



HLPW6: RANS TFG

Fidelity Pointwise Grid Generation Efforts

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Carolyn Woeber (Application Engineering Director), **Nick Wyman** (Software Engineering Group Director)

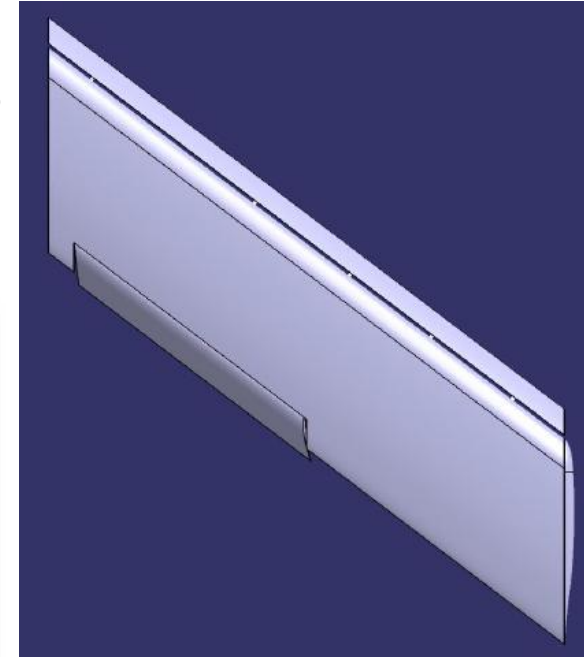
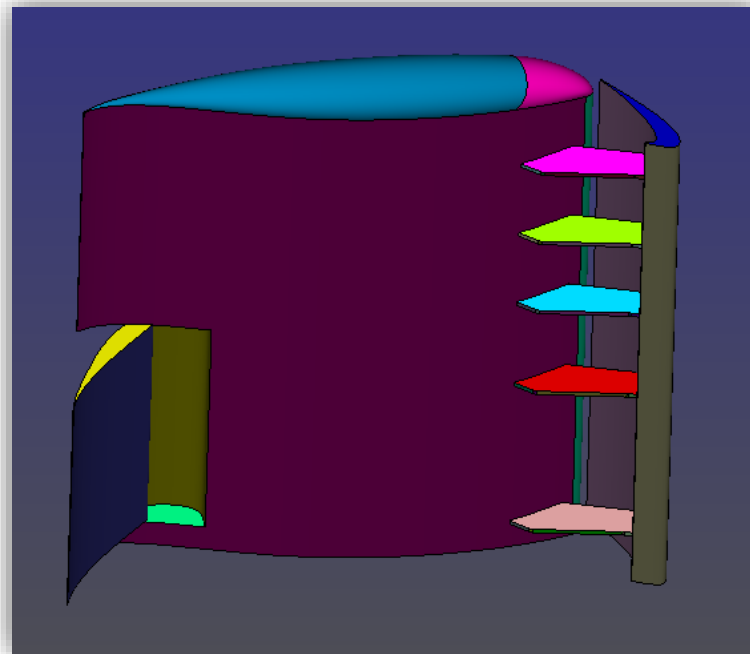
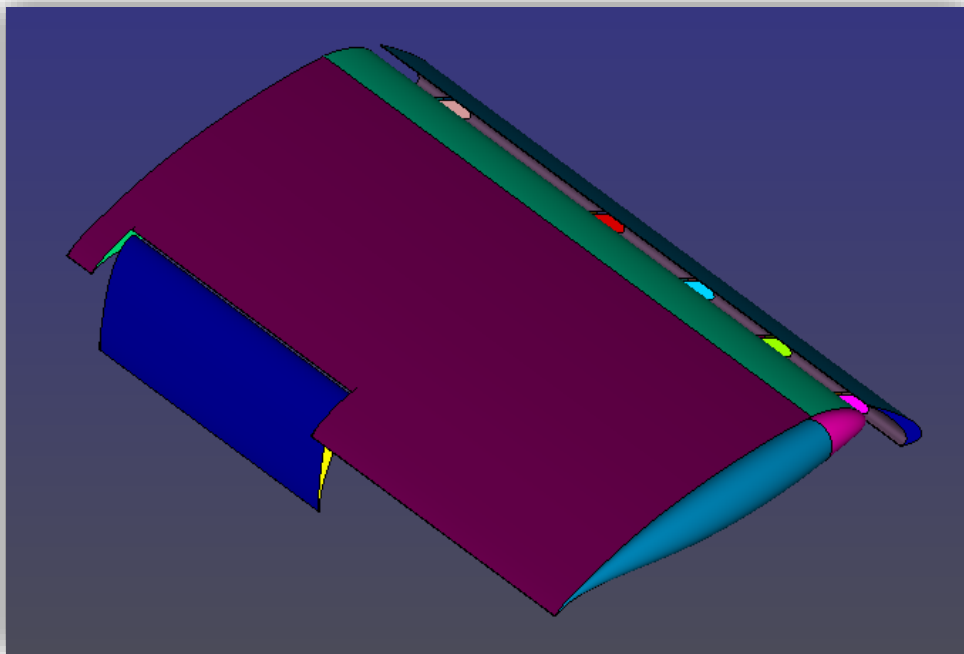
February 11, 2026

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HLPW6

Test Case 1: CRM-HLS

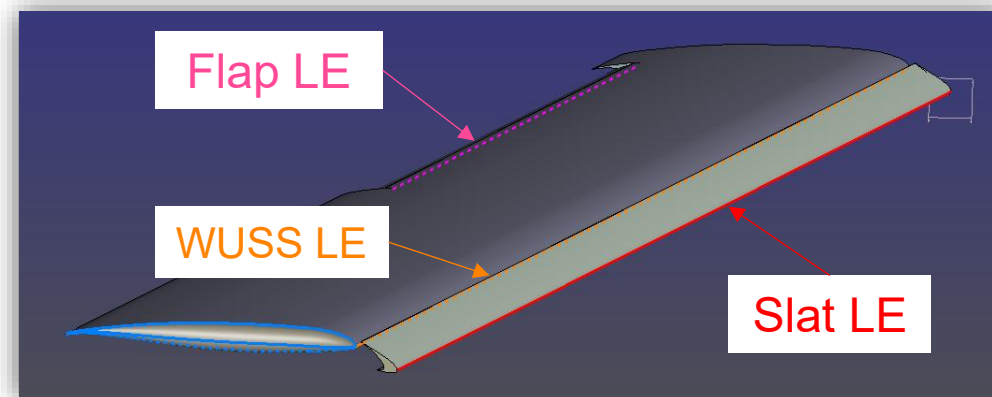
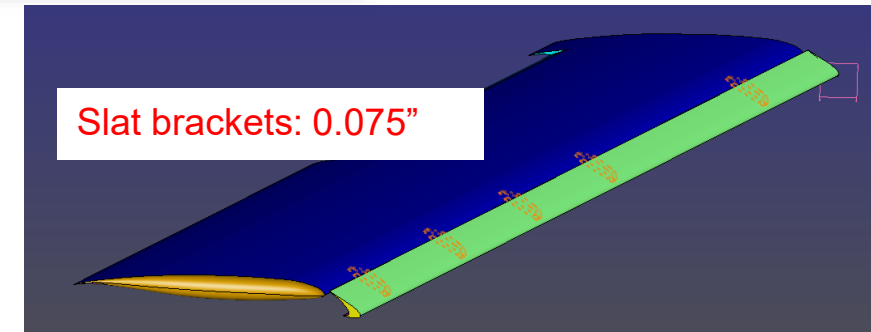
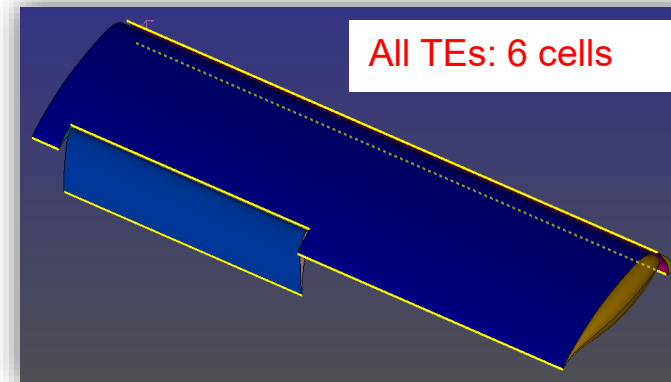
- Simplified High-Lift Configuration with a full span slat and a partial span flap
- Free air at 3.55 million Re_{MAC}



