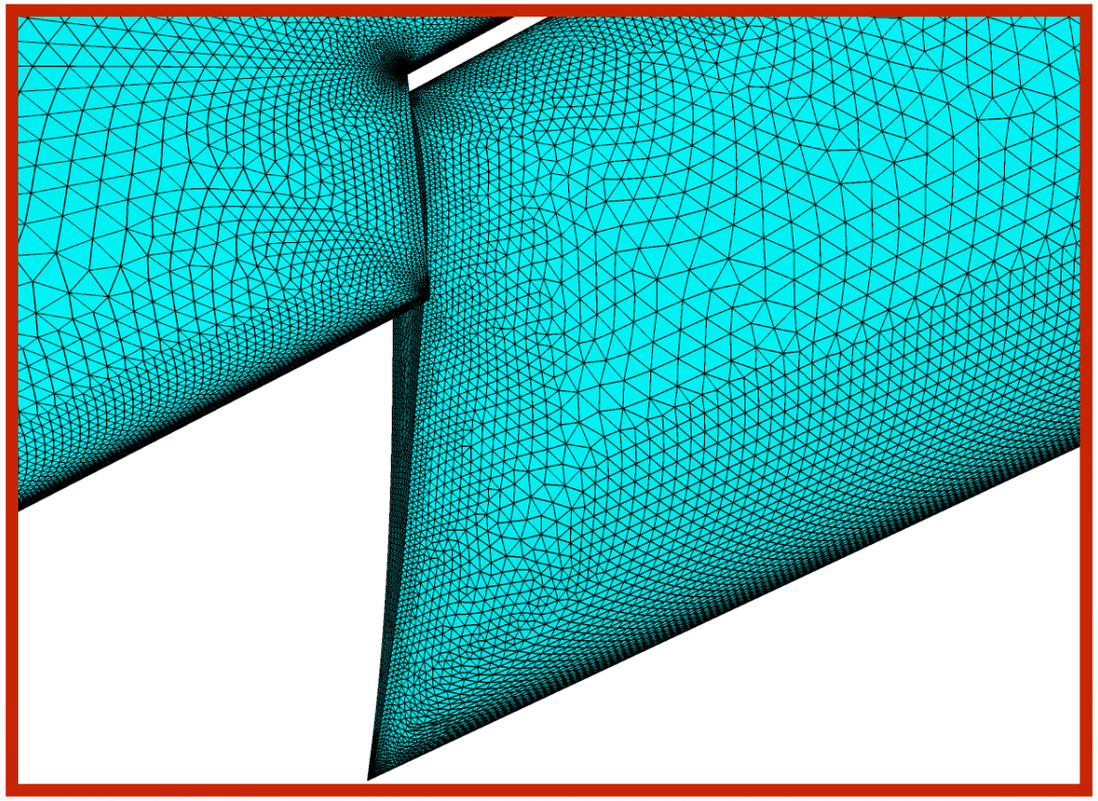


C2-JSM

E-JSM

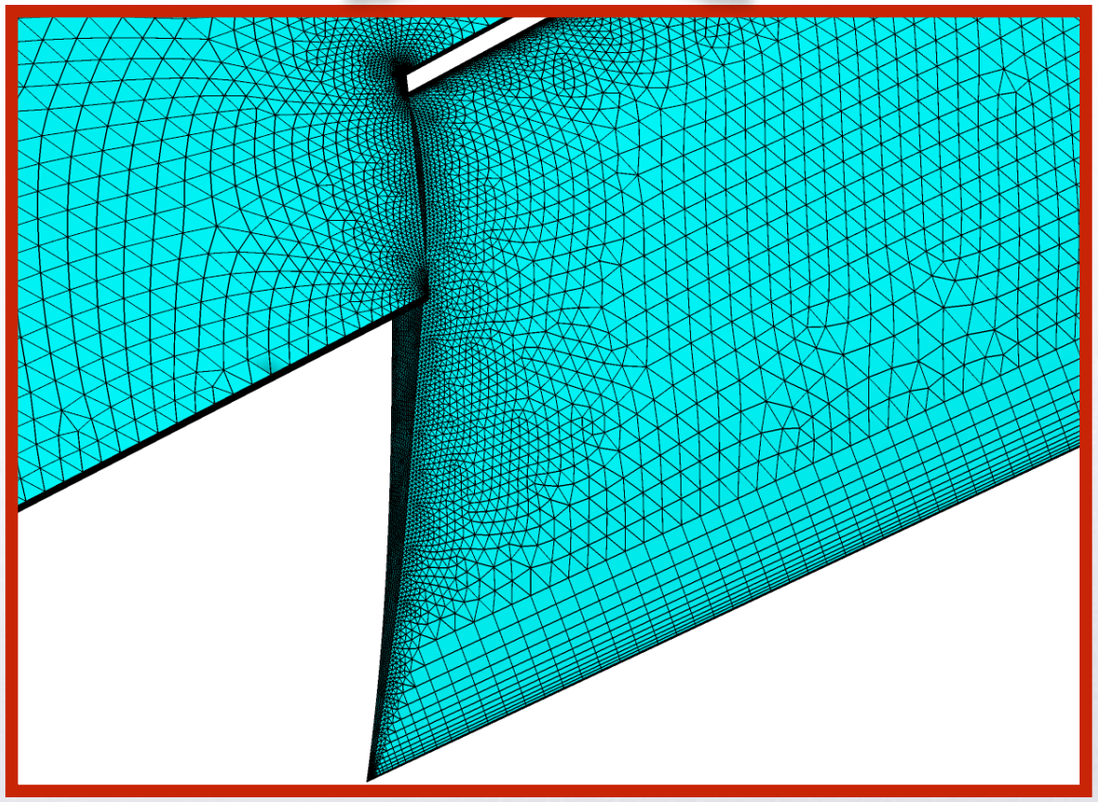


Grid Overview: Flap Tip

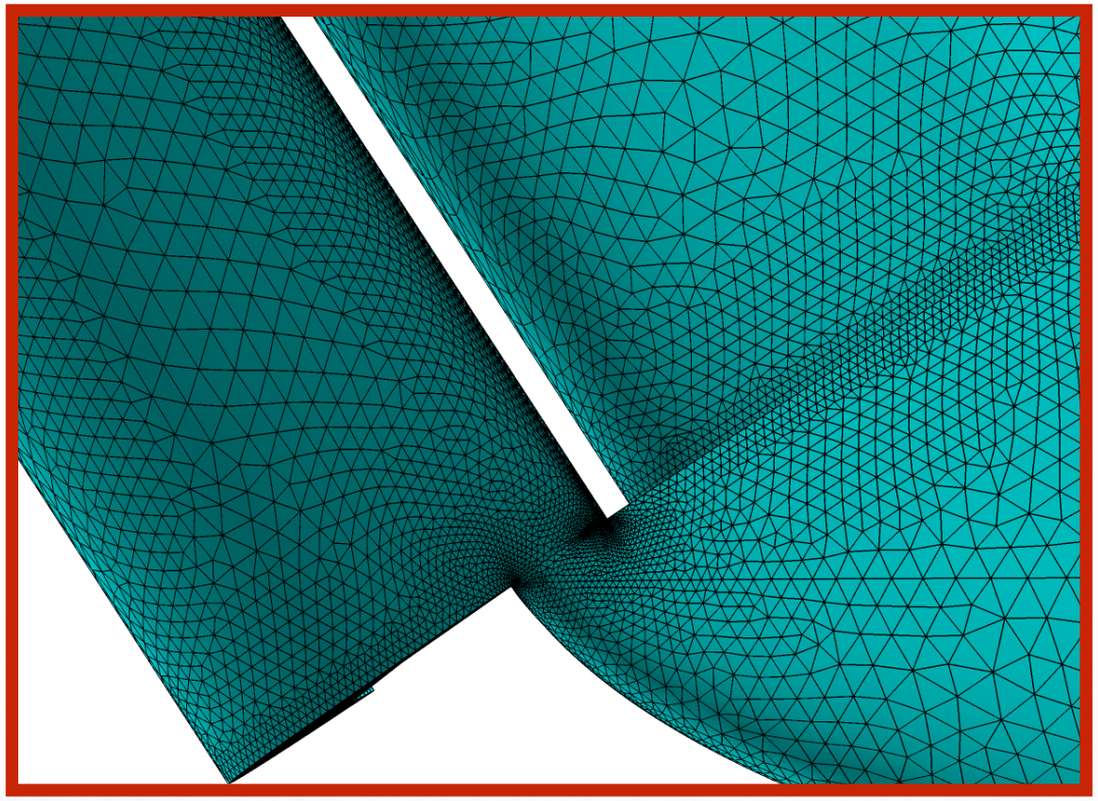


C2-JSM

E-JSM

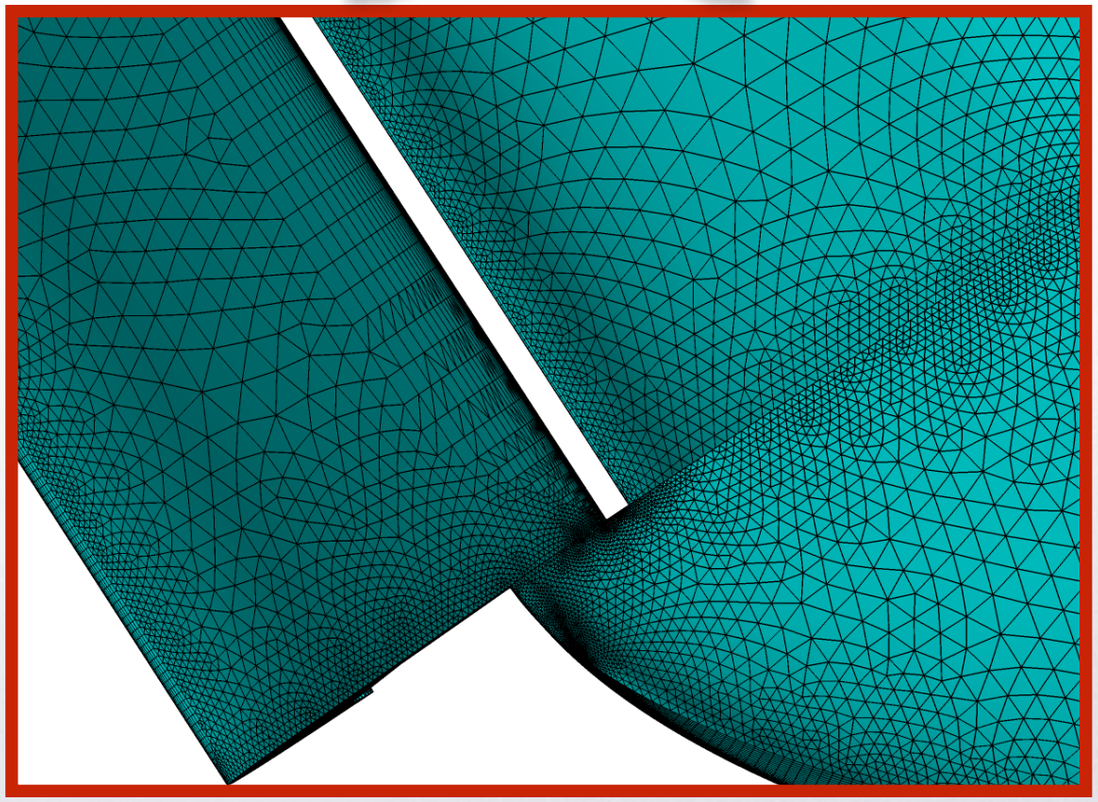


Grid Overview: Slat Tip



C2-JSM

E-JSM



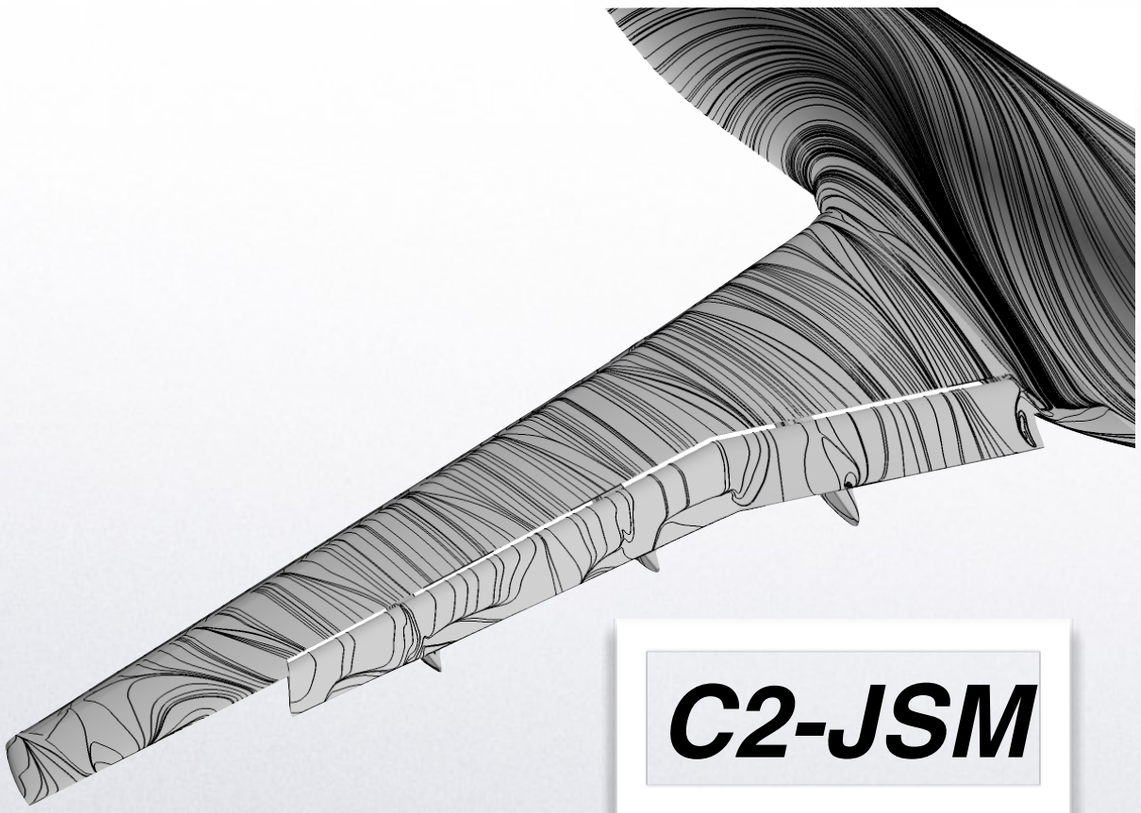
Case 2a: Grid Summary

	C2-JSM (Med) VGRID	E-JSM (Med-V1) ANSA
Surface mesh size (Millions)	0.927	1.7
