

Modeling for External Aerodynamics Analysis

A-Class
Aerodynamics

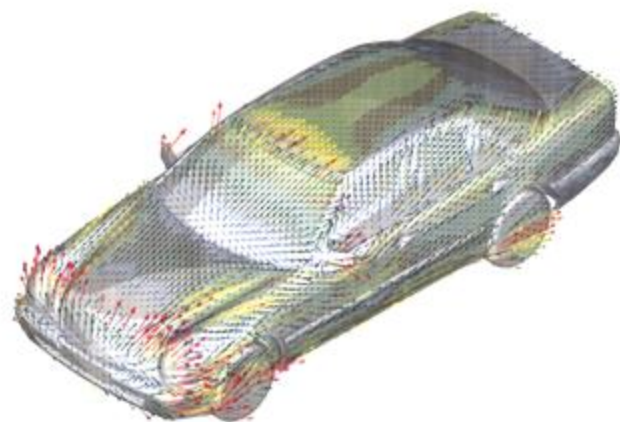
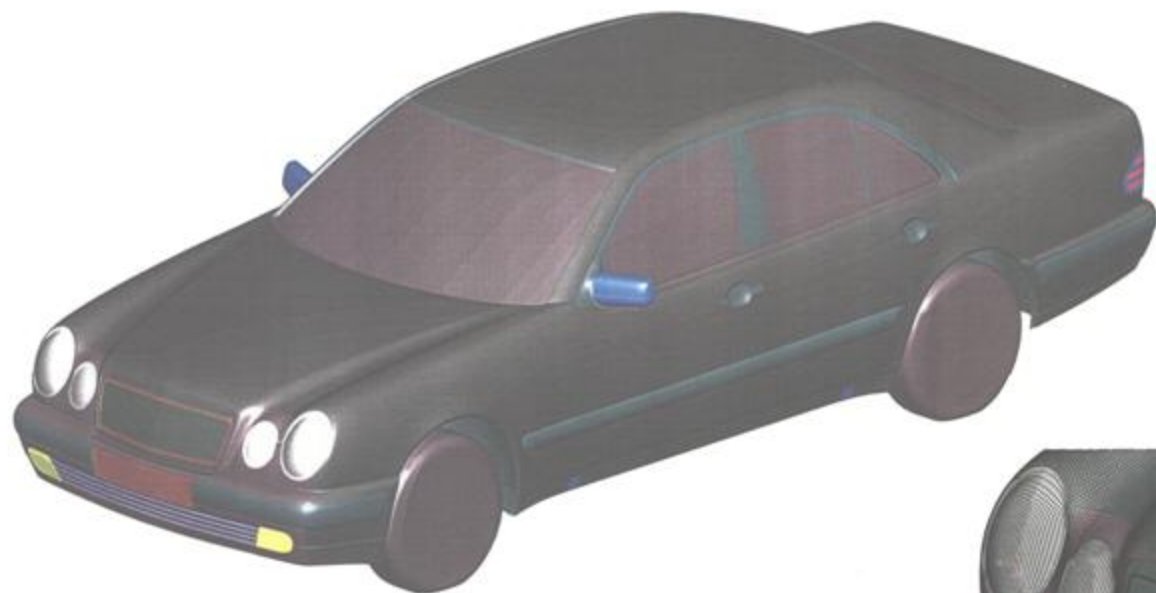
- Past Experience
- Goals for the A-Class Aerodynamics
- Automation - EZAero
- Future Direction



