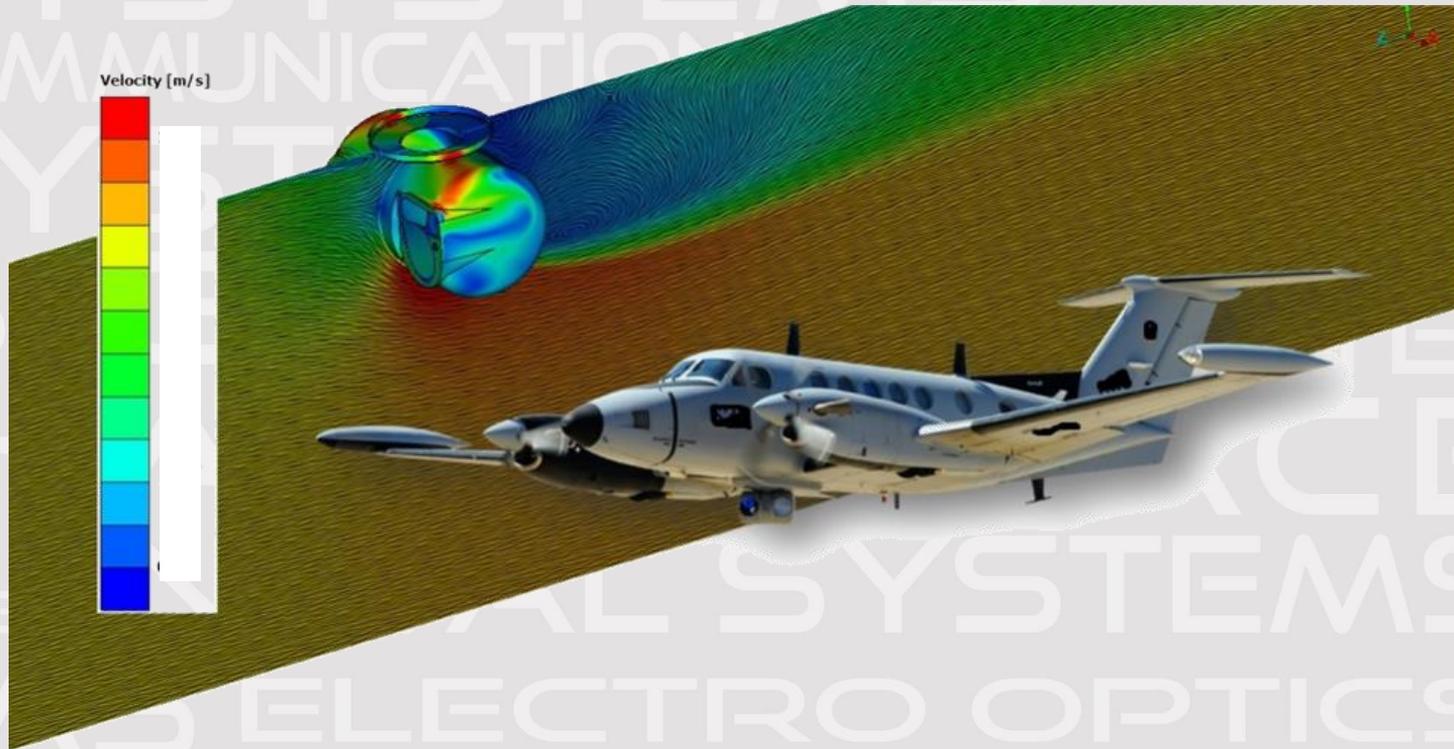


External Flow Analysis (CFD) for an Airborne Gimbal



David Lozano
Elbit Systems – ISTAR

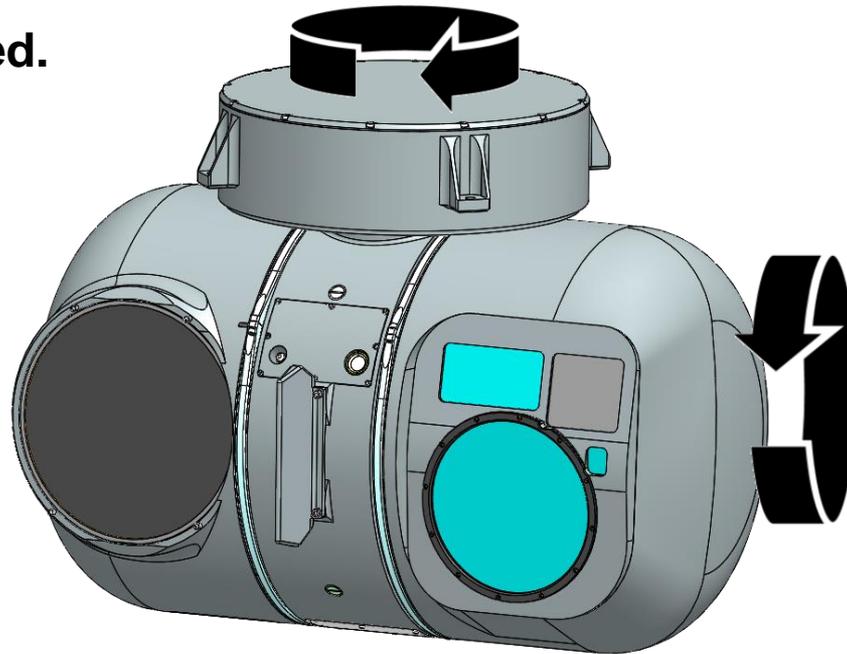
Problem Description

- Development project of an airborne electro-optic gimbal, based on observation sensors



Problem Description – con't