Volume mesh size (Millions)	51.5	108.5
Trailing edge points	8	8
Growth rate		1.16
First cell height (mm)	0.00363	0.0015

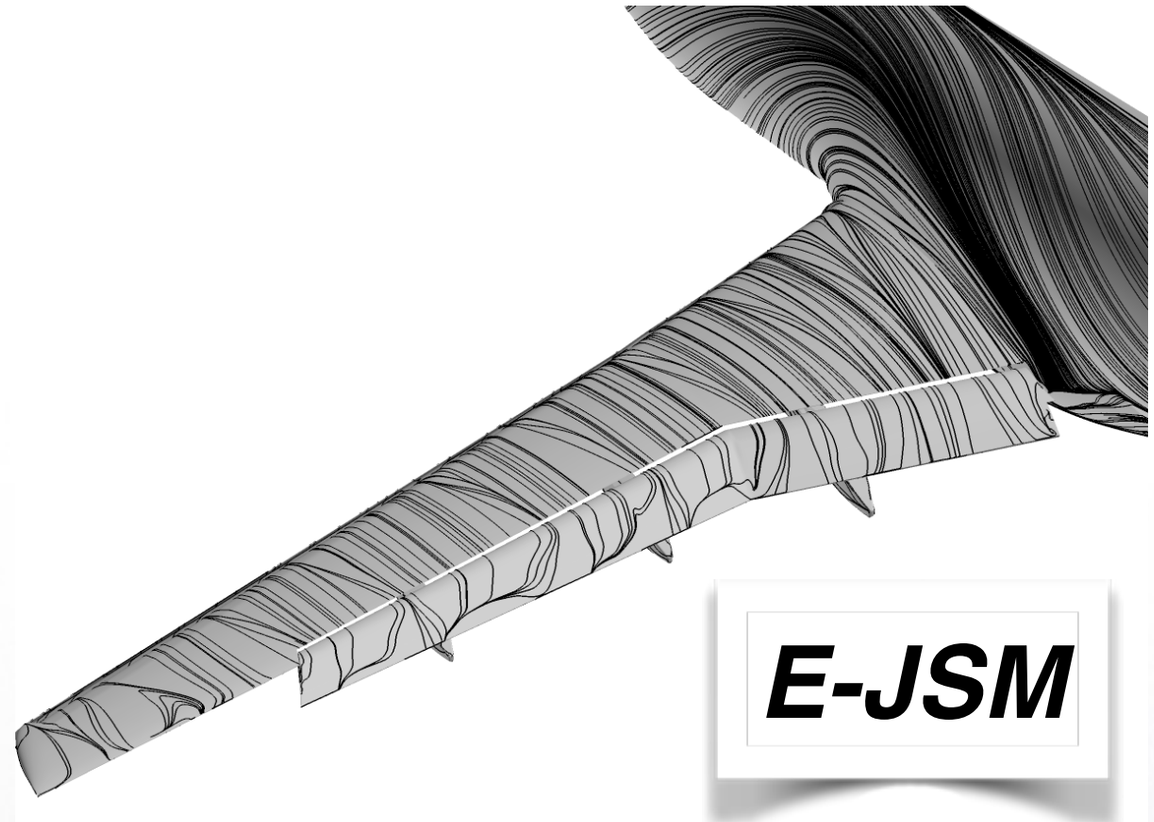
Case 2a: Convergence

		α = 10.47°			
		Res.	C_L		
Grid	Model	MF	Var.	Comp.	Exp.
C2-JSM	SST	1.5	0.13	2.14	2.2
	SSG/LRR-w	2	0.0076	2.04	
E-JSM	SST	3.02	0.00	2.24	
	SSG/LRR-w	2.2	0.00	2.177	

Surface Restricted Streamlines (SST)