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9 Million Cell Aero Model

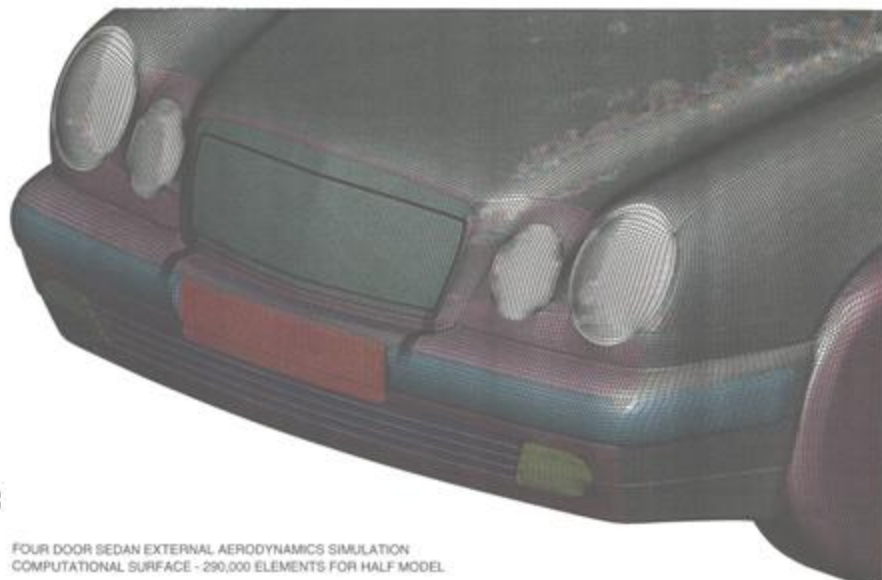


FOUR DOOR SEDAN EXTERNAL AERODYNAMICS SIMULATION
COMPUTATIONAL SURFACE - 290,000 ELEMENTS FOR HALF MODEL

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FOUR DOOR SEDAN EXTERNAL AERODYNAMICS SIMULATION
COMPUTATIONAL SURFACE - 290,000 ELEMENTS FOR HALF MODEL

Mesh Density Study

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MESH SENSITIVITY

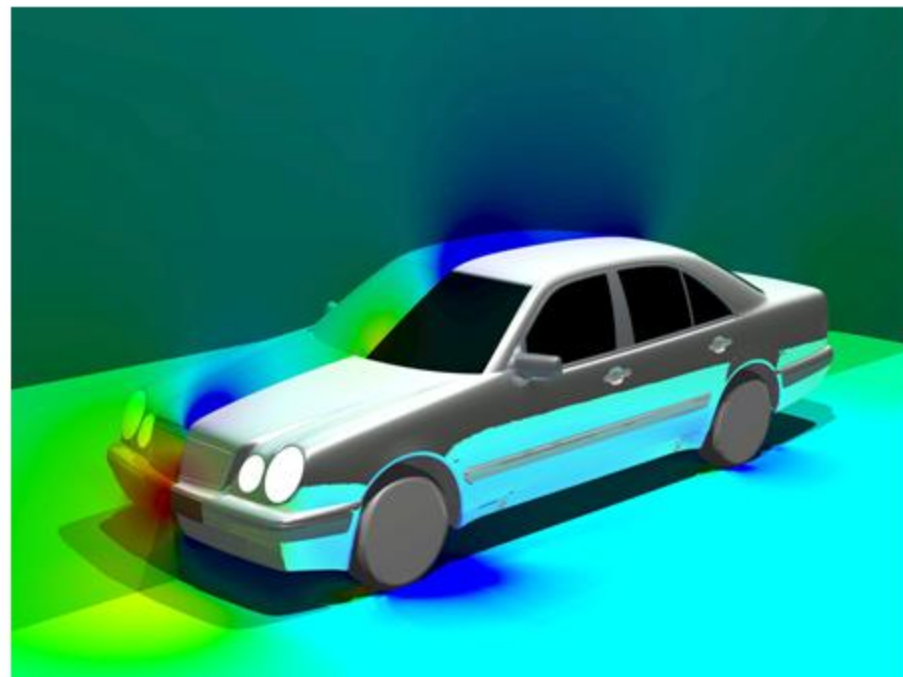
SOURCE	DRAG	LIFT
1 million cells	0.3604	0.0639
2.8 million cells	0.2624	0.0889
9 million cells	0.2466	0.0195
Experiment	0.2340	-0.0295

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9 Million Cell Aero Model

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Excellent Results, However Too Long of Turn-Around Time: 7 Weeks Modeling Time, 3 weeks CPU time

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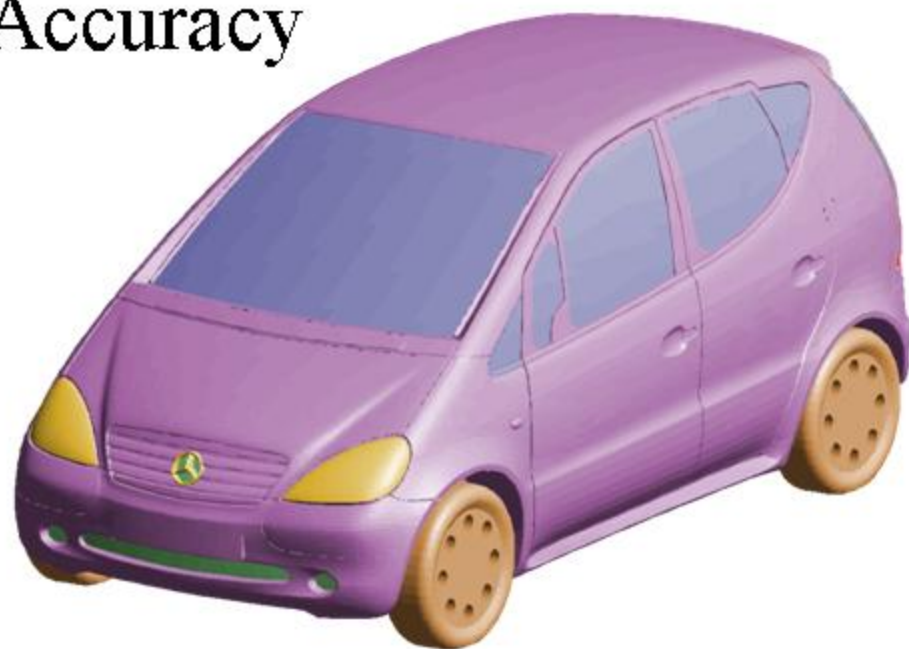
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Goals for the A-Class Aerodynamics