- ▶ Important project with demanding development schedule
- ▶ During PDR a question raised about which azimuth and elevation motors should be defined.



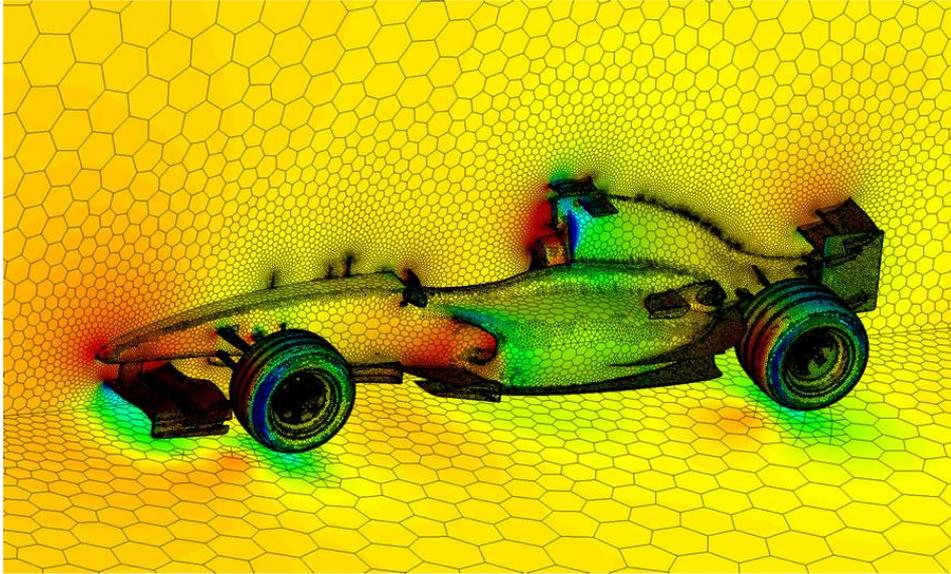
- ▶ The choice had a significant influence on weight, current consumption and heat dissipation inside the unit.