C2-JSM



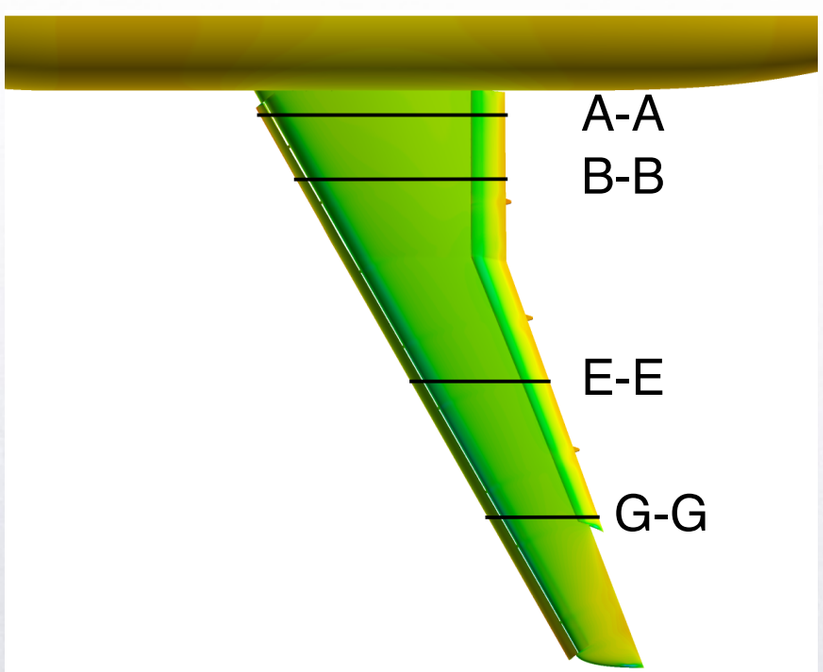
E-JSM

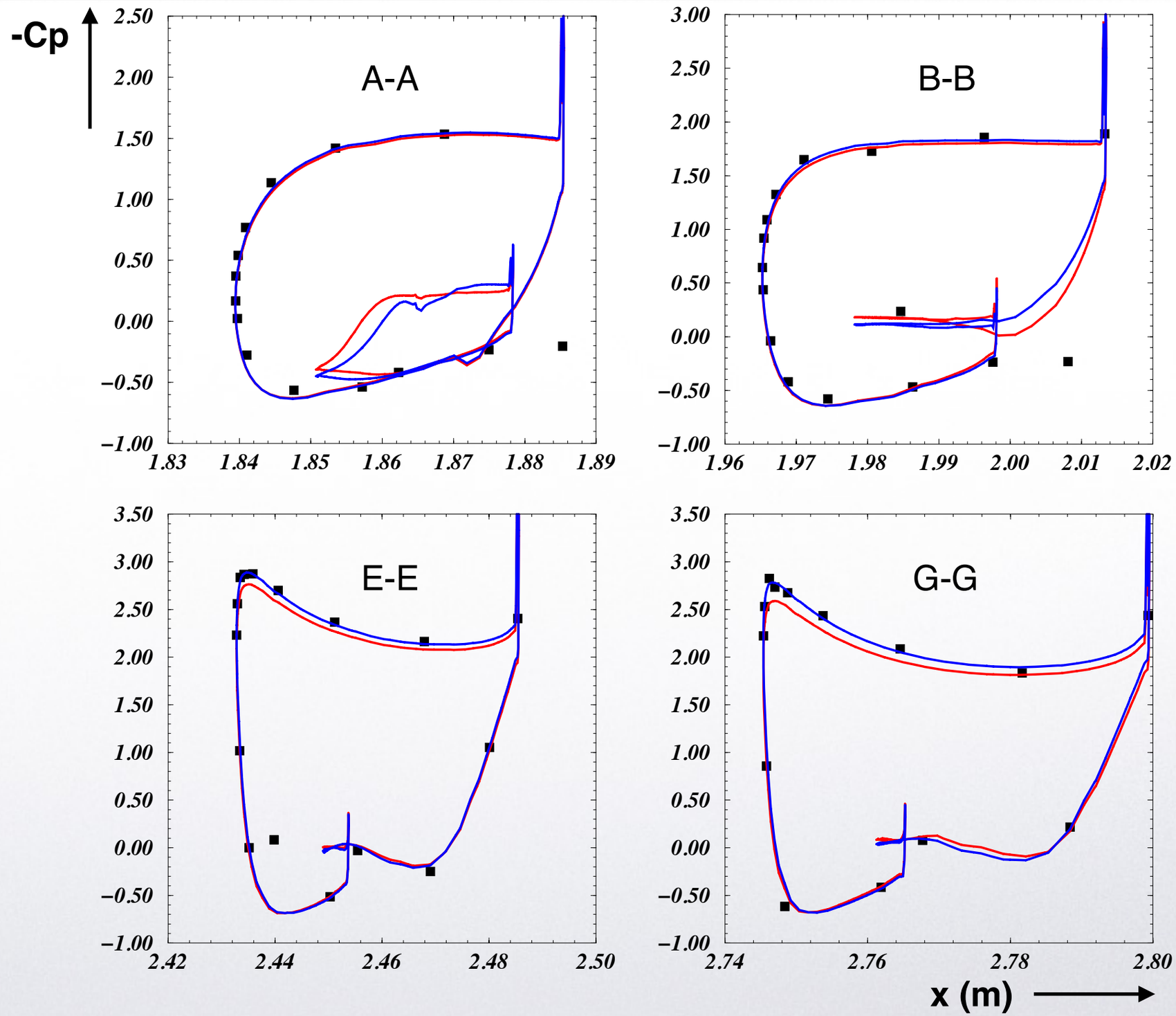
Slat Cp distribution: α = 10.47°

SSG/LRR-w: E-JSM

SST: E-JSM

Experiment



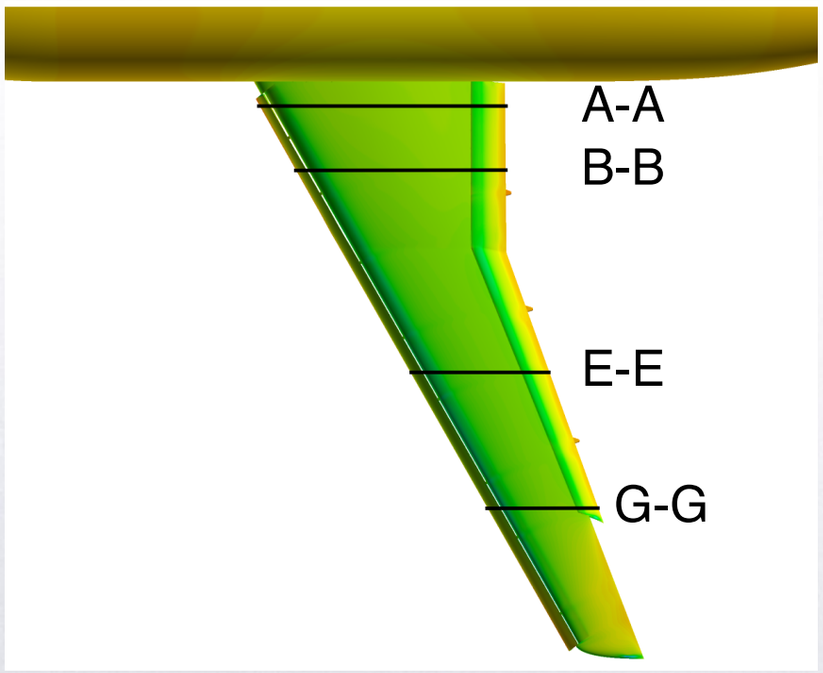