- Quicker Turn-Around Time
 - Incorporate **samm** to automate mesh generation process.
- Maintain Accuracy



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Meshing Criterion

- Boundary Layer Grid
 - Yplus Value between 30-200
- Grid Distribution
 - As Fine as possible capture gradients on vehicle surface.
 - Need high density in wake to capture bubble closure in wake region of vehicle
 - High density between vehicle and ground to capture the correct mass flow below the vehicle (Generally affect the C_l).

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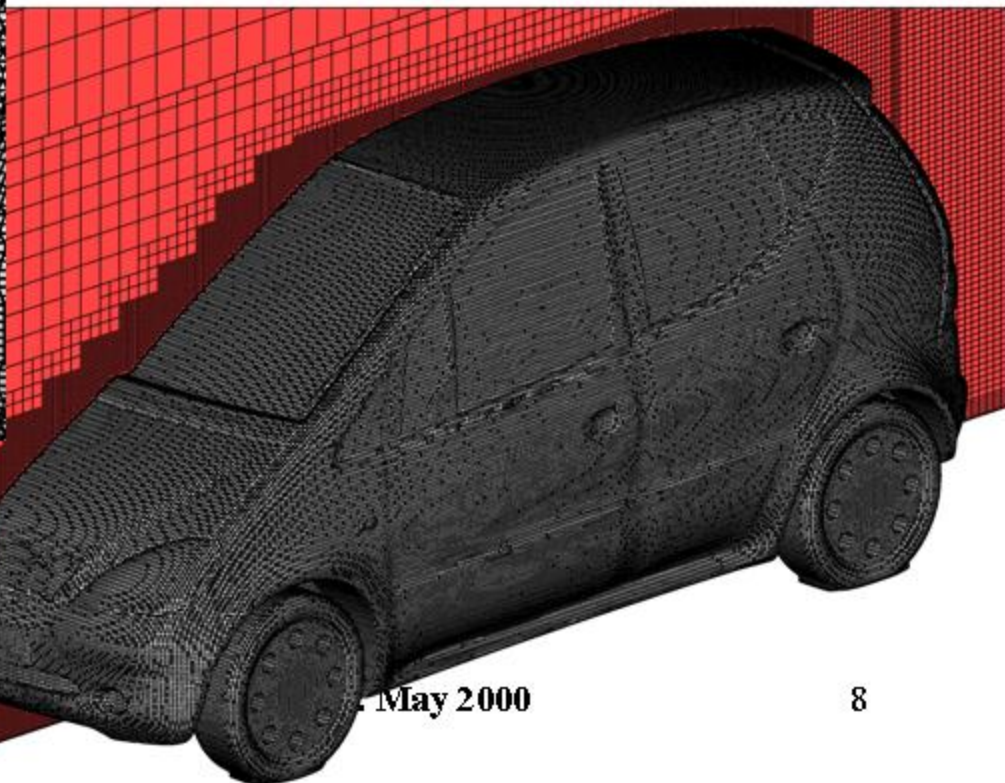
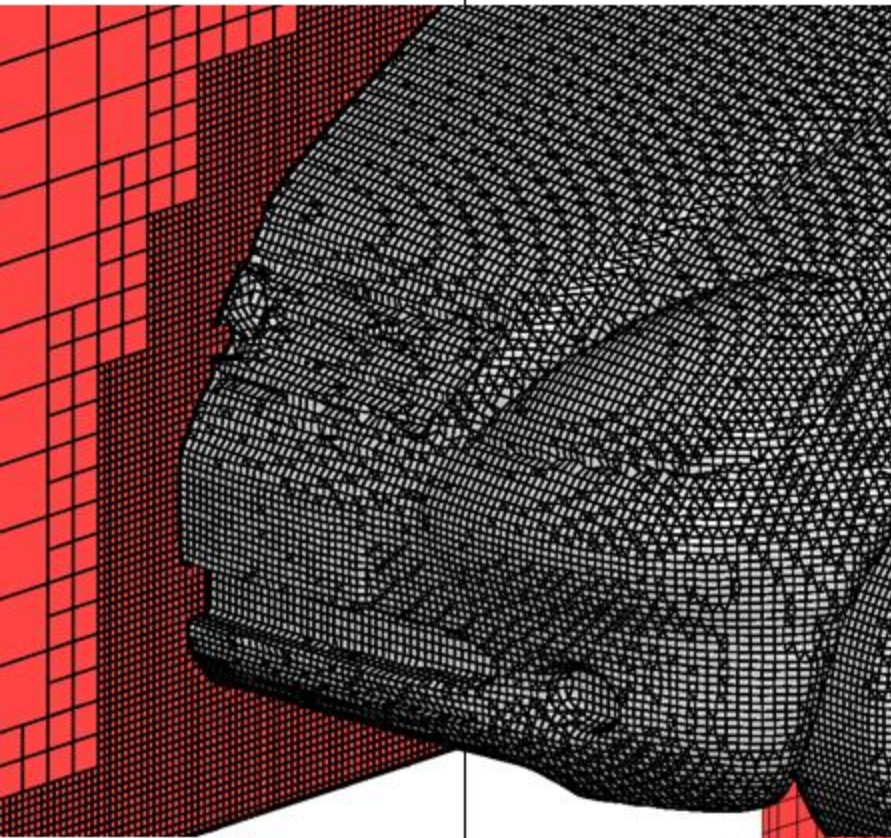
A-Class Settings