CRM-HLS

Surface Meshing *Recipe*

- Defining Surface Mesh Recipe based on “Best Practices”
- **Automatic Surface Mesh (ASM) – Baseline (Lvl-B):**
 - **Global:**
 - Max. Edge Length = 0.5 inches (1.66% C_{REF})
 - Curvature Resolution = 15 deg
 - Max. Aspect Ratio = 40
 - Growth Rate = 1.2 (unless locally adjusted)
 - Quad Dominant Algorithm
 - **Surfaces:**
 - Mapping: 6 subdivisions or cells (equal distribution) applied to all TE surfaces
 - Resolution: Applied target edge lengths of 0.075 (0.25% C_{REF}) to slat brackets
 - **Boundaries:**
 - Slat LE: 5 deg, GR = 1.1, 10 constant layers
 - WUSS LE: 5 deg, GR = 1.1, 30 constant layers
 - Flap LE: 5 deg, GR = 1.1, 10 constant layers
 - Wing Tip: 5 deg

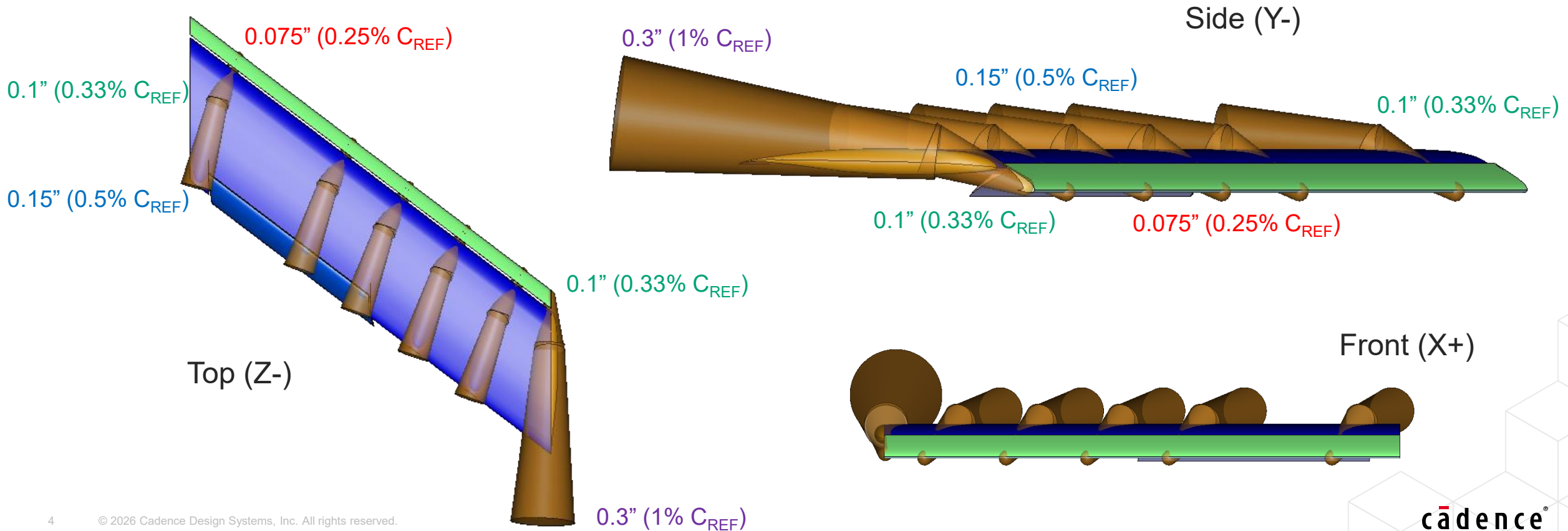


CRM-HLS

Targeted Surface and Volume Mesh Refinement

- Source shapes are created along the wake of each slat bracket
- Wake angles are re-adjusted based on the preliminary RANS solutions

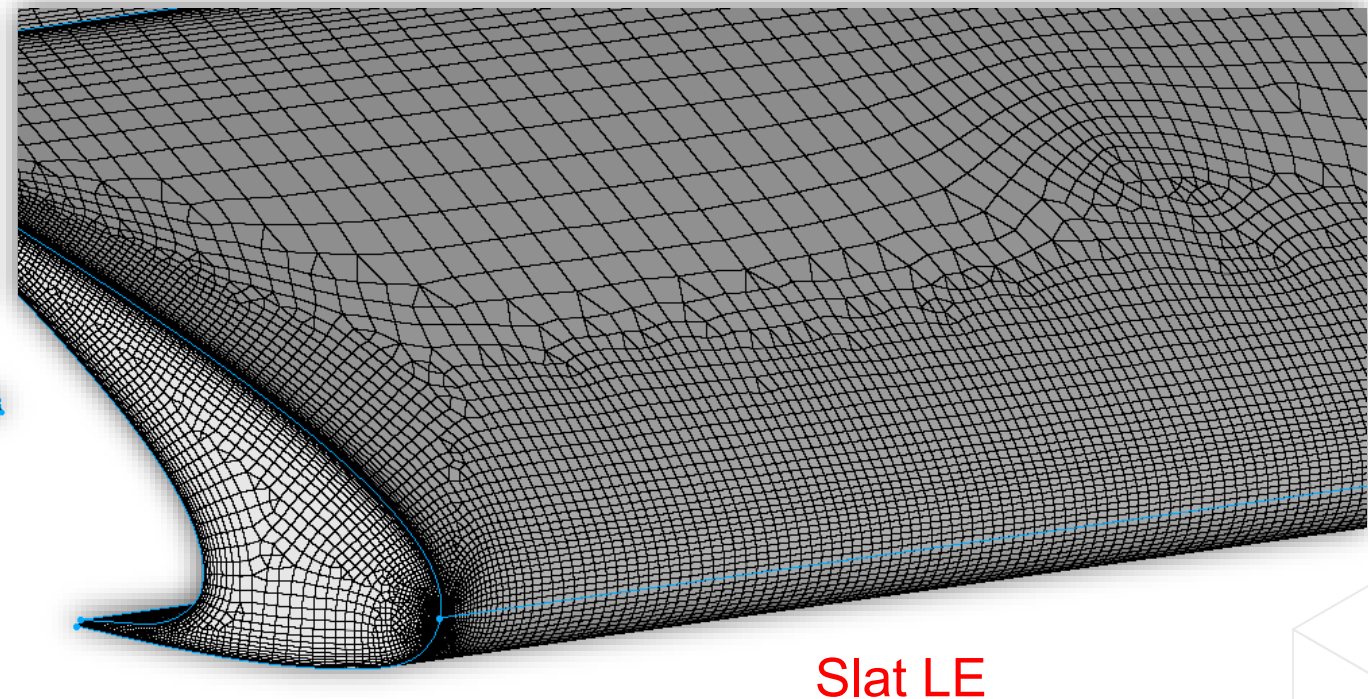
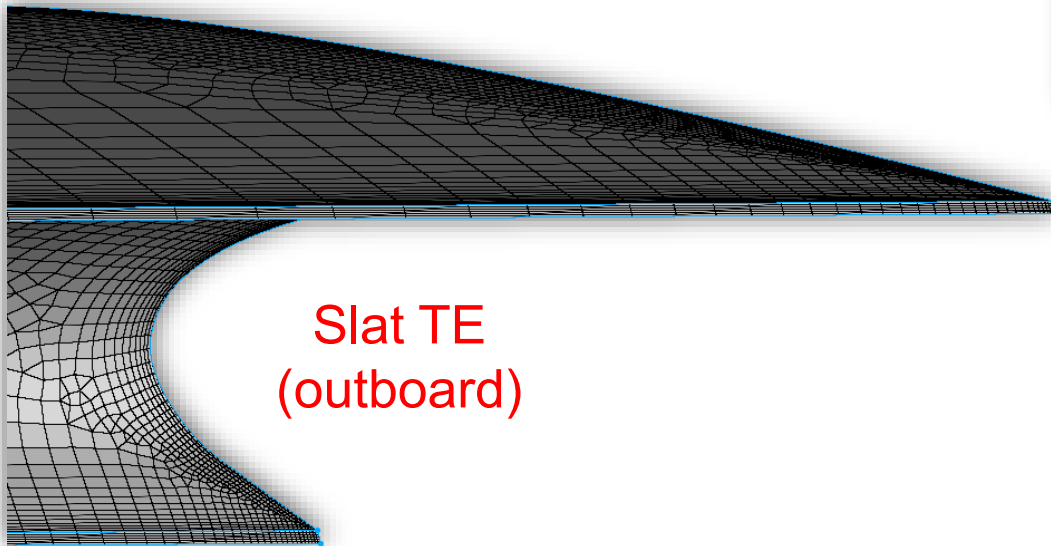
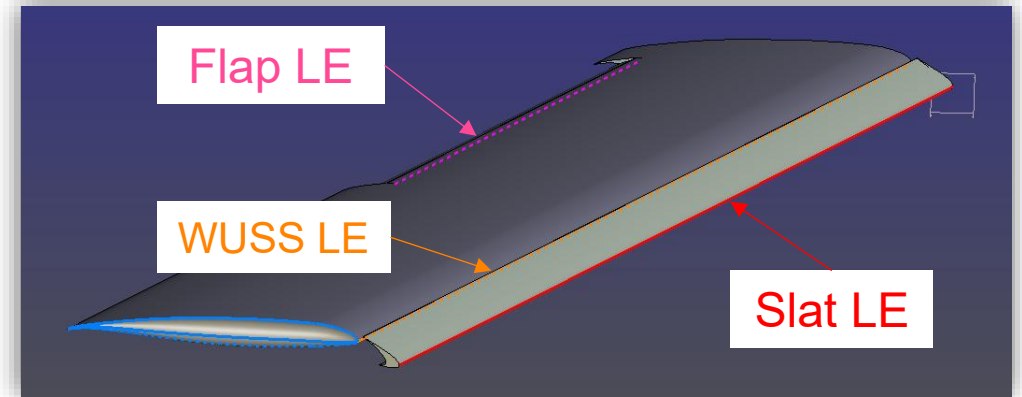
Baseline (Lvl-B)