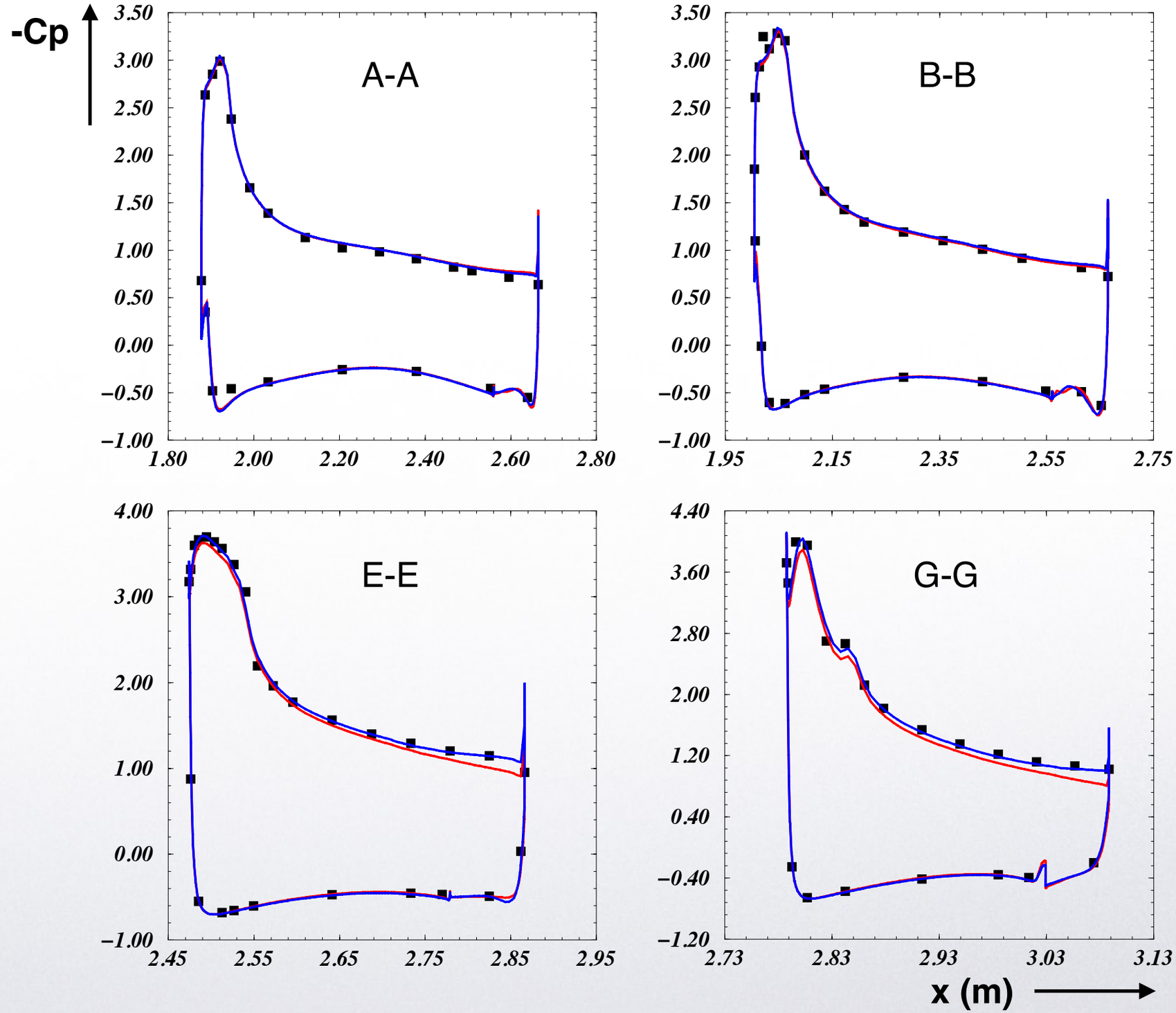
Wing Cp distribution: α = 10.47°

SSG/LRR-w: E-JSM

SST: E-JSM

Experiment



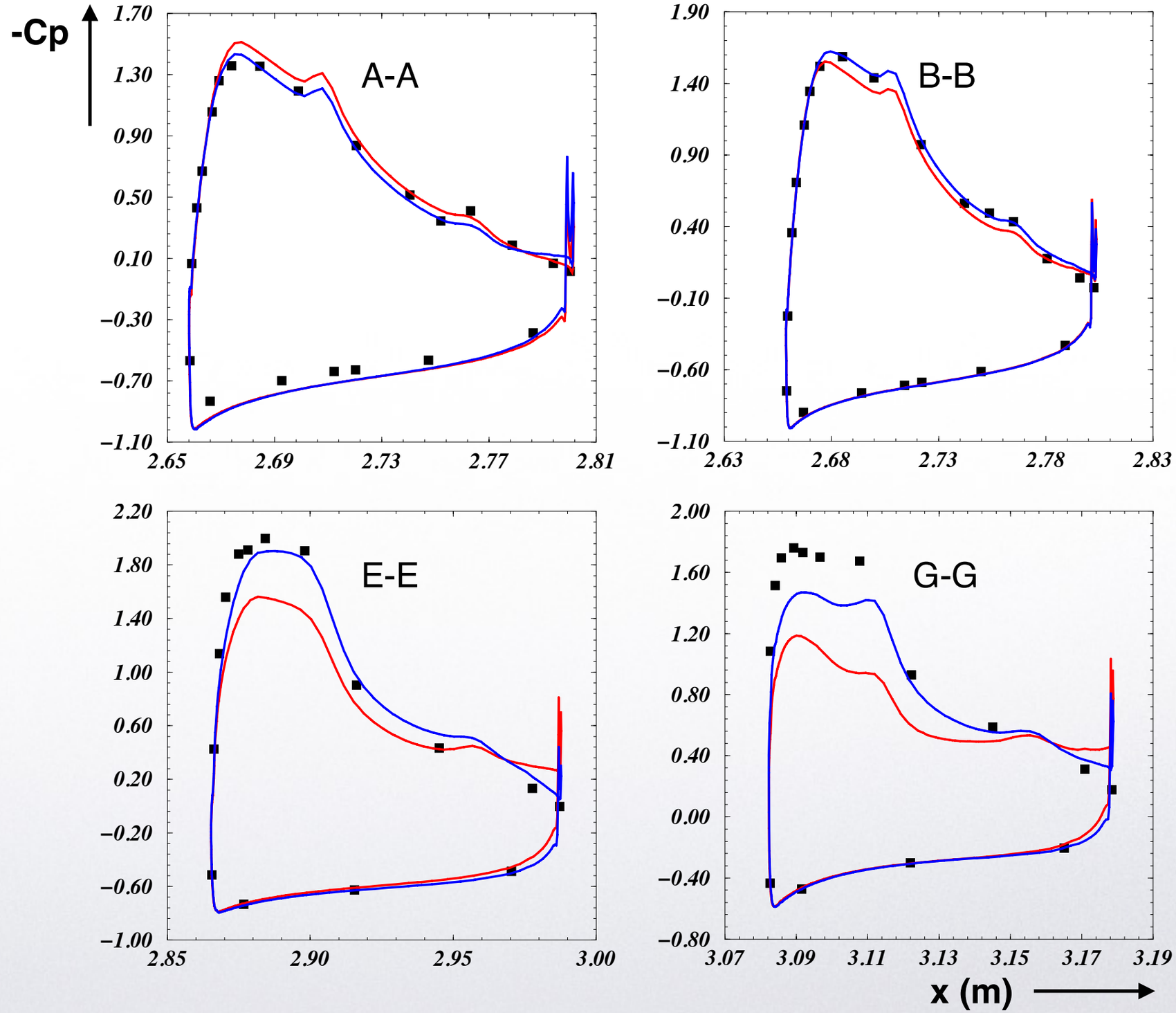


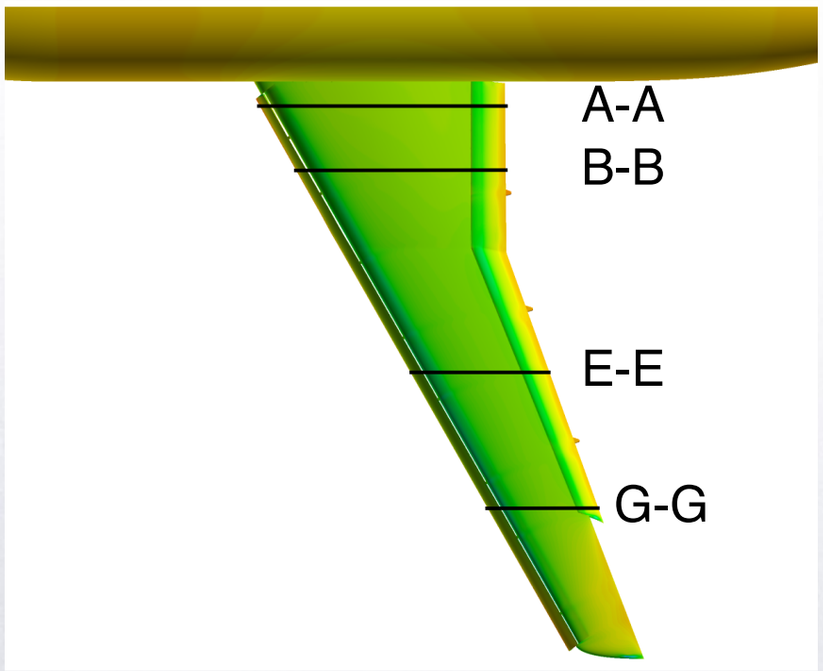
Flap Cp distribution: α = 10.47°