- Wall Layer: .8mm
- Boundary Layer: 4 Layers Total of 4.7mm
(used to transition from the Wall thickness to Main flow field)
- Near Vehicle Cell Size: 10mm
- Wake Region: 20mm
- Cell Layers Below Vehicle: 18
- Total Cells: 6.5 million

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samm Mesh Generation for the A-Class



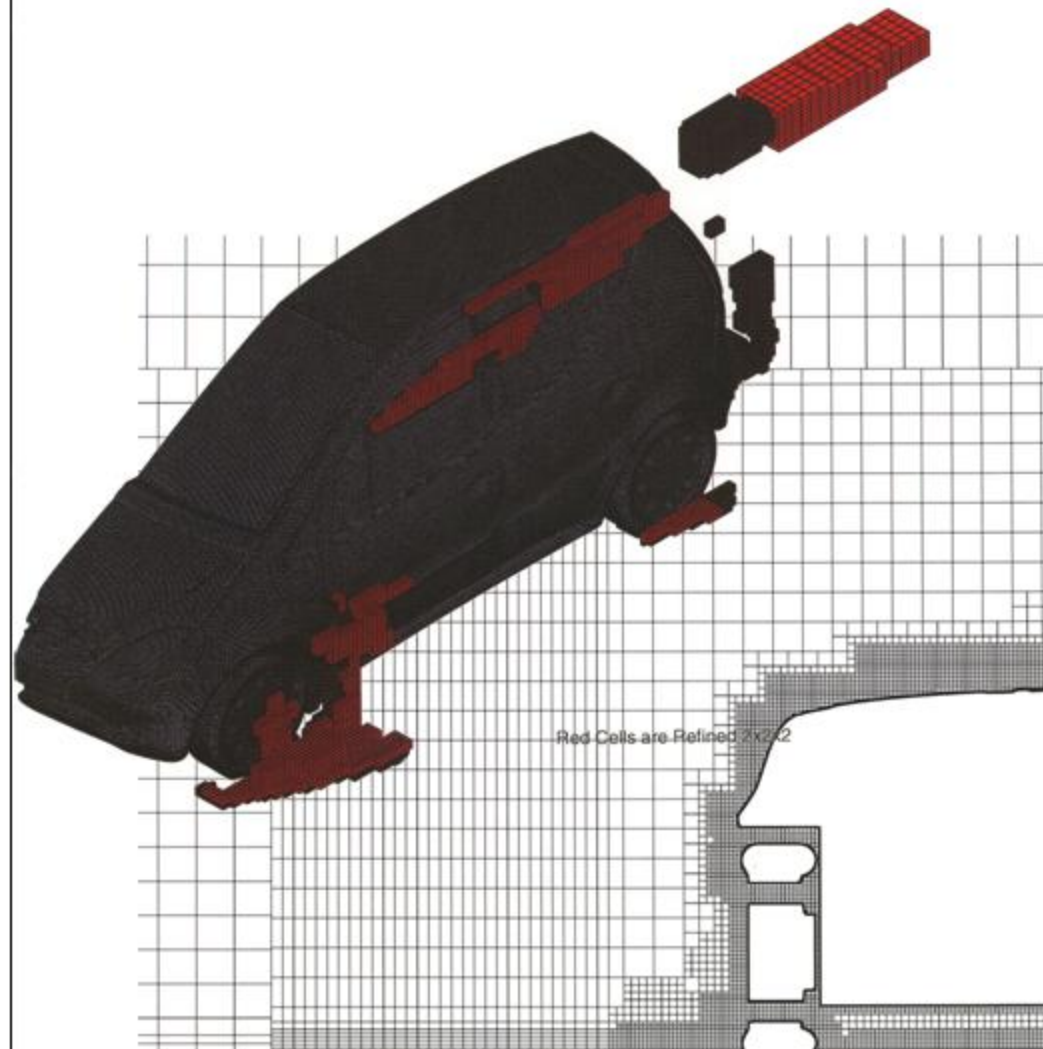
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A-Class Vehicle