Problem Description – con't

▲ Preliminary moments during flight were defined :

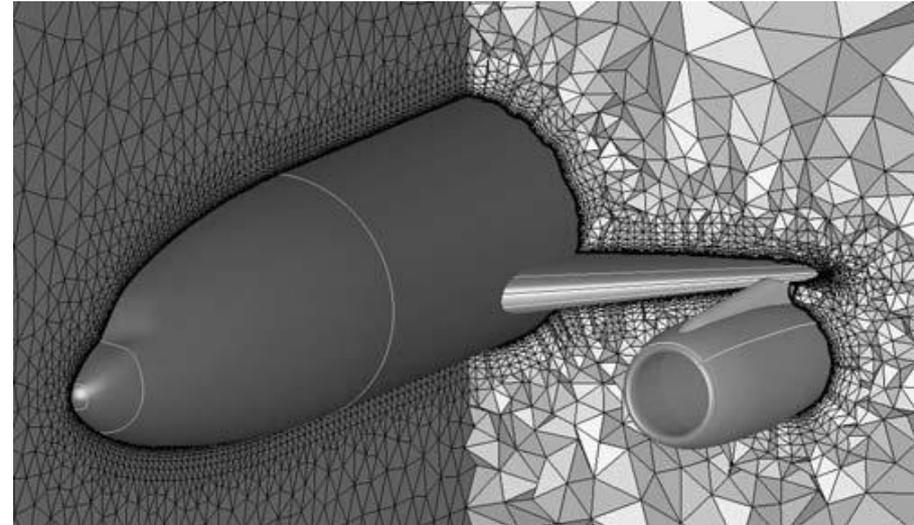
	OutAz Motor	OutEl Motor
Wind Torque [Nm] @ xxxkn	x	x
Bearing Friction [Nm]	x	x
Dyn. Seal Friction [Nm]	x	x
Inertia [kg m ²]	x	x
Accel Torque @1 rad/s ² [Nm]	x	x
Unbalance @1g [Nm]	x	x
Total Torque Demand [Nm]	x	x



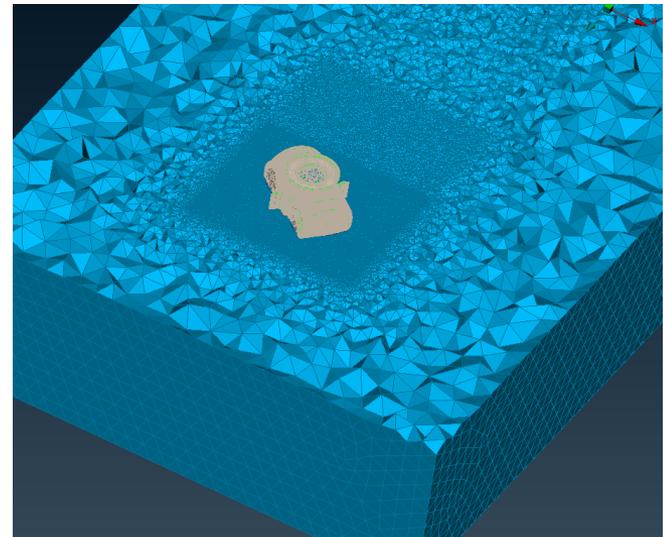
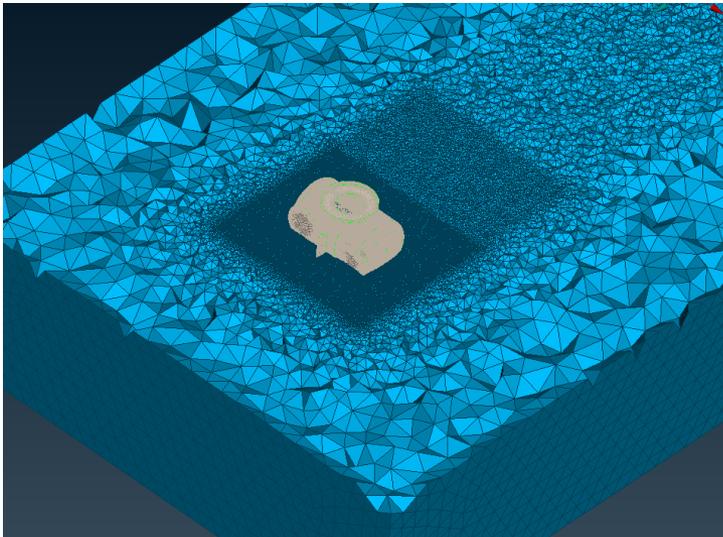


In CFD we need to model the DOMAIN, the object only defines the boundary conditions.