SSG/LRR-w: E-JSM

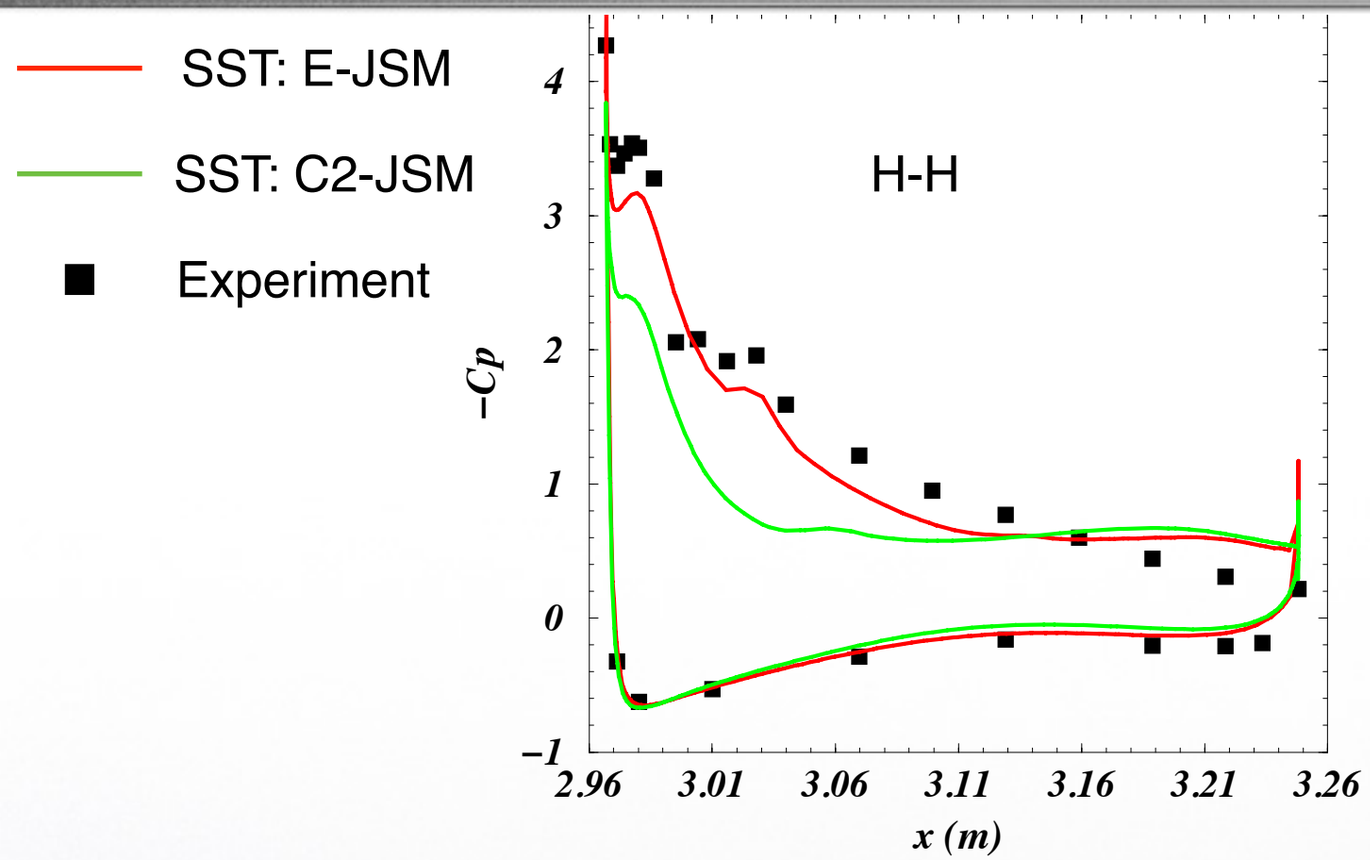
SST: E-JSM

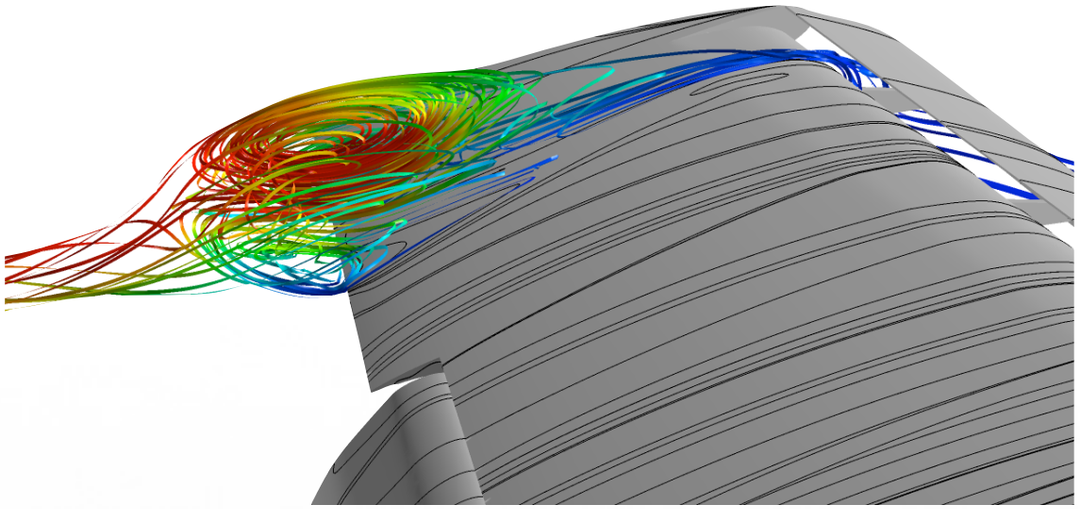
Experiment



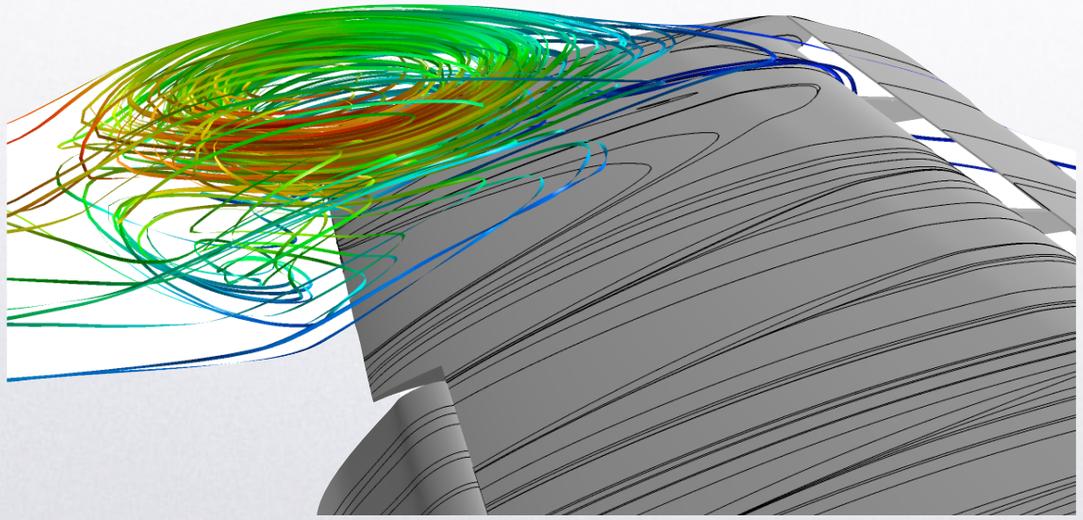


Streamlines Near Wing Tip at α = 10.47° (SST)