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Surface Meshing

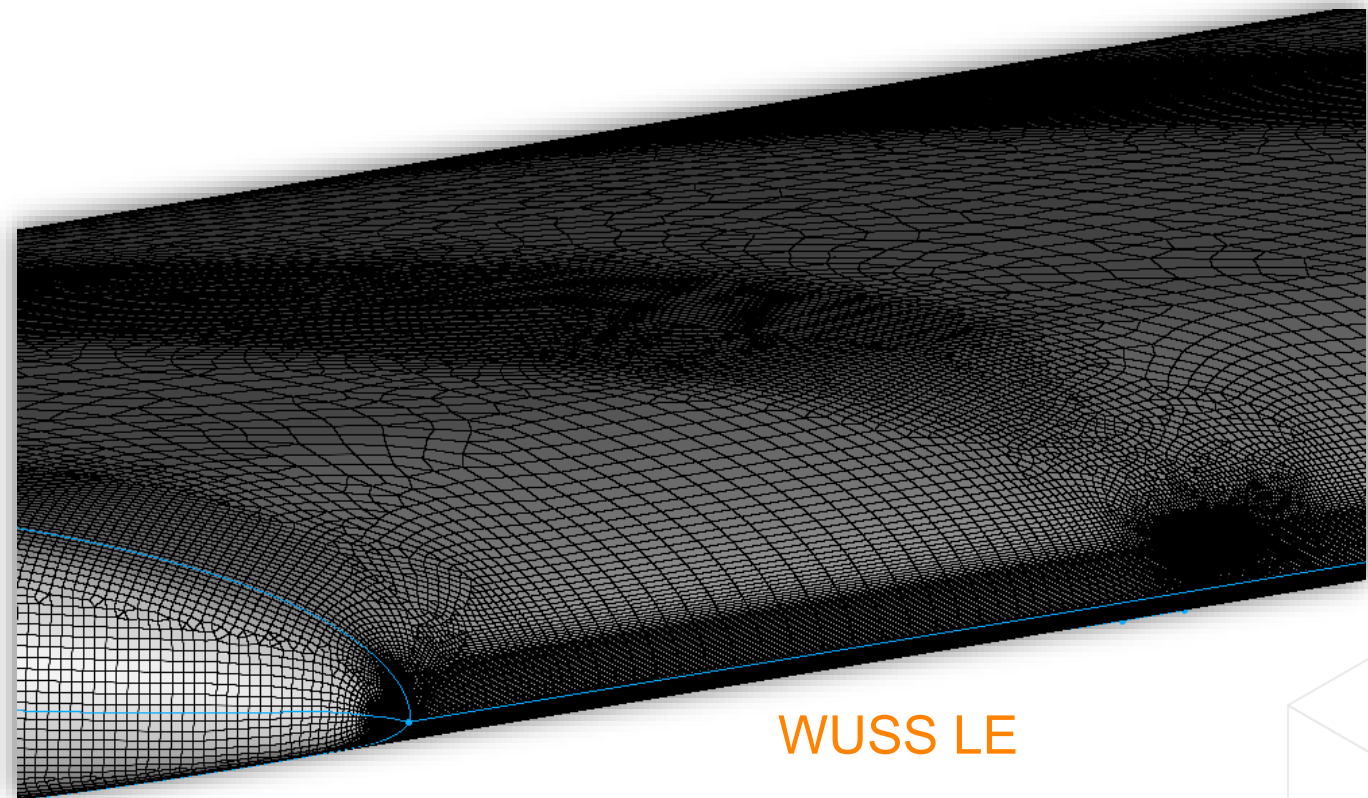
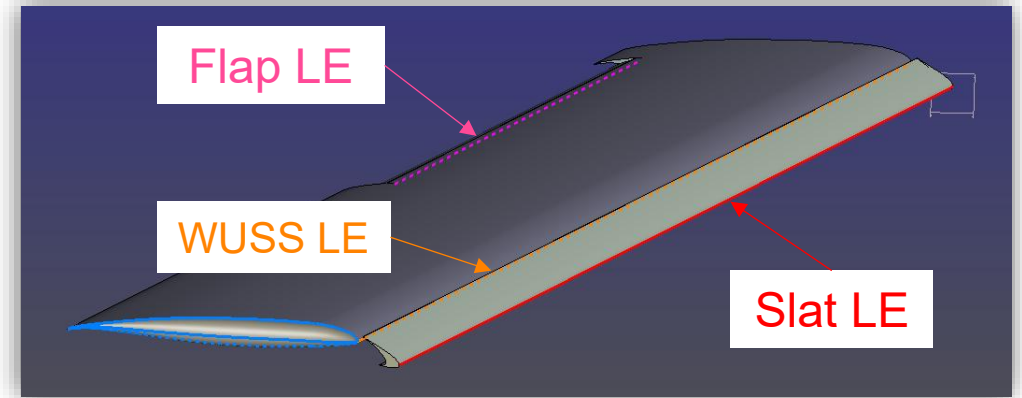
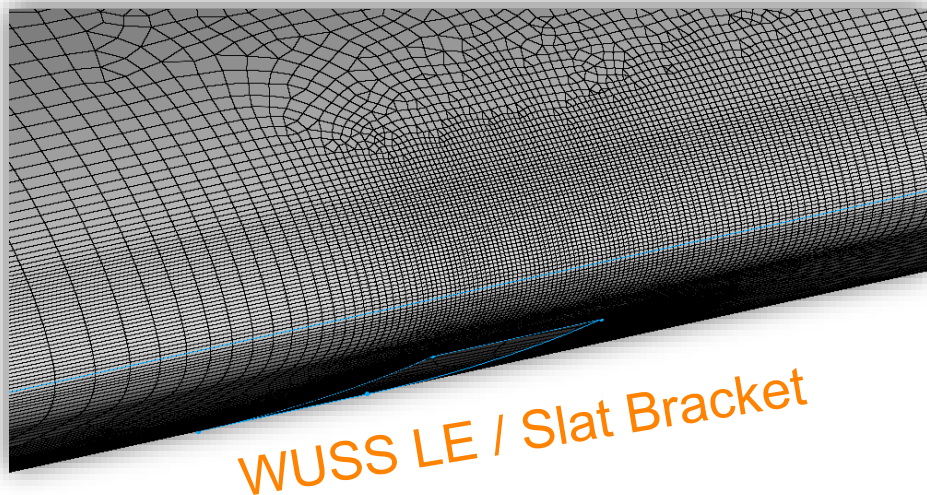
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 - Wing Tip: 5 deg