The modeling process is relatively complicated, iterative and very time consuming.



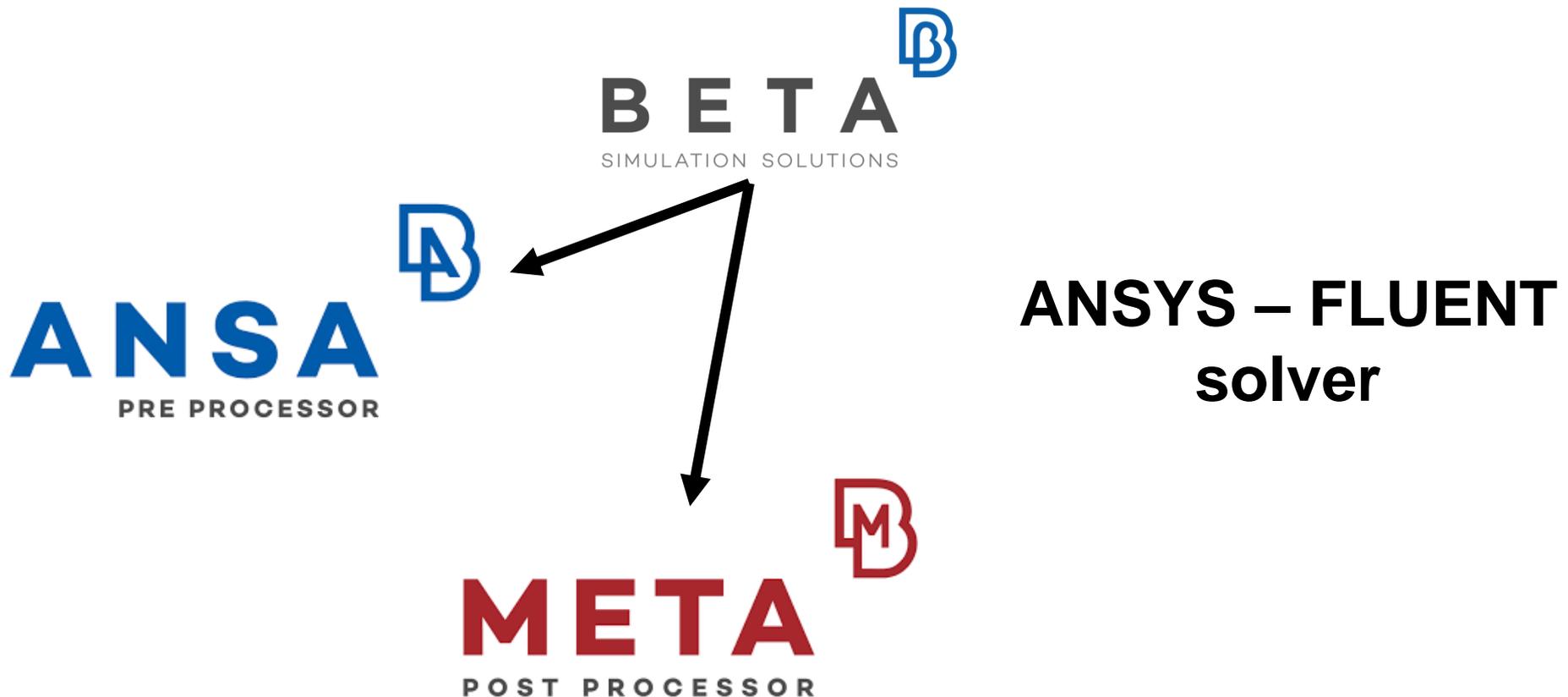
- ▶ Which angles of azimuth and elevation will lead to the highest moments?
- ▶ Examine the developed moments on different angles.
- ▶ Each new angle changes the domain, so for each angle remodeling is required.



Our Modeling/Analysis Tools

▶ The tool that was used in Elbit, CFDDesign (Autodesk CFD), with limited modeling capabilities is not suitable to perform large quantity of run-ups

▶ Following are the selected tools:



 Preliminary modeling was performed for few successful run-ups.