A-Class Aerodynamics



A-CLASS EXTERNAL AERO MODEL
SAMI Model, 7.375 m/s Case
4.9 Million Fluid Cells (Refined Based on Vorticity)

X = 0. mm



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Automation: EZAero

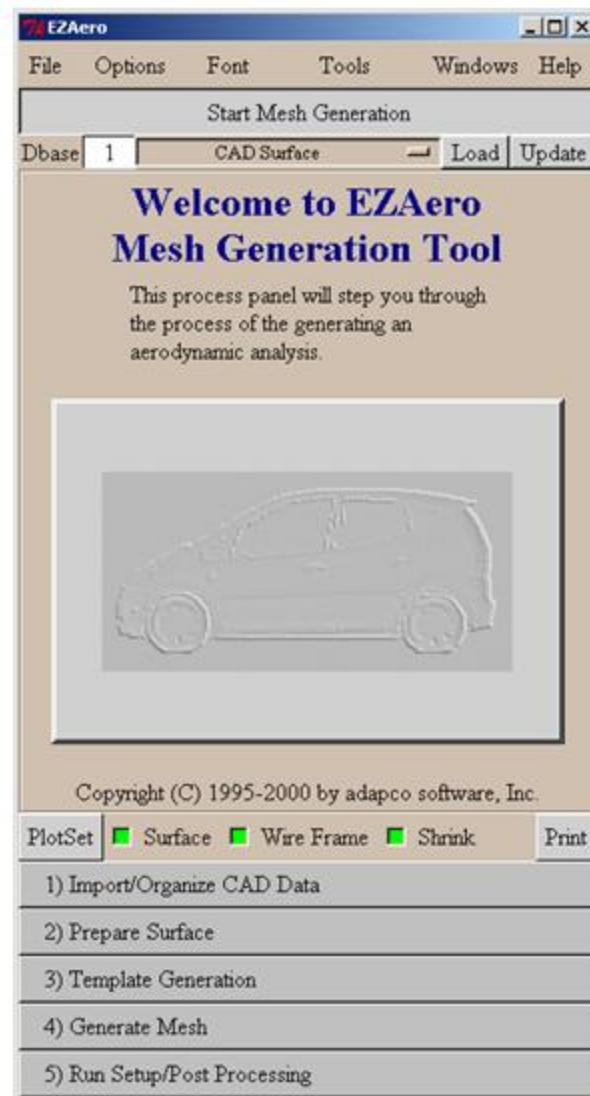
A-Class
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- Easy-to-Use GUI designed specifically for External Aerodynamics



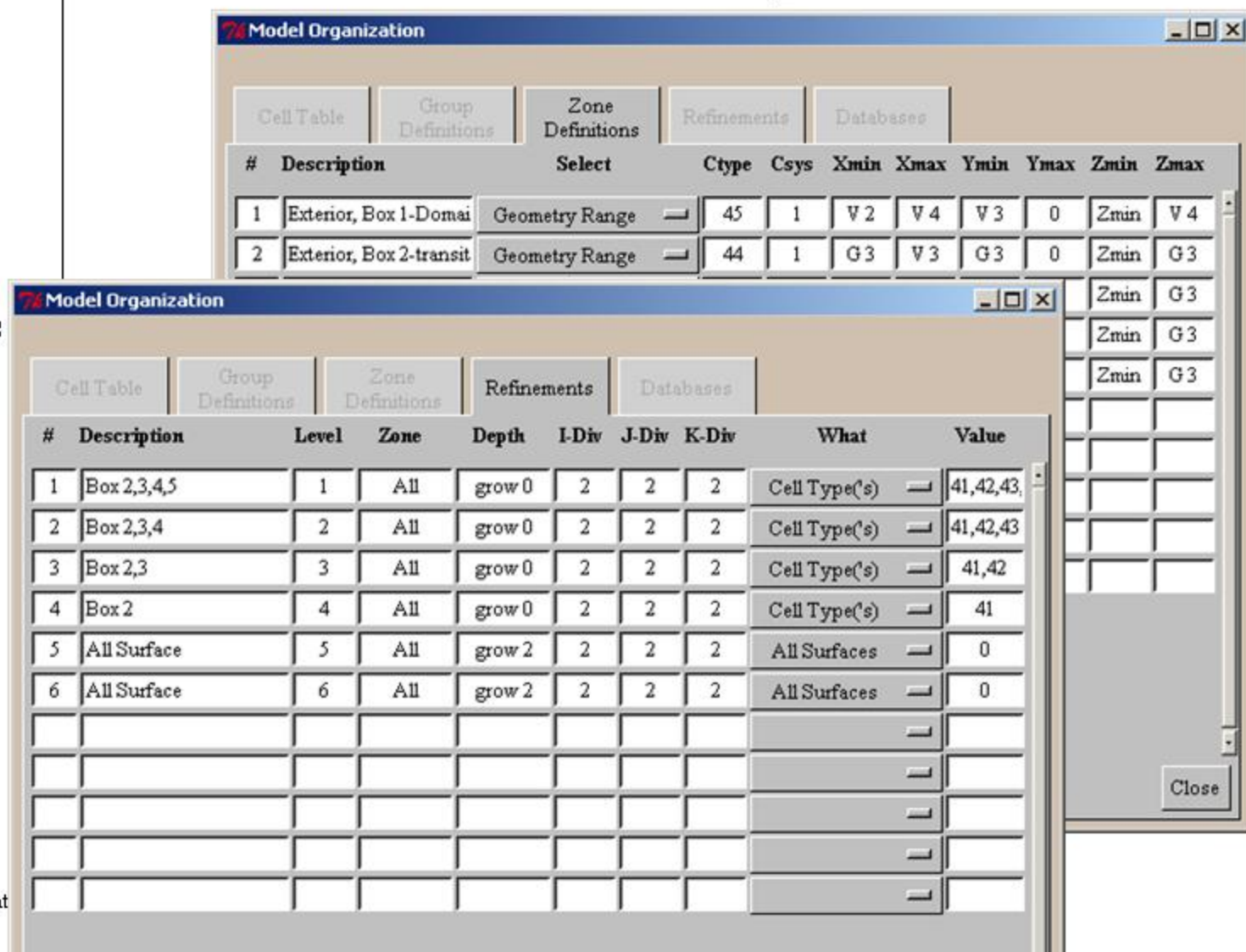
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Setup