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Surface Meshing

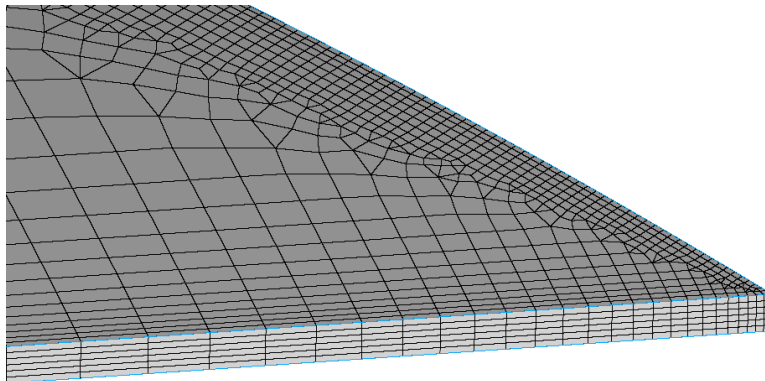
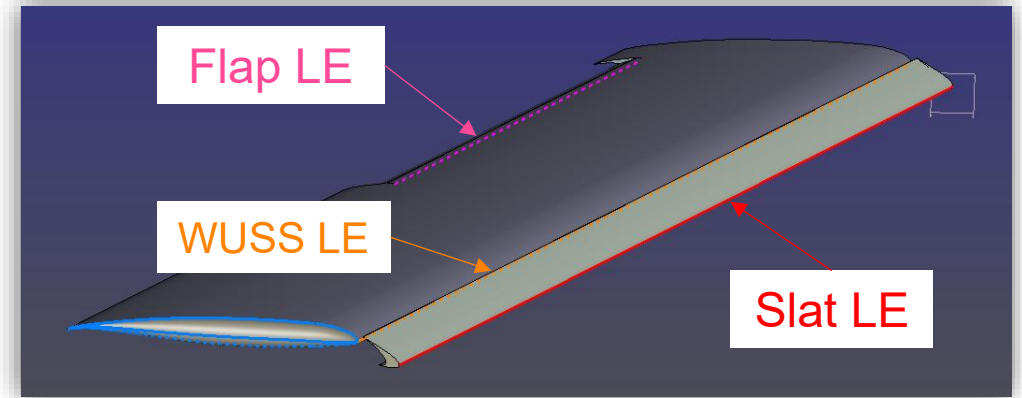
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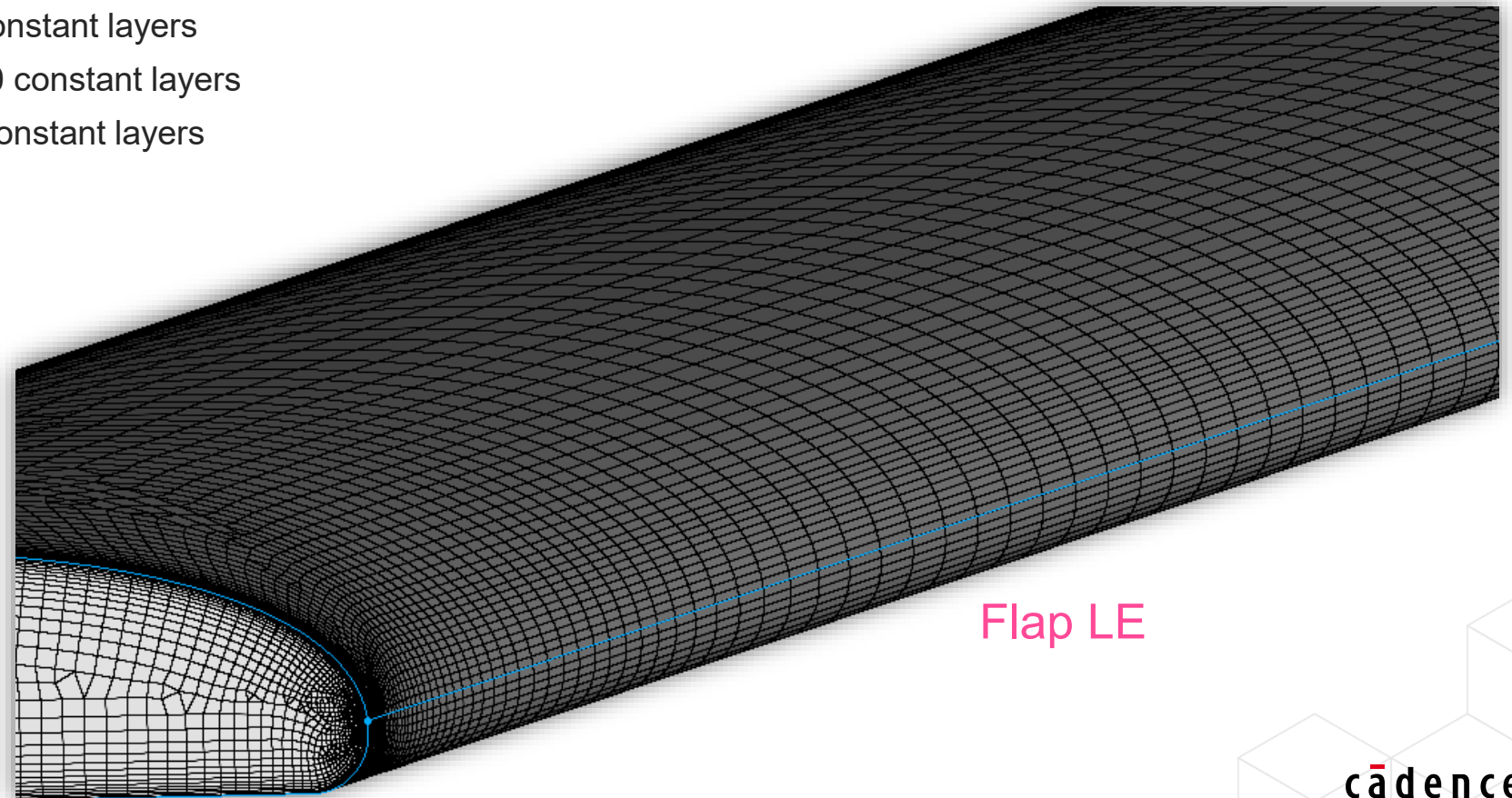
CRM-HLS