E-JSM

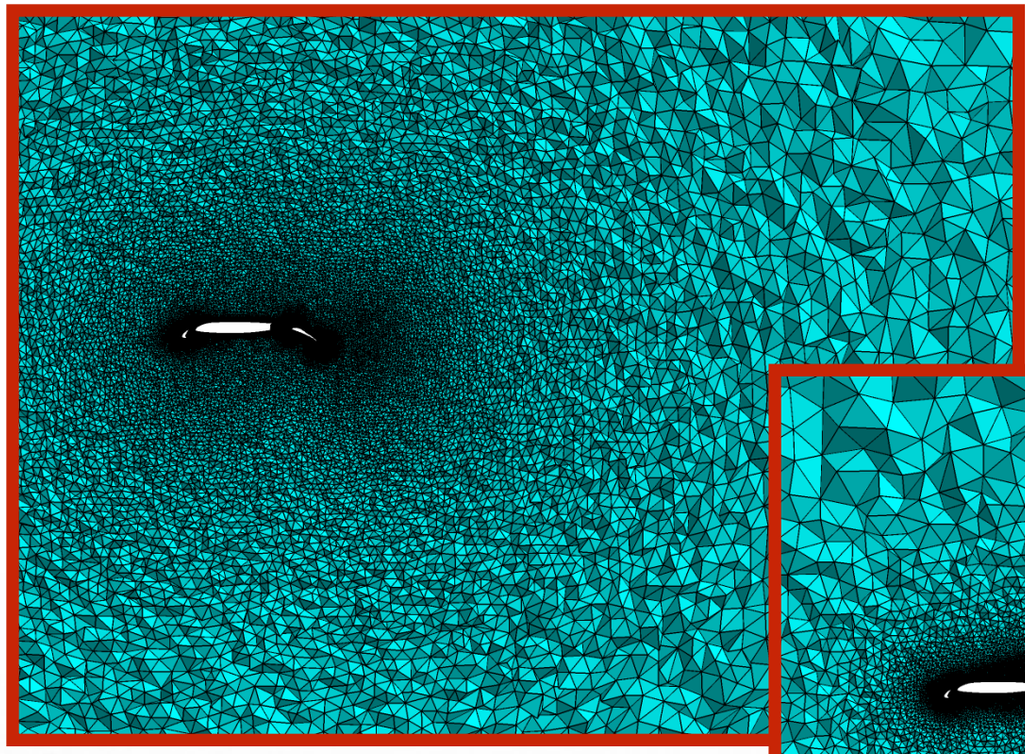


C2-JSM

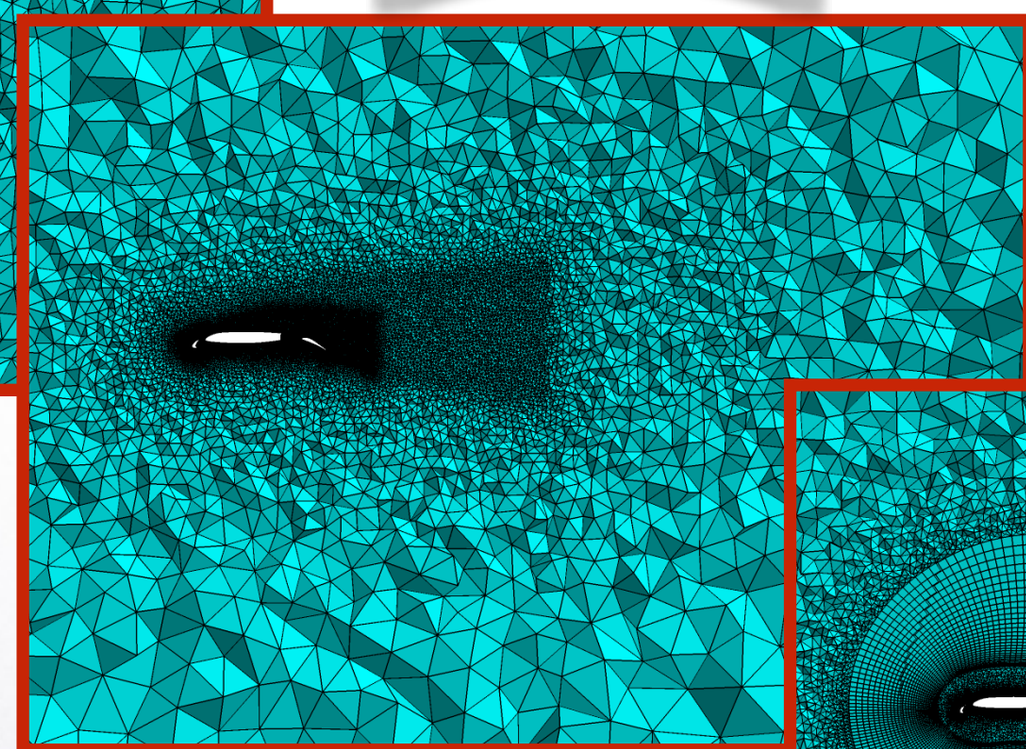
Grid Refinement Study

Preliminary Results

Grid Overview

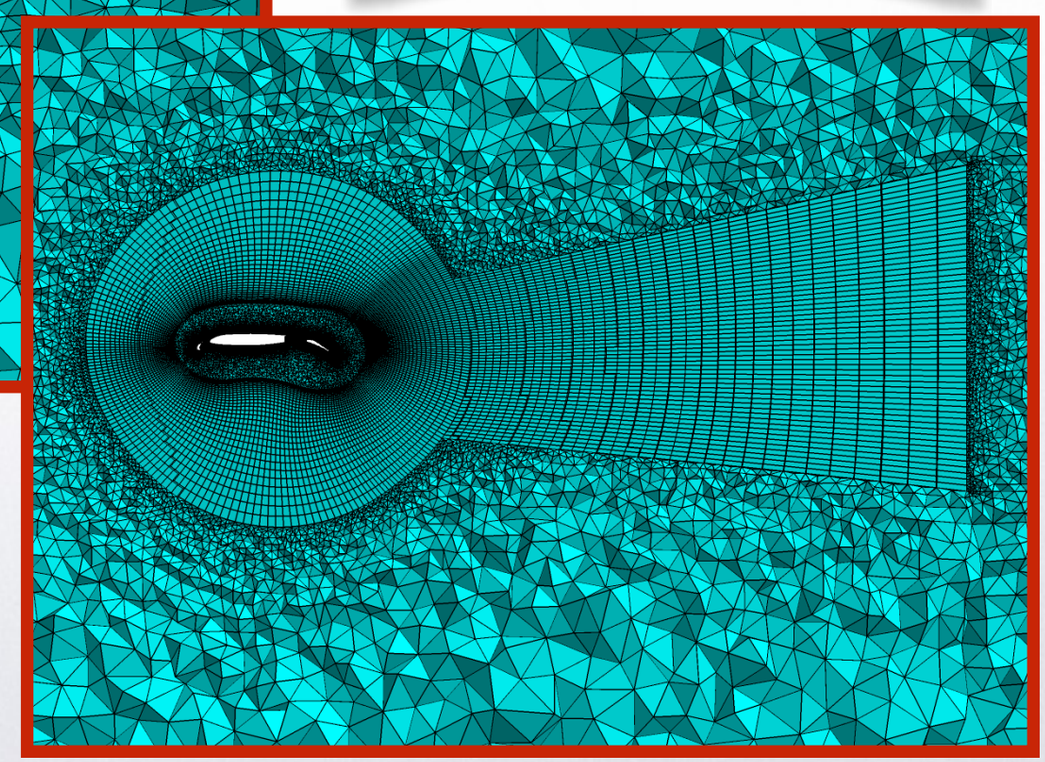


E-JSM (ANSA)

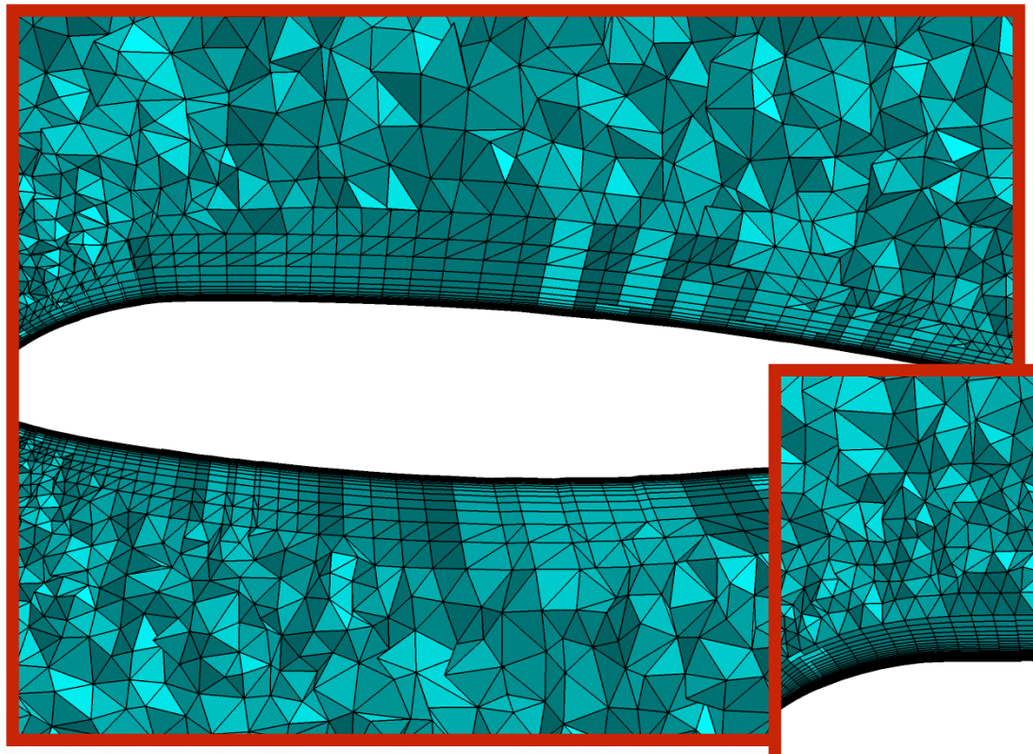


ISCFDC (Pointwise)

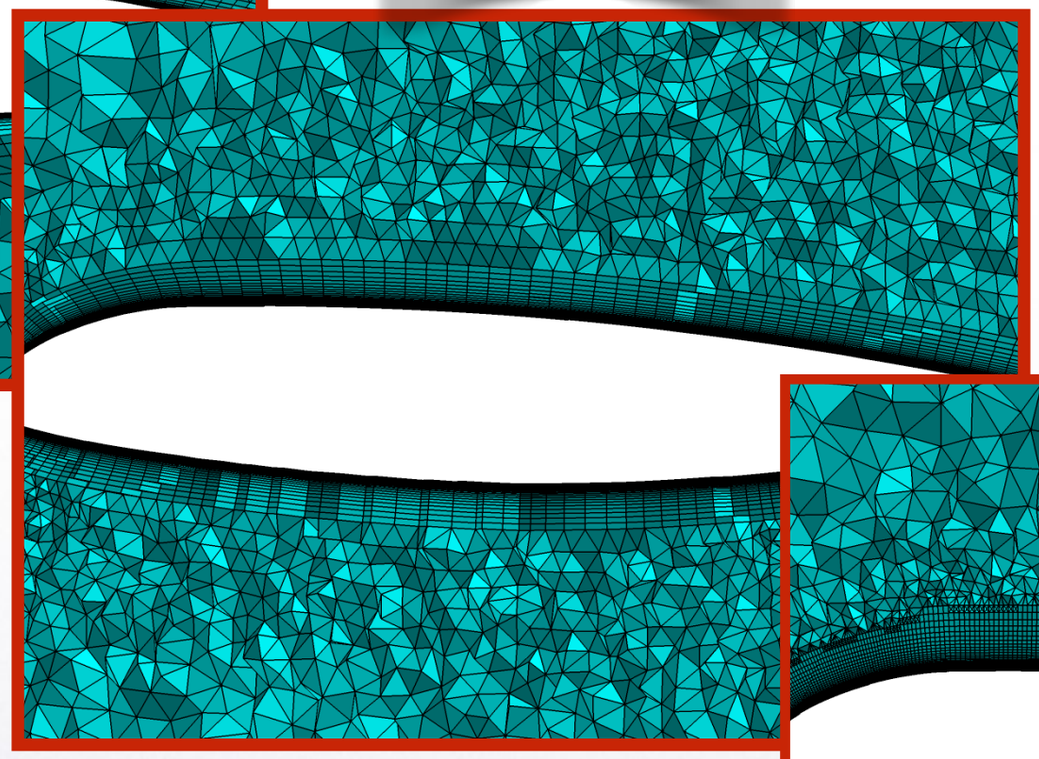
C2-JSM (VGRID)