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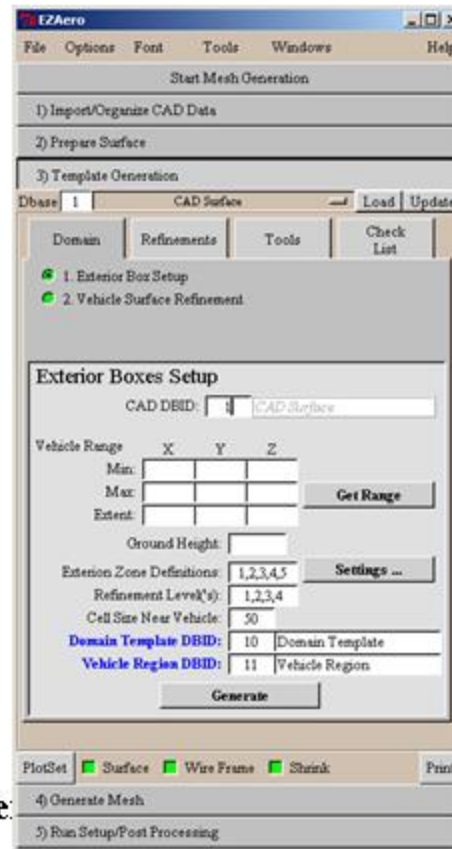
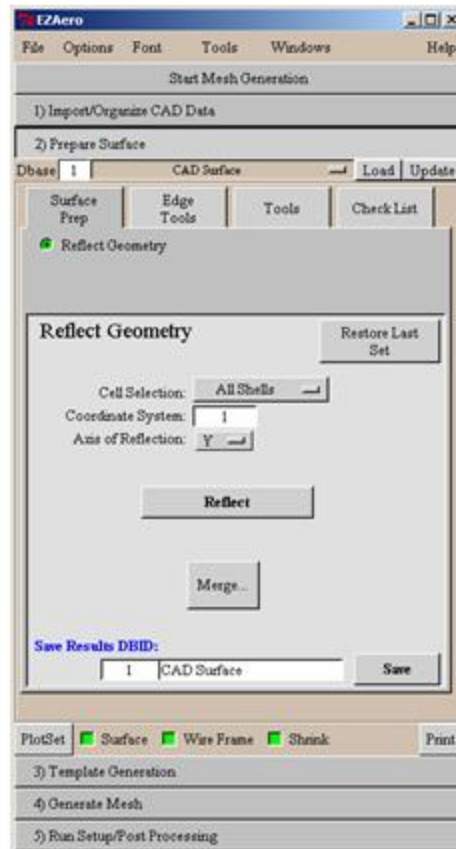
Step Through Process