Surface Meshing

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Flap TE

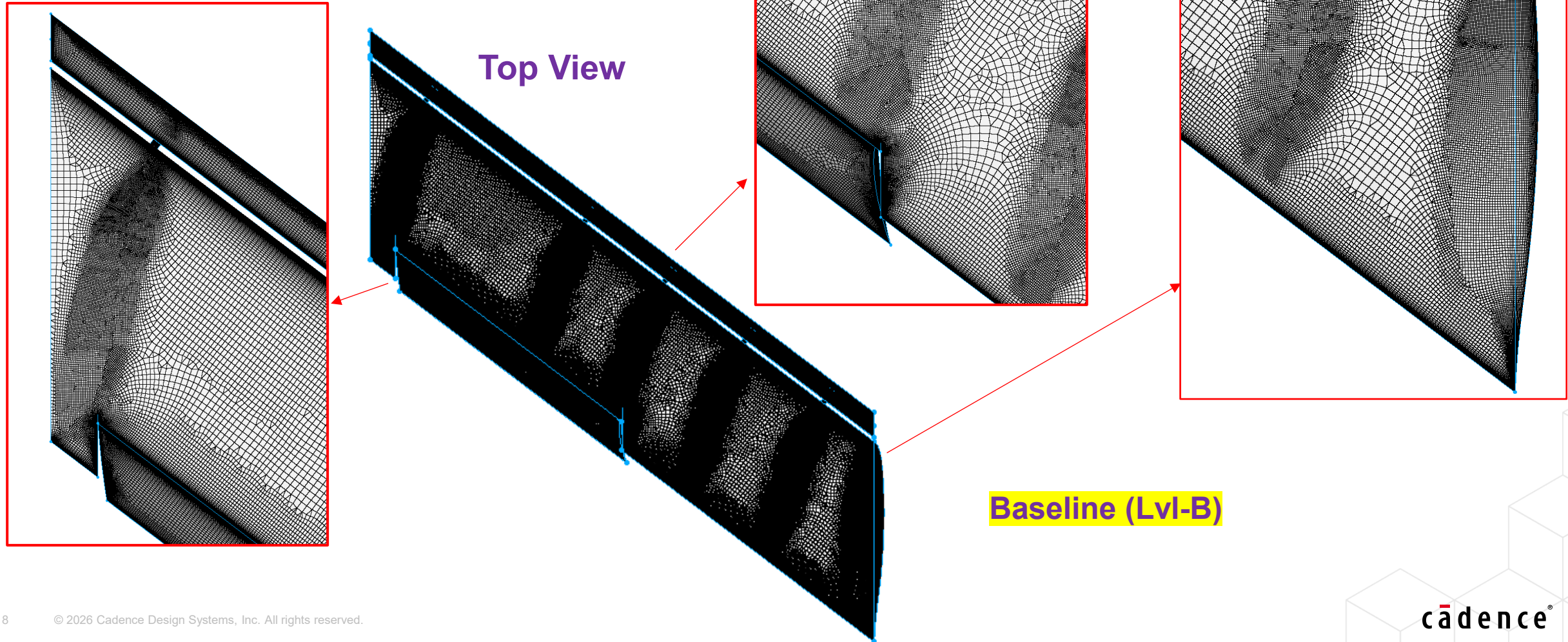


Flap LE

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Surface Meshing

- Targeted Surface Mesh Refinement

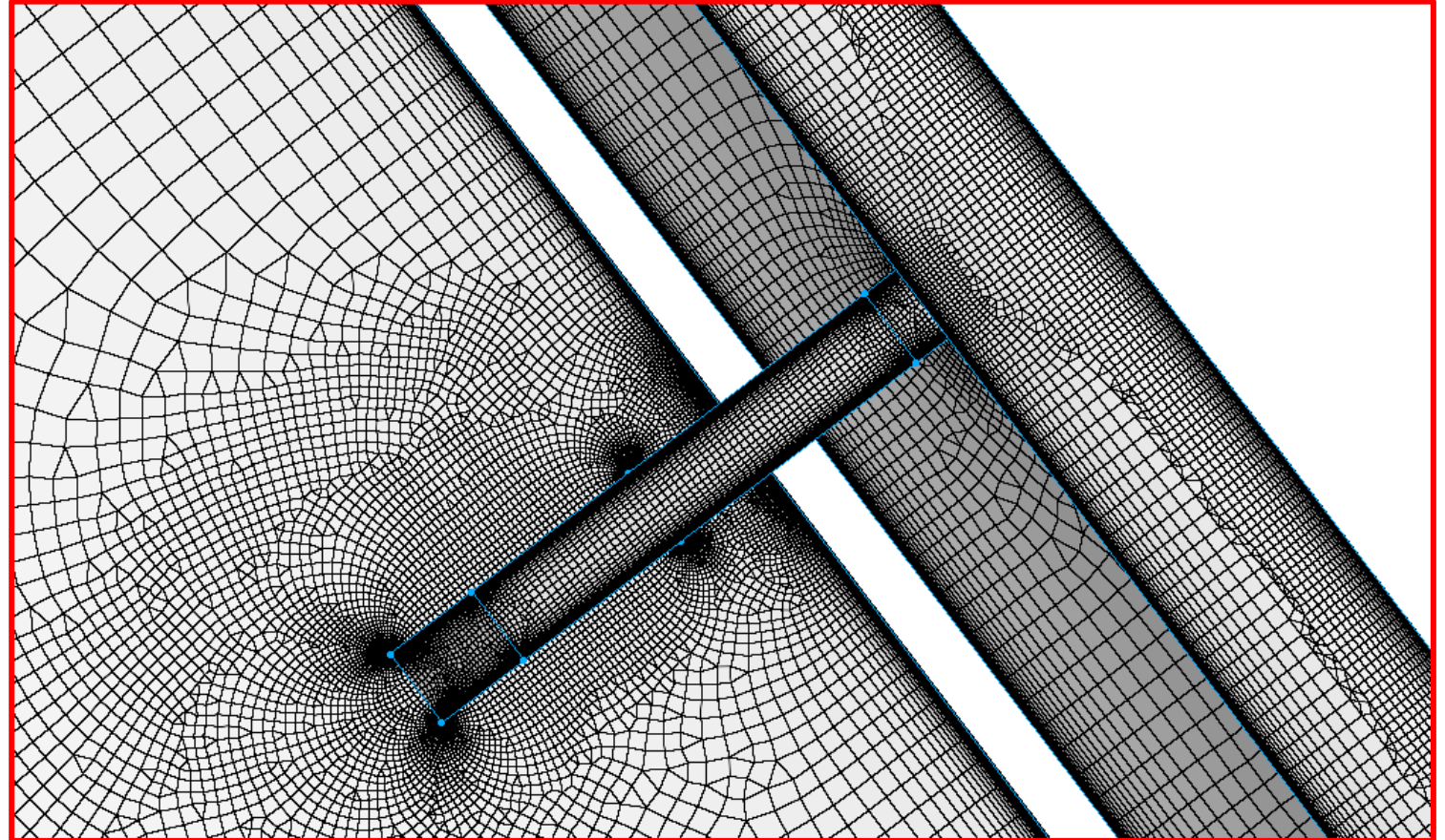
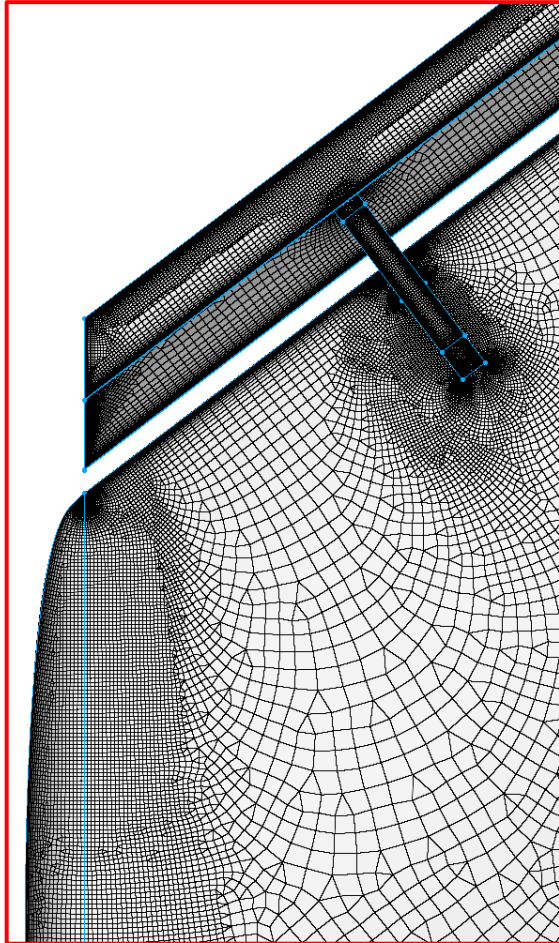


CRM-HLS

Surface Meshing

Baseline (Lvl-B)

- Targeted Surface Mesh Refinement








Bottom View: Middle Slat Bracket

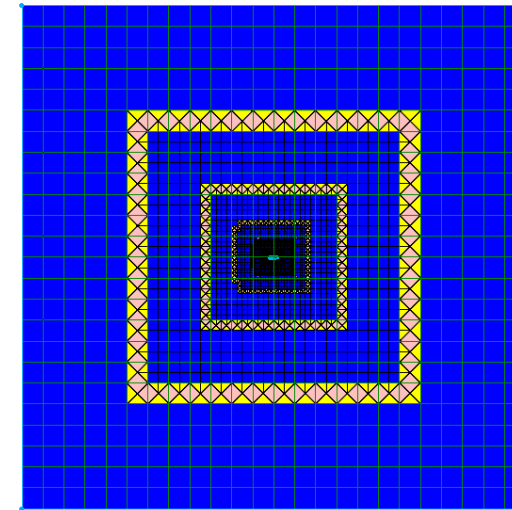
**Bottom View:
Wing Tip / Slat-Brkt #5**