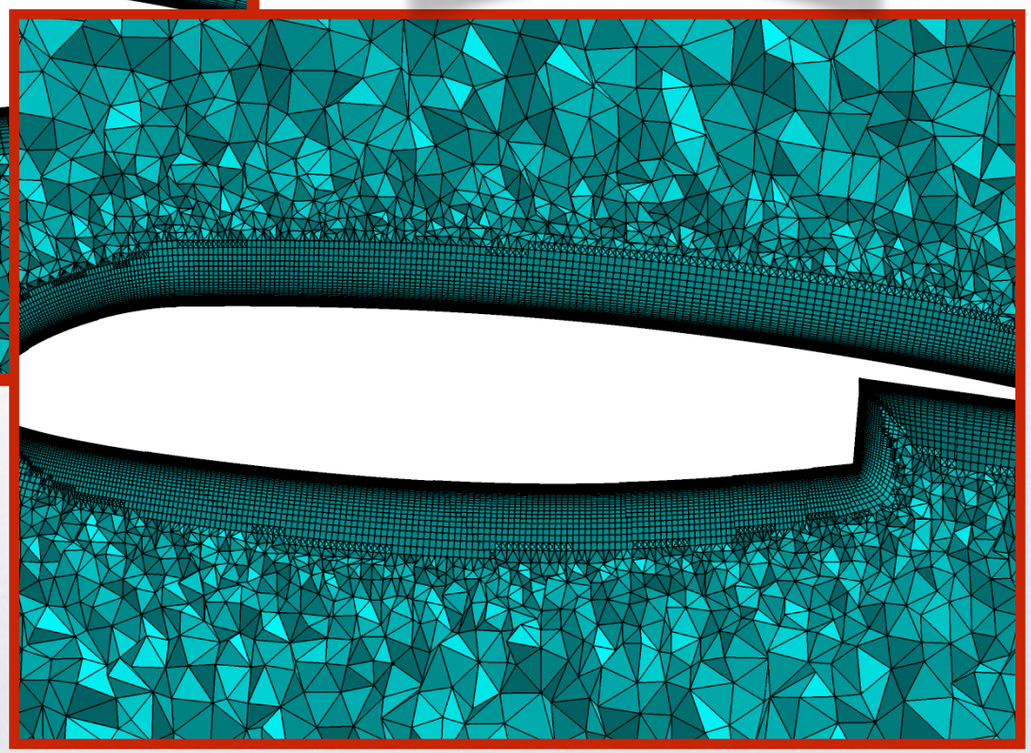
Grid Overview: Wing Section



C2-JSM

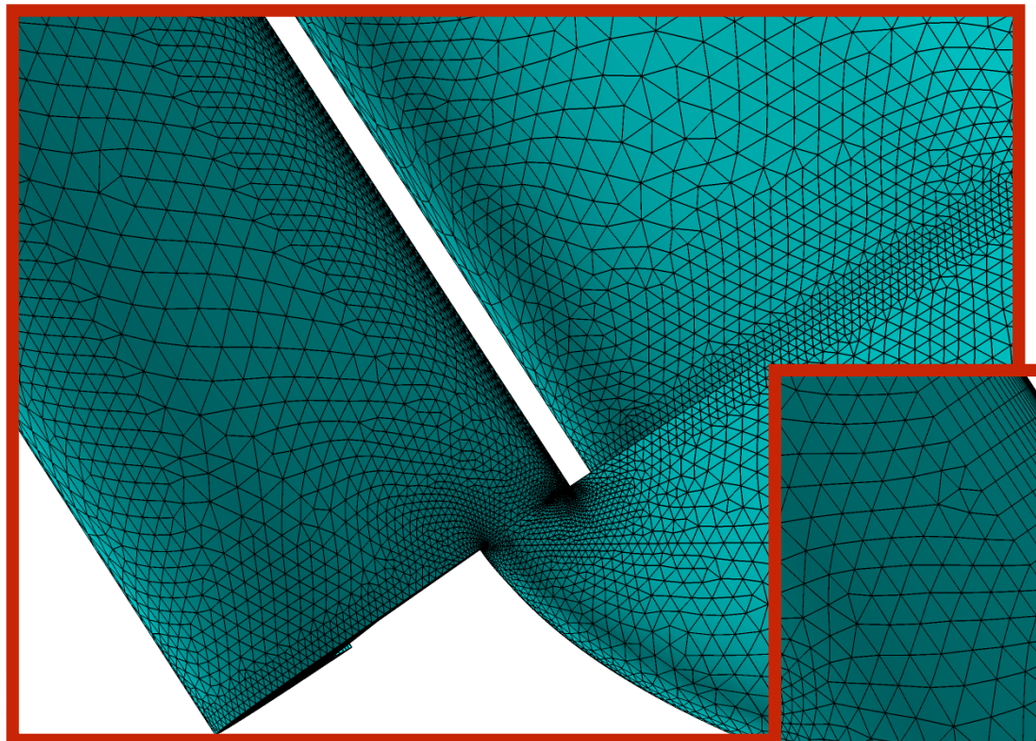


E-JSM

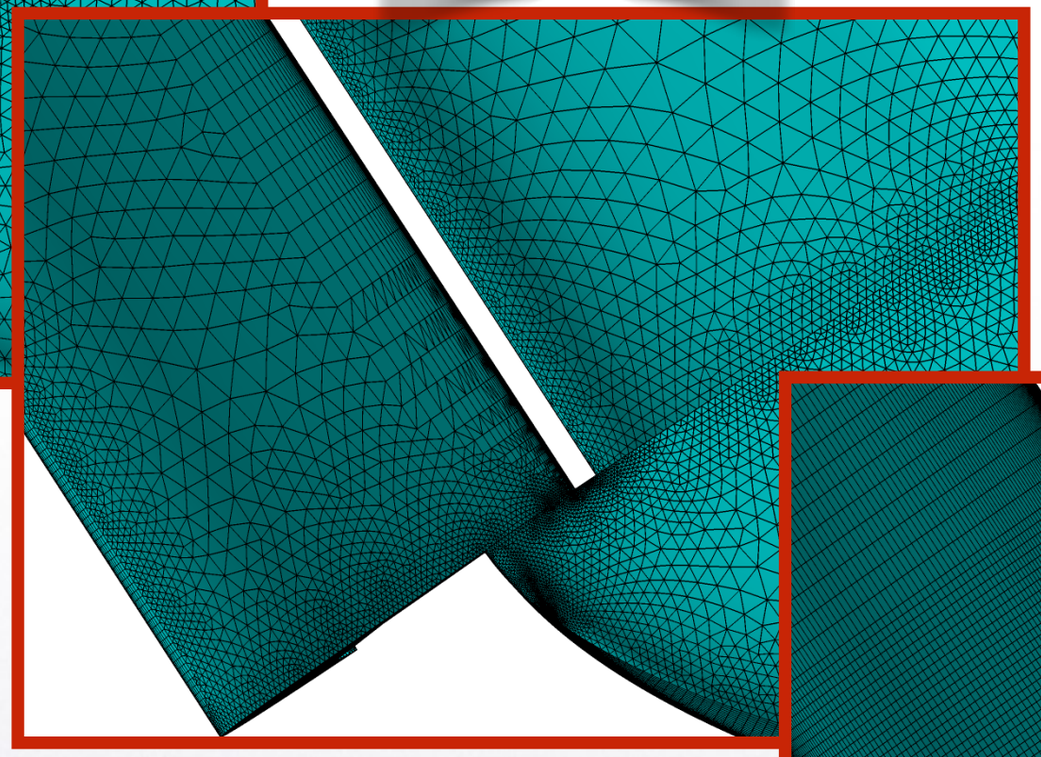


ISCFDC

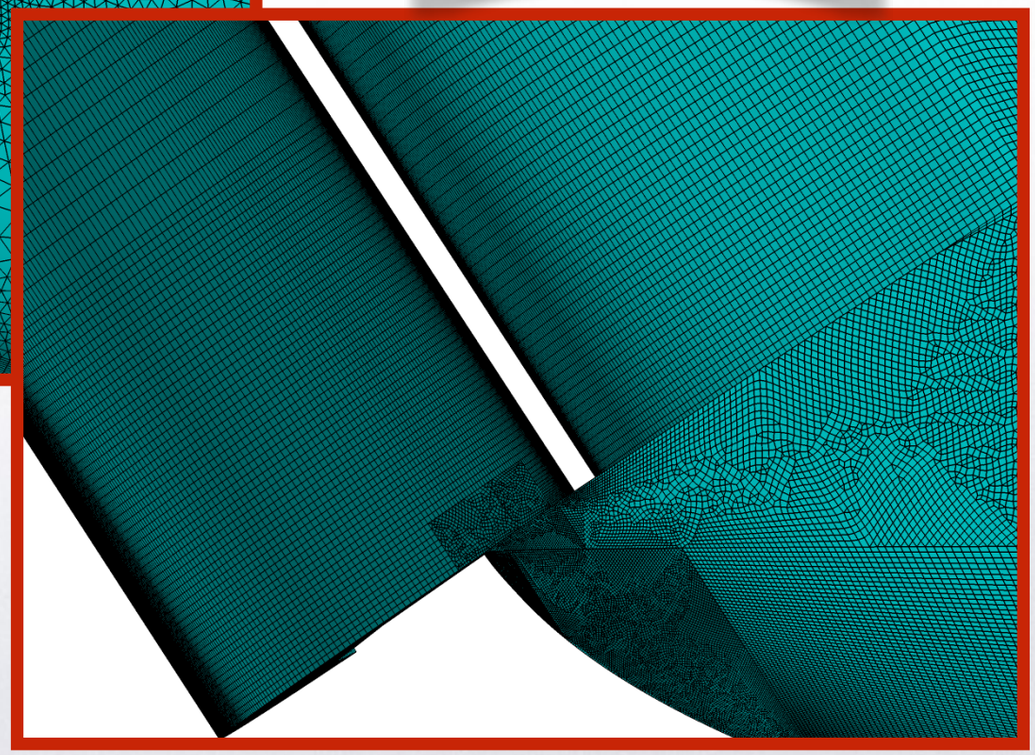
Grid Overview: Slat Tip



E-JSM



ISCFDC

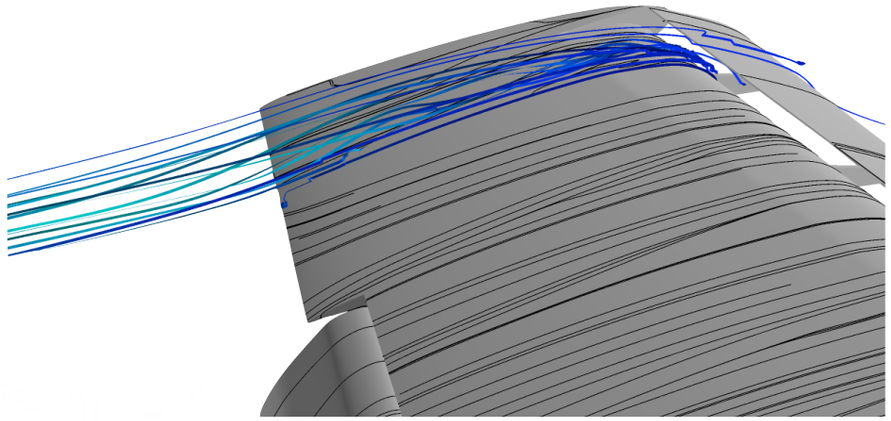


C2-JSM

Case 2a Grid Summary

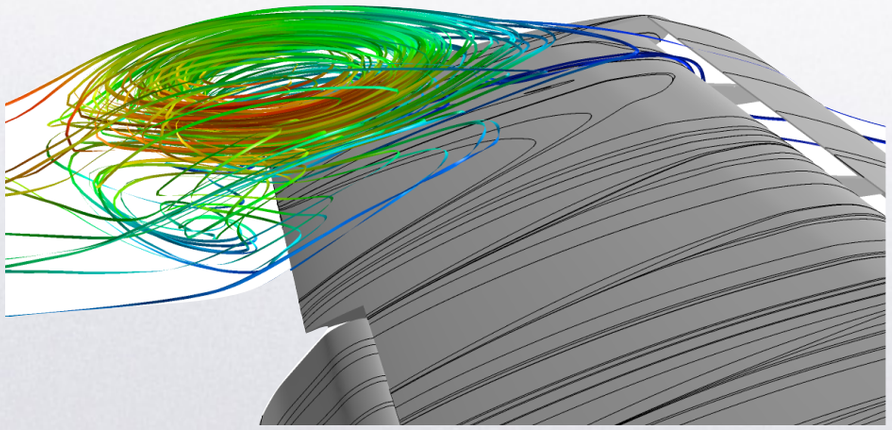
	C2-JSM (Med) VGRID	E-JSM (Med-V1) ANSA	ISCFDC (Med) Pointwise
Surface mesh size (Millions)	0.927	1.7	1.885
Volume mesh size (Millions)	51.5	108.5	146.5
Trailing edge points	8	8	slat: 21 main & flap: 31
Growth rate		1.16	3 first layers = 1.0 14 layer = 1.125 T-Rex =1.14
First cell height (mm)	0.00363	0.0015	0.0025