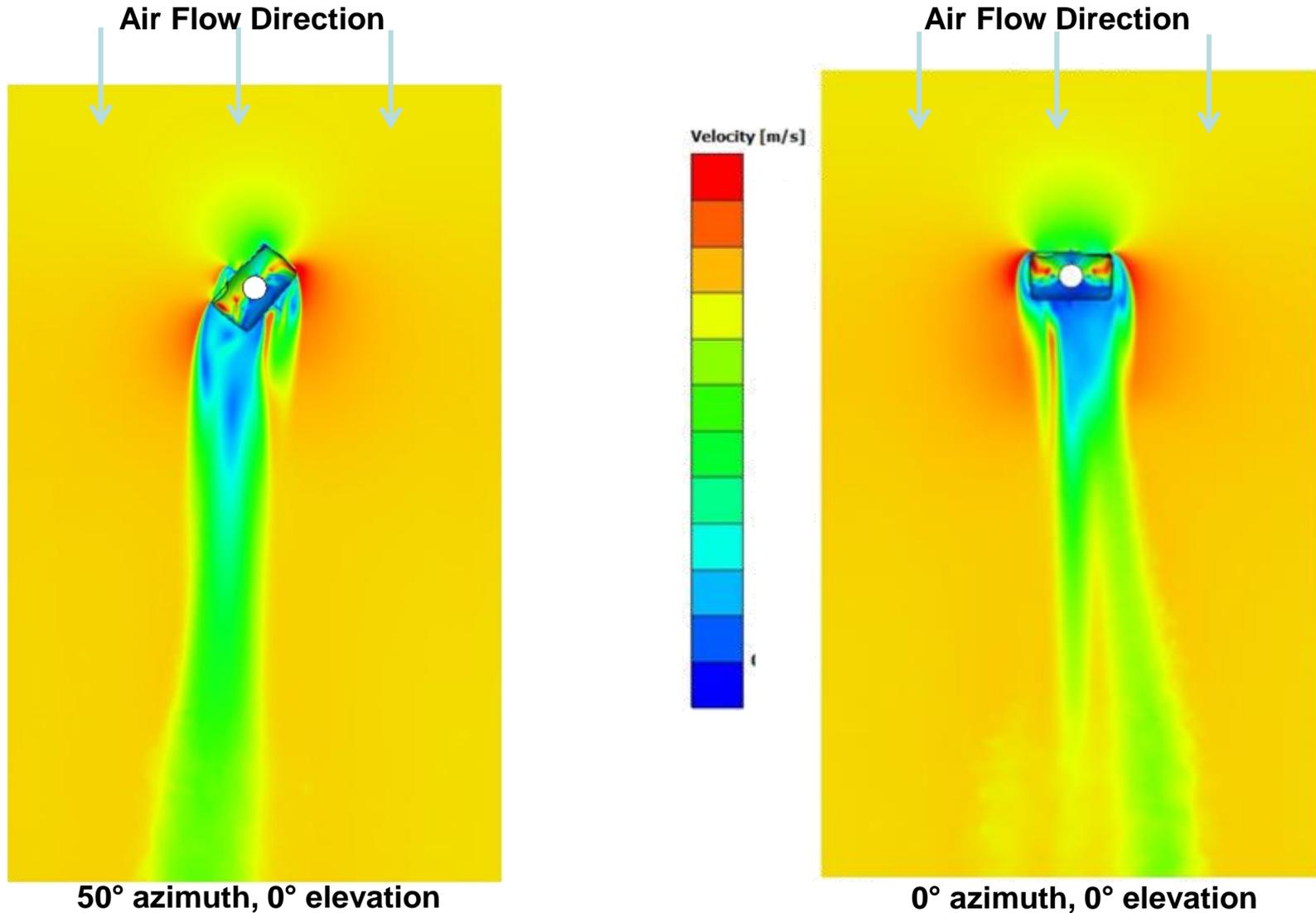
 After preliminary modeling, we used the automated ANSA modeling tool – “Batch Mesh”.

The use of Batch Mesh scenario enabled us an almost automatic modeling process for many different cases.