CRM-HLS

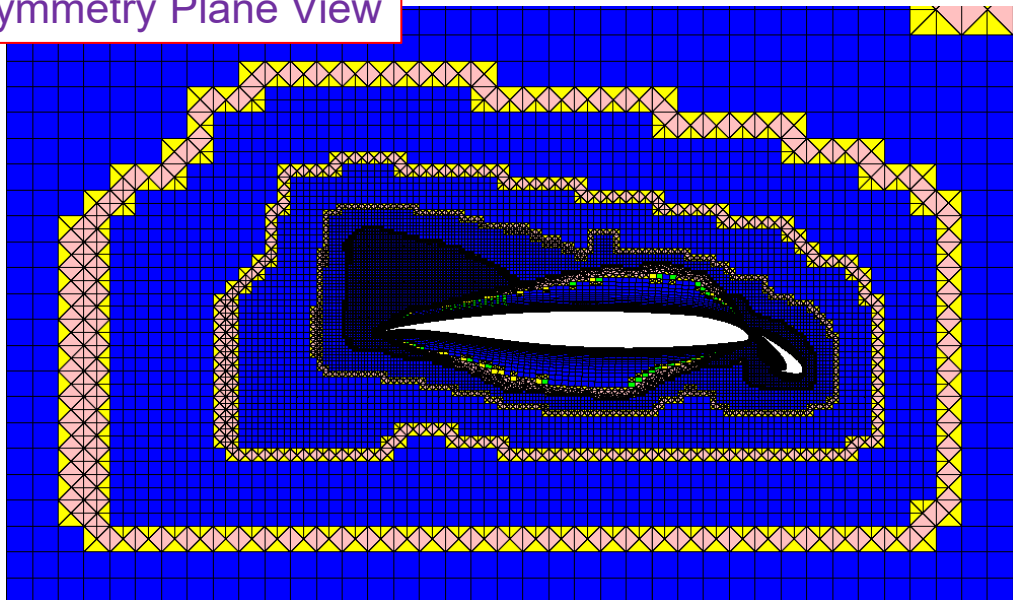
Volume Meshing

- Family 1: HexVoxel
 - Quad Dominant Surface Mesh + Voxel Farfield
 - Levels A through E are available
 - Boundary layer growth rate = 16% (Lvl-B) and scaled with the refinement factor for other grid levels.
 - Growth profile: 1.0 1.0 1.16 1.16 1.16 ...
(example for Lvl-B)

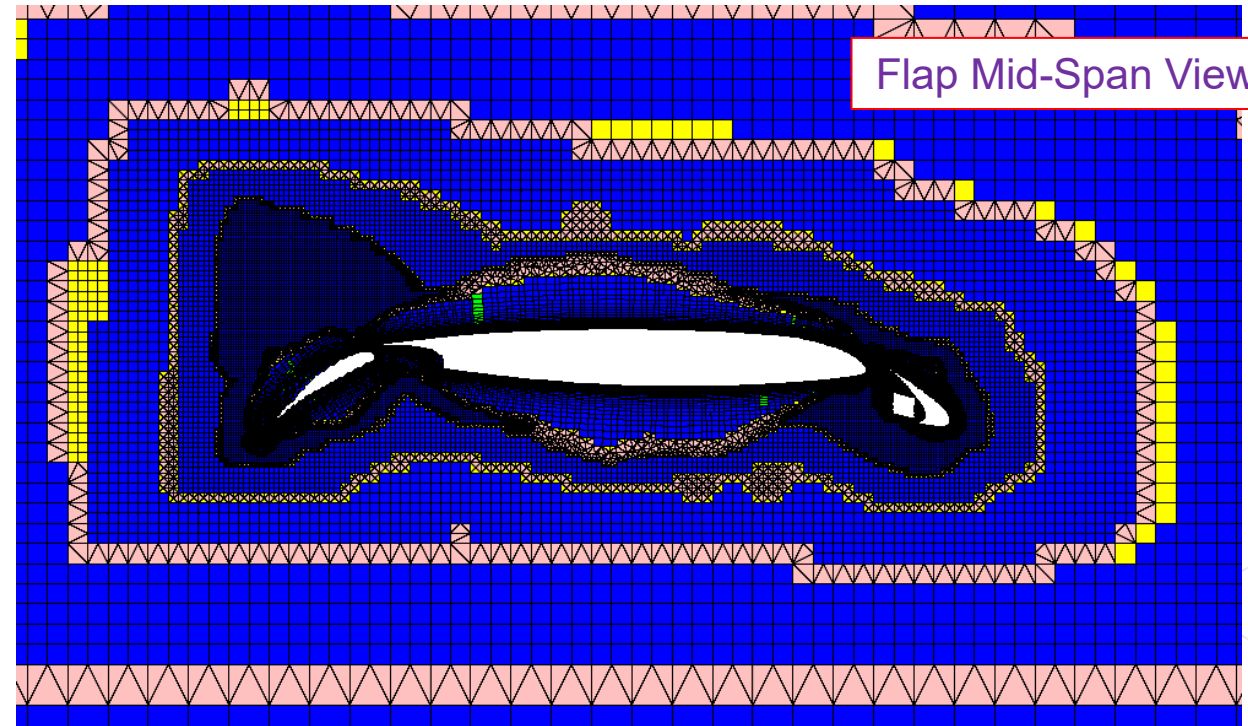
Type	Color	Count
Tets		16,027,916
Pyramids		2,542,107
Prisms		811,092
Hexes		24,136,232
All		43,517,347



Symmetry Plane View



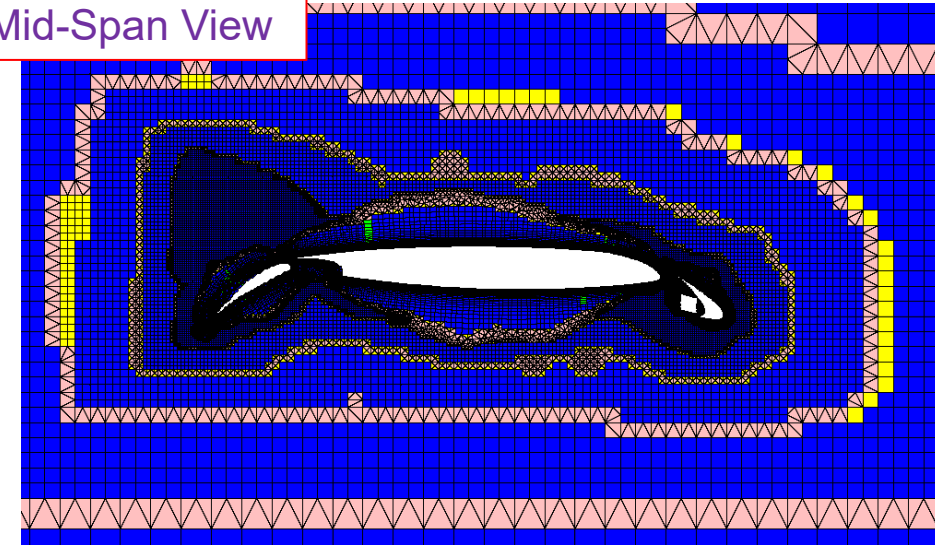
Flap Mid-Span View



CRM-HLS

Volume Meshing

Lvl-B: Flap Mid-Span View








- Family 1: HexVoxel
 - Quad Dominant Surface Mesh + Voxel Farfield
 - Levels A through E are available

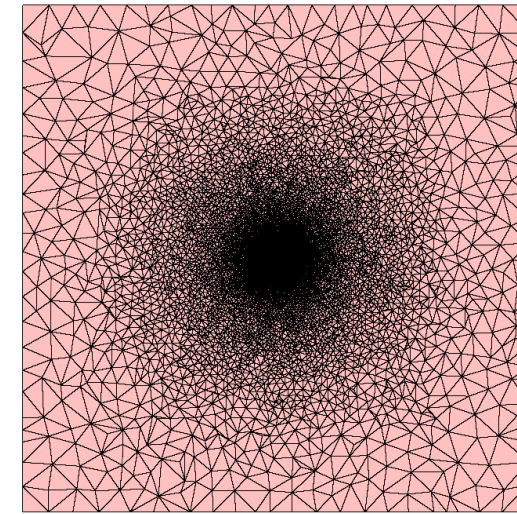
Grid Level	Cell Count	Node Count	Refinement Factor	Target y^+
A	25,435,031	15,520,444	0.75	4/3
B	43,517,347	28,289,287	1.0	1.0
C	106,410,939	75,726,976	1.5	2/3
D	237,759,230	180,918,004	2.0	0.5
E	568,667,444	457,688,006	3.0	1/3