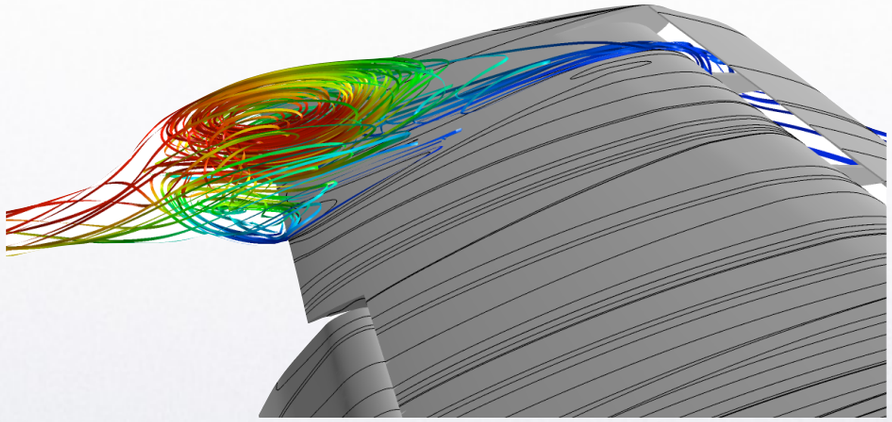
Streamlines Near Wing Tip at α = 10.47° (SST)



ISCFDC

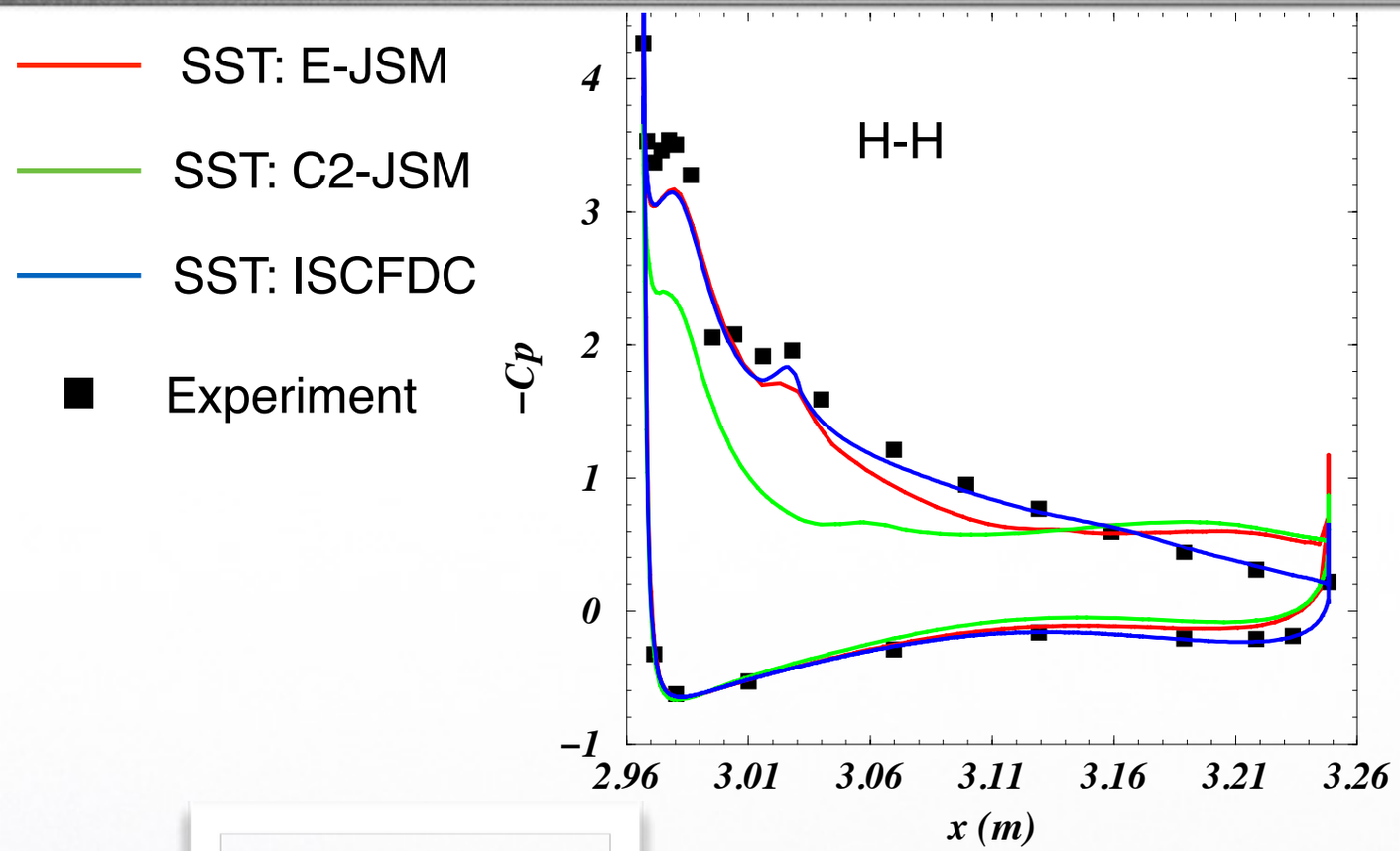
C2-JSM

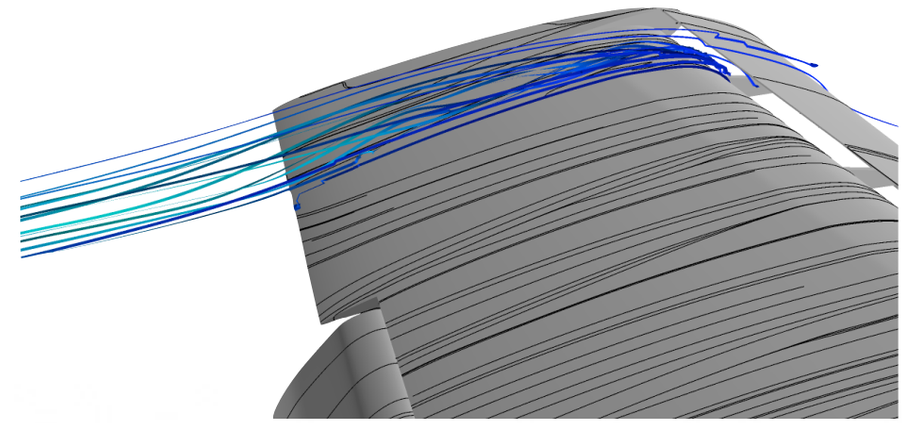




E-JSM

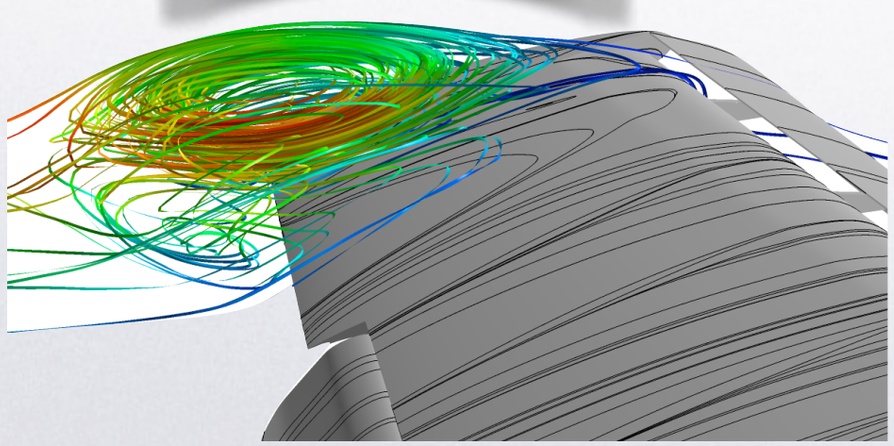
Streamlines Near Wing Tip at α = 10.47° (SST)

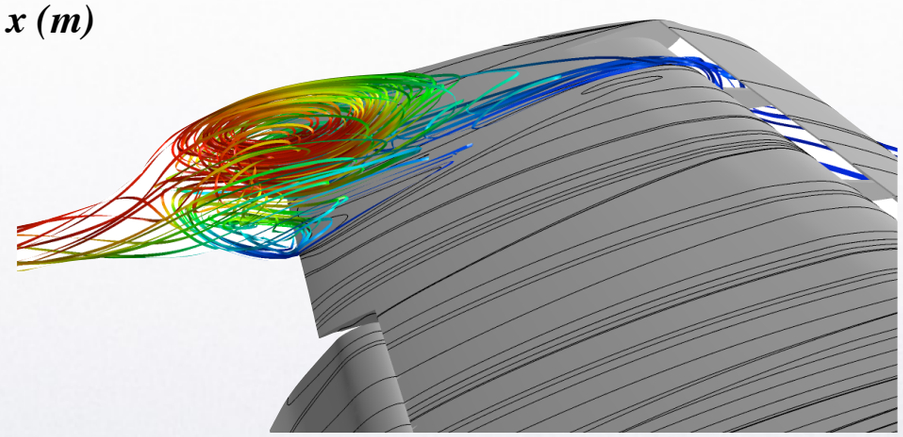




ISCFDC

C2-JSM





E-JSM

Conclusions

- Separation is highly sensitive to grid resolution
- Overall SST model performance is better than the SSG/LRR-w model (!?)
- Steady flow simulation appropriate?

THANK
YOU