 With the help of the developed tool, we succeeded to perform more than 50 run-ups for different cases that combined different elevation and azimuth angles - in a month and half.

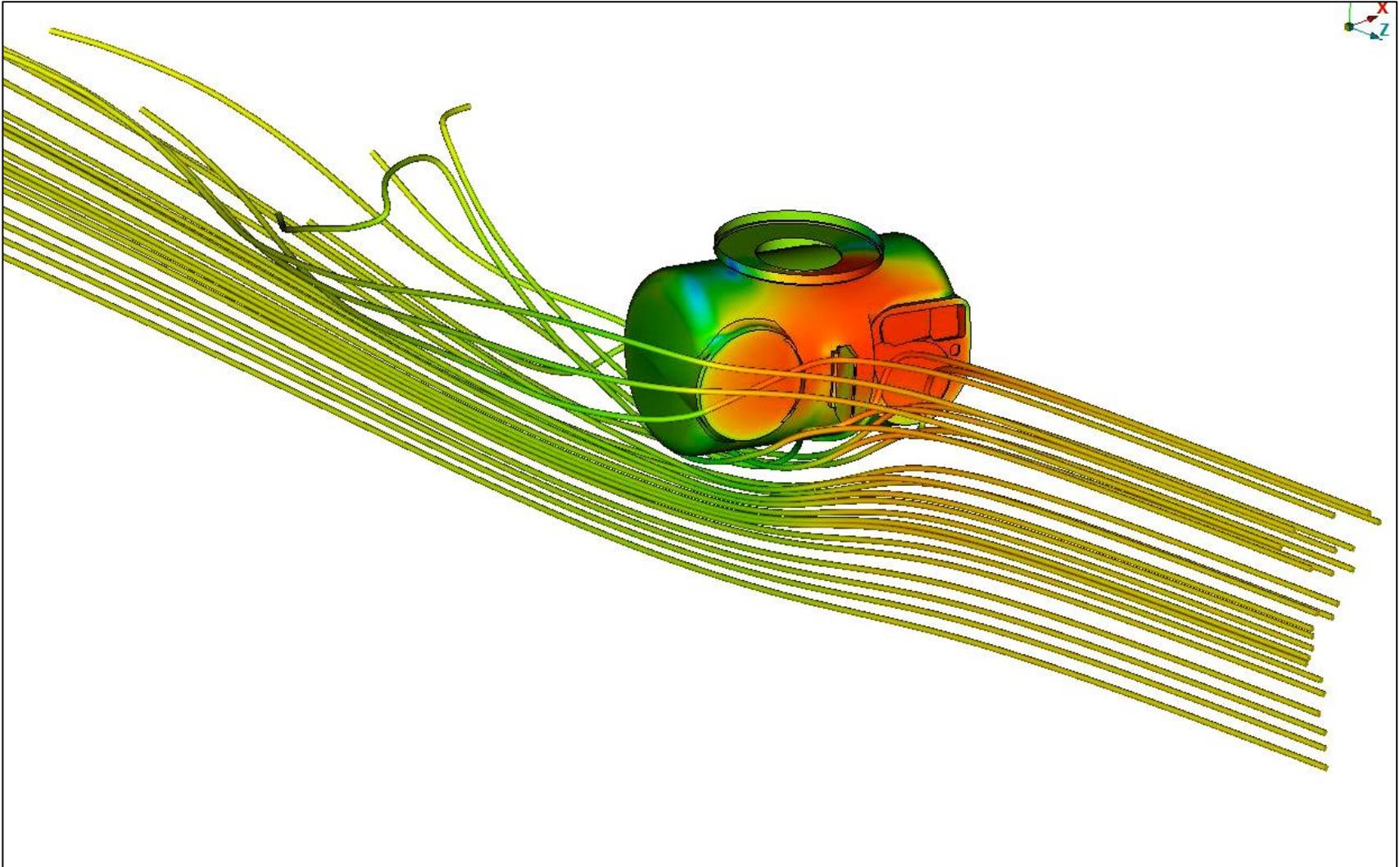
Results

Flow Distribution, Top View, Middle Cut View