CRM-HLS

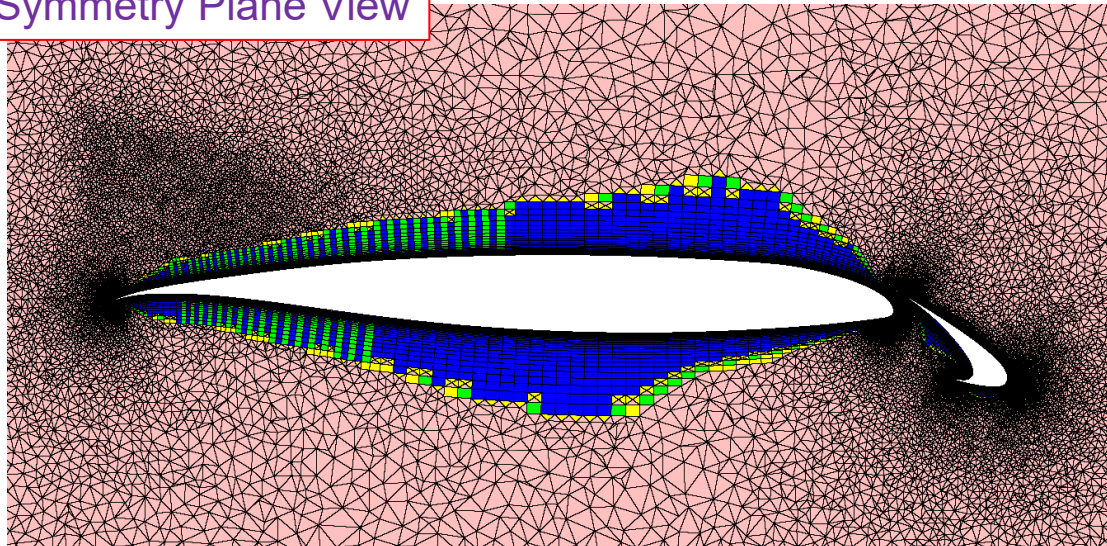
Volume Meshing

- Family 2: HexIsoTet
 - Quad Dominant Surface Mesh + IsoTet Farfield
 - Levels A through E are available
 - Boundary layer growth rate = 16% (Lvl-B) and scaled with the refinement factor for other grid levels.
 - Growth profile: 1.0 1.0 1.16 1.16 1.16 ...
(example for Lvl-B)

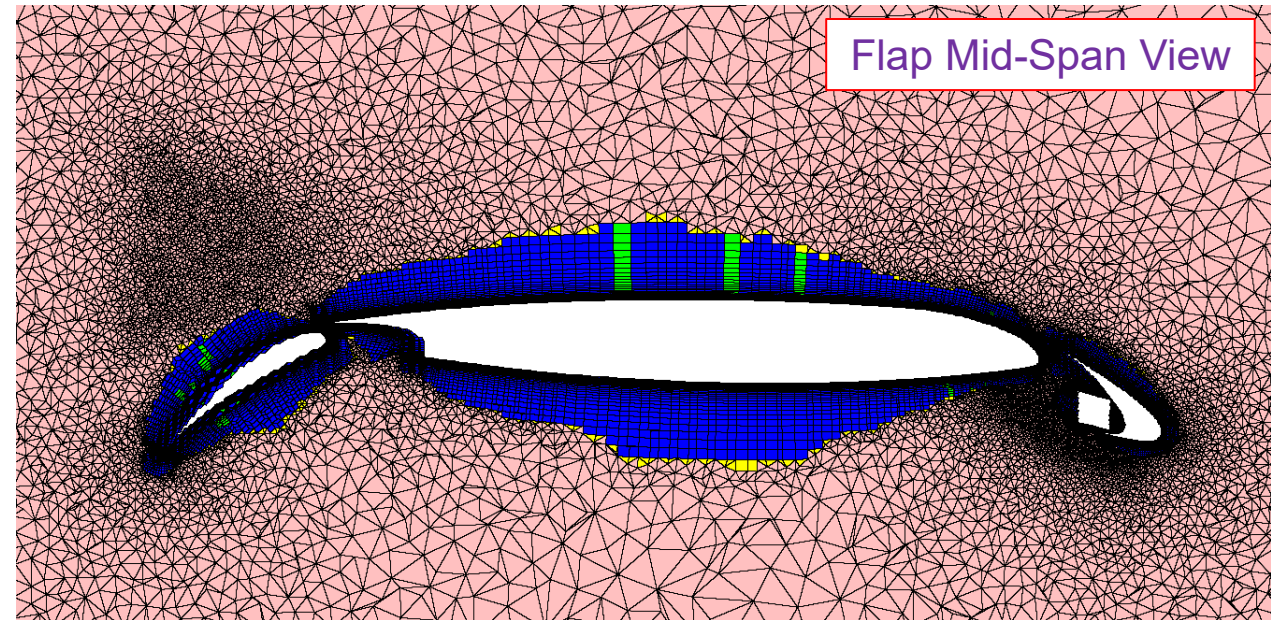
Type	Color	Count
Tets		25,315,880
Pyramids		978,189
Prisms		796,642
Hexes		19,419,165
All		46,509,876



Symmetry Plane View



Flap Mid-Span View

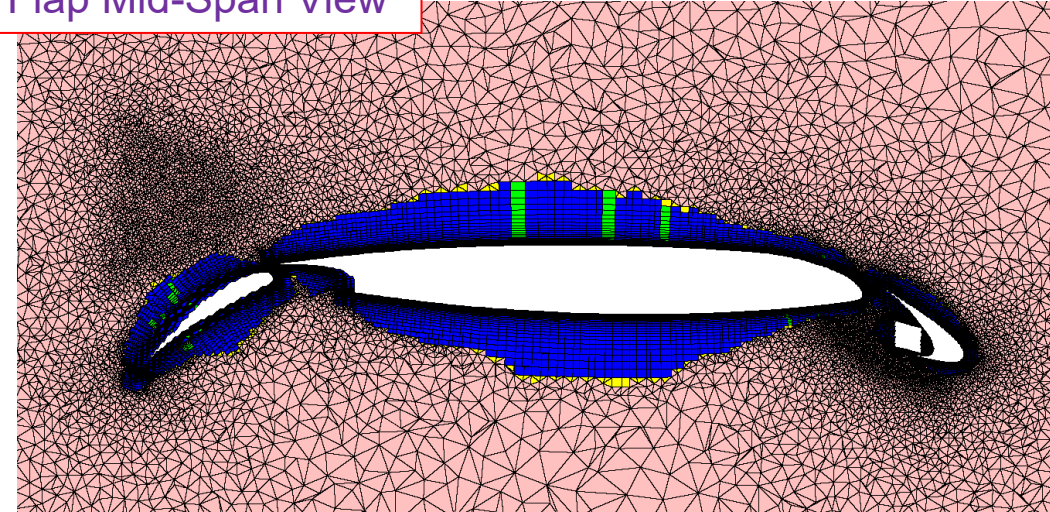


CRM-HLS

Volume Meshing

Lvl-B: Flap Mid-Span View

- Family 2: HexIsoTet
 - Quad Dominant Surface Mesh + IsoTet Farfield
 - Levels A through E are available