1) Import Data

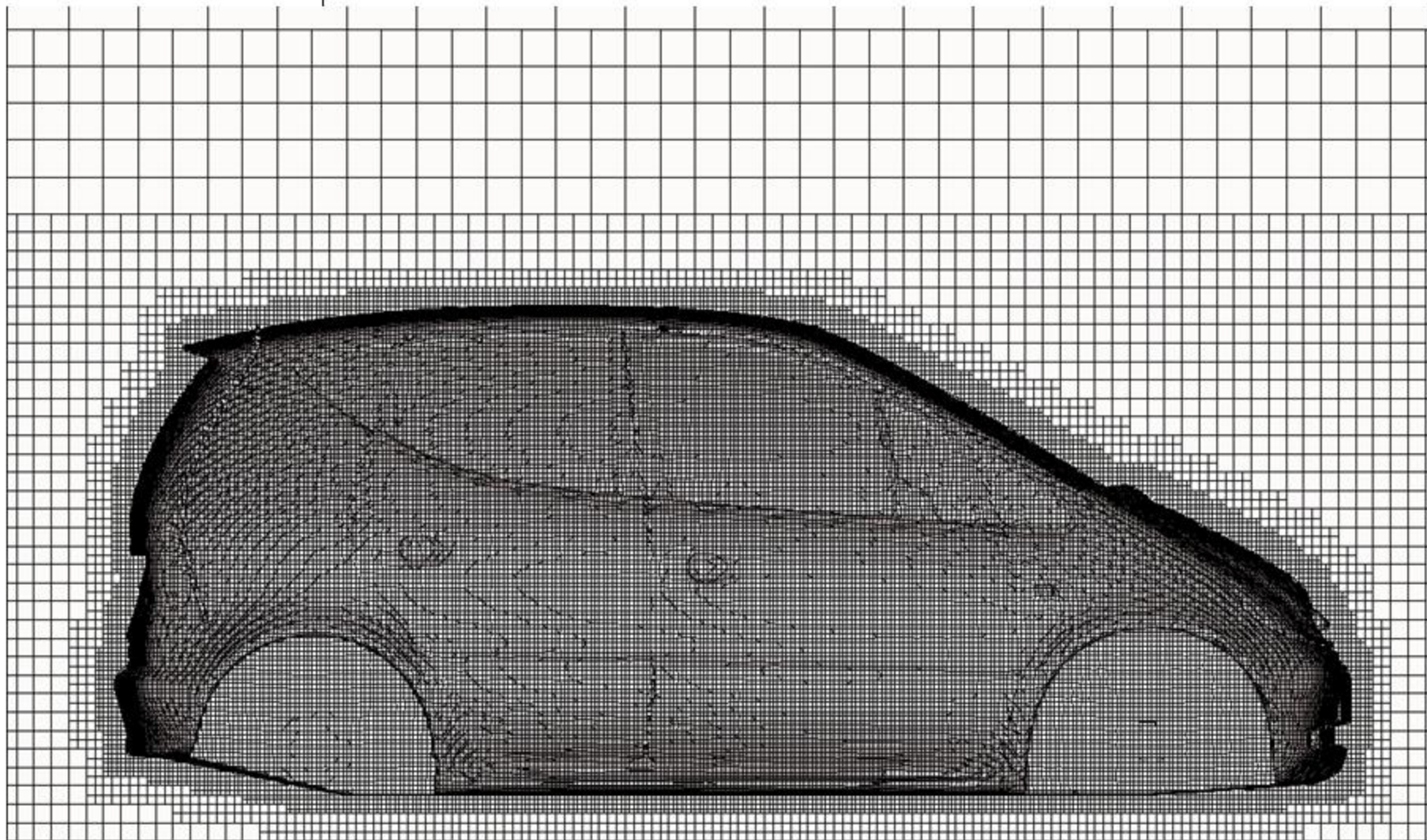
2) Prepare Surface

3) Build Template

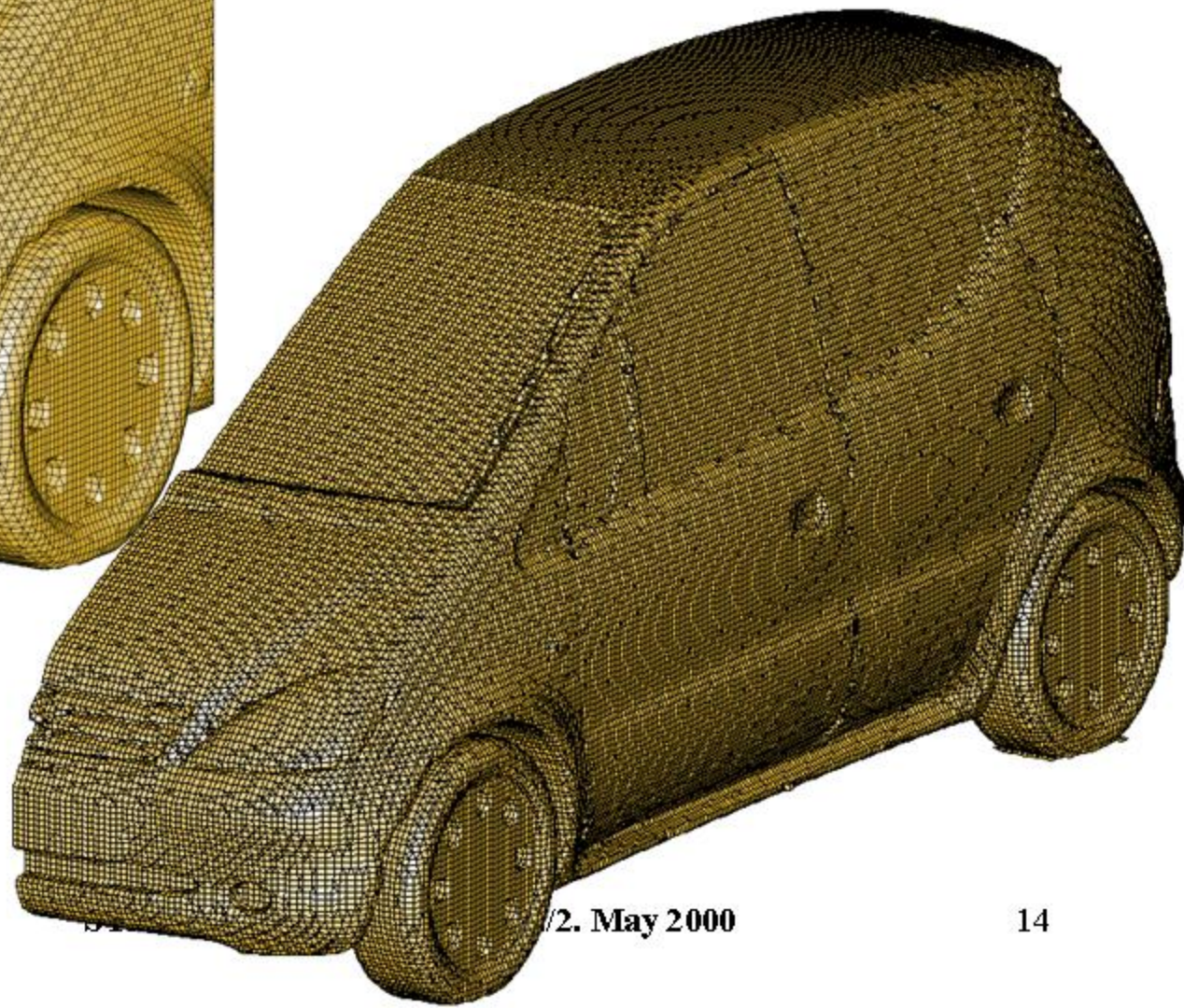
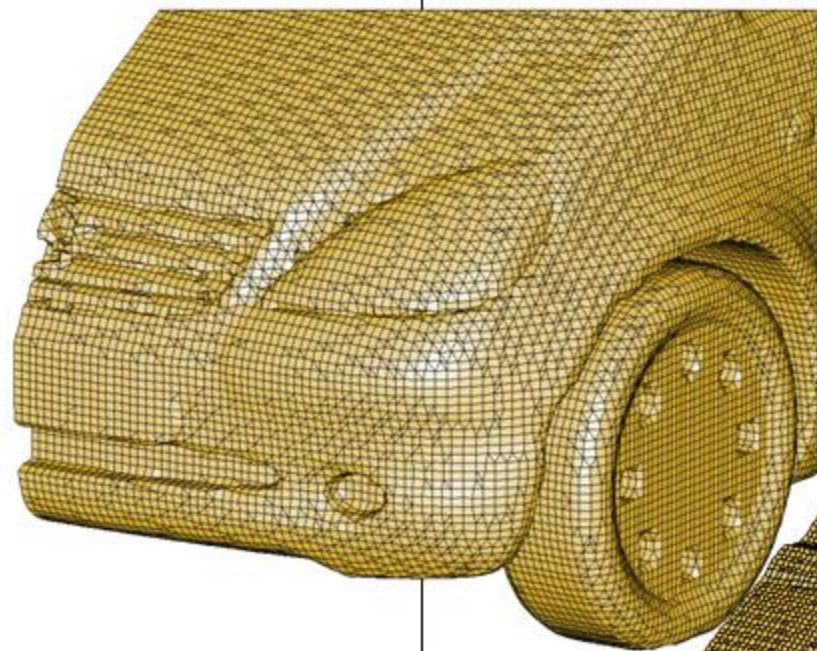
4) Generate Mesh



Resultant Mesh



Resultant Mesh



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Future Direction

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- 1 Day Turn Around for New Vehicle
- Real Time Updates for Minor Modifications



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