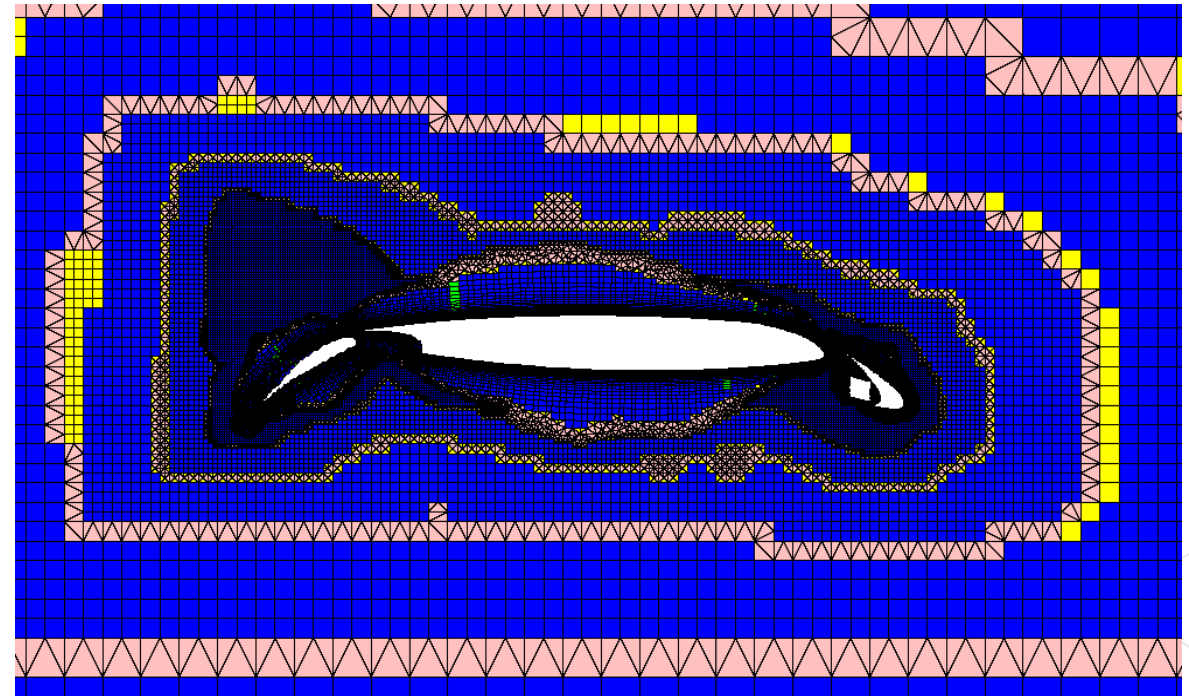
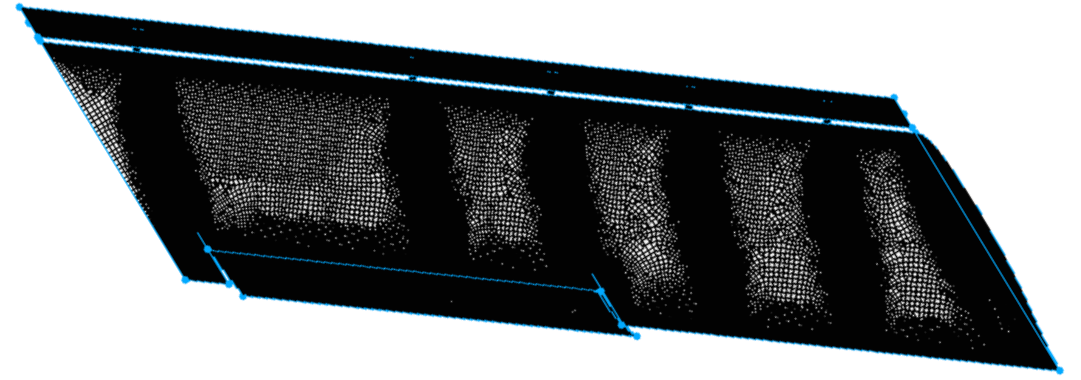


Grid Level	Cell Count	Node Count	Refinement Factor	Target y^+
A	27,208,818	13,428,913	0.75	4/3
B	46,509,876	24,570,112	1.0	1.0
C	116,911,995	66,940,962	1.5	2/3
D	265,665,810	164,250,168	2.0	0.5
E	678,260,498	418,801,298	3.0	1/3

HLPW6-TC1: CRM-HLS

Summary

- Two grid families are generated and made available for the CRM-HLS configuration
- Mesh recipe for the baseline mesh is defined based on best practices, experience from past workshops, preliminary RANS solutions, and grid sensitivity analysis
- Grid family 1 (F1) utilizes a quad-dominant surface (leading to hex-dominant boundary layer mesh) followed with the Voxel (hexCore) meshing technique in the off-body region
- Grid family 2 (F2) utilizes the same surface meshing strategy but uses isotropic tetrahedra meshing for the farfield region
- Meshes are provided in both CGNS and UGRID (b8.ugrid/mapbc) formats.

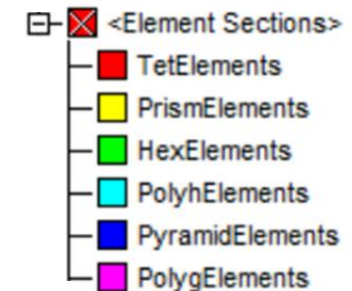
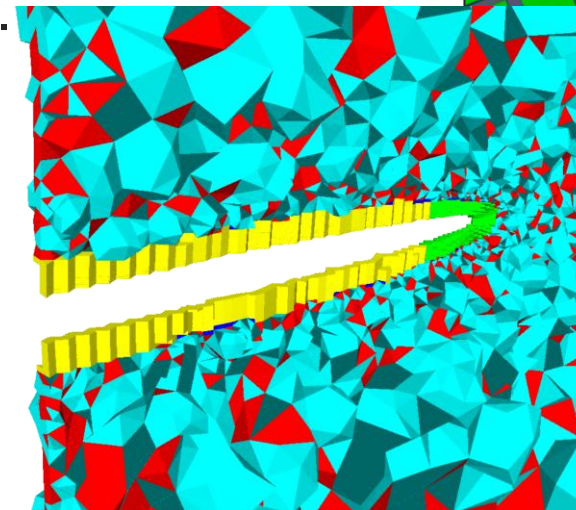
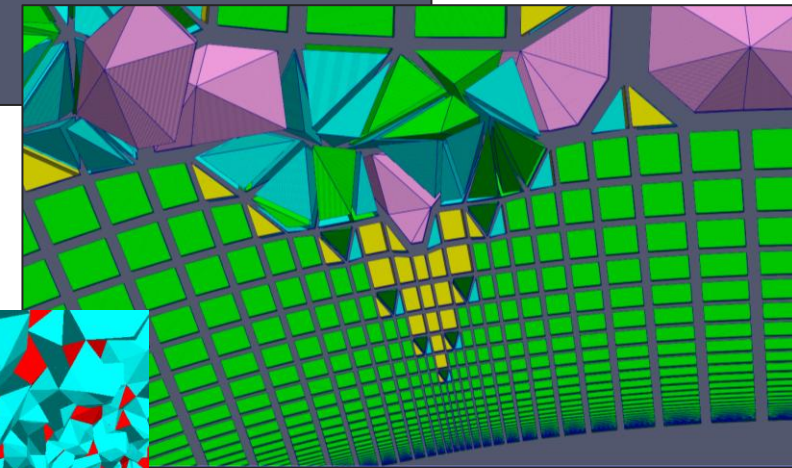
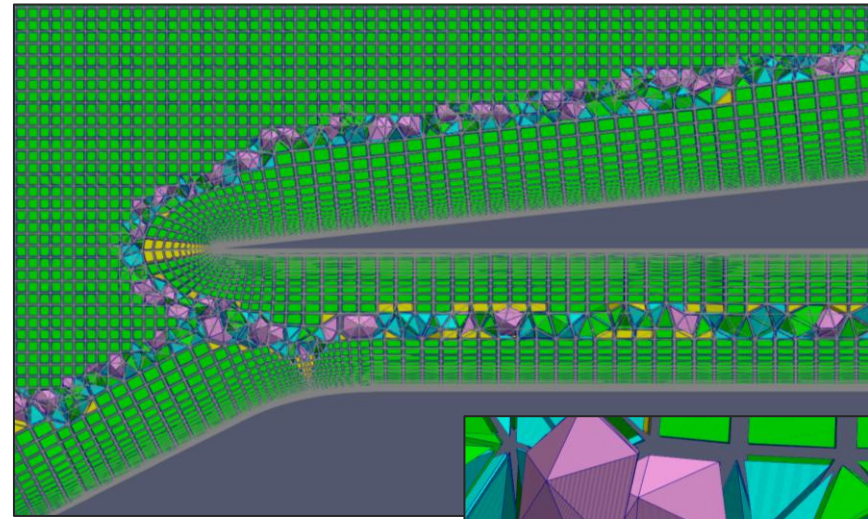


HLPW6-TC1: CRM-HLS

Summary

- Meshes are available on the HLPW6 website.
- If any TFG participants wish to collaborate on specific variations of the meshes or alternate mesh characteristics, please feel free to reach out to our team.
- Our team also plans on providing additional grid families based on alternative meshing strategies.
- We can also provide **poly** versions of these meshes:
 - T-Rex transition poly + Voxel poly
 - T-Rex transition poly + IsoTet poly

We welcome feedback!
For any questions, please reach out
via email to rezadj@cadence.com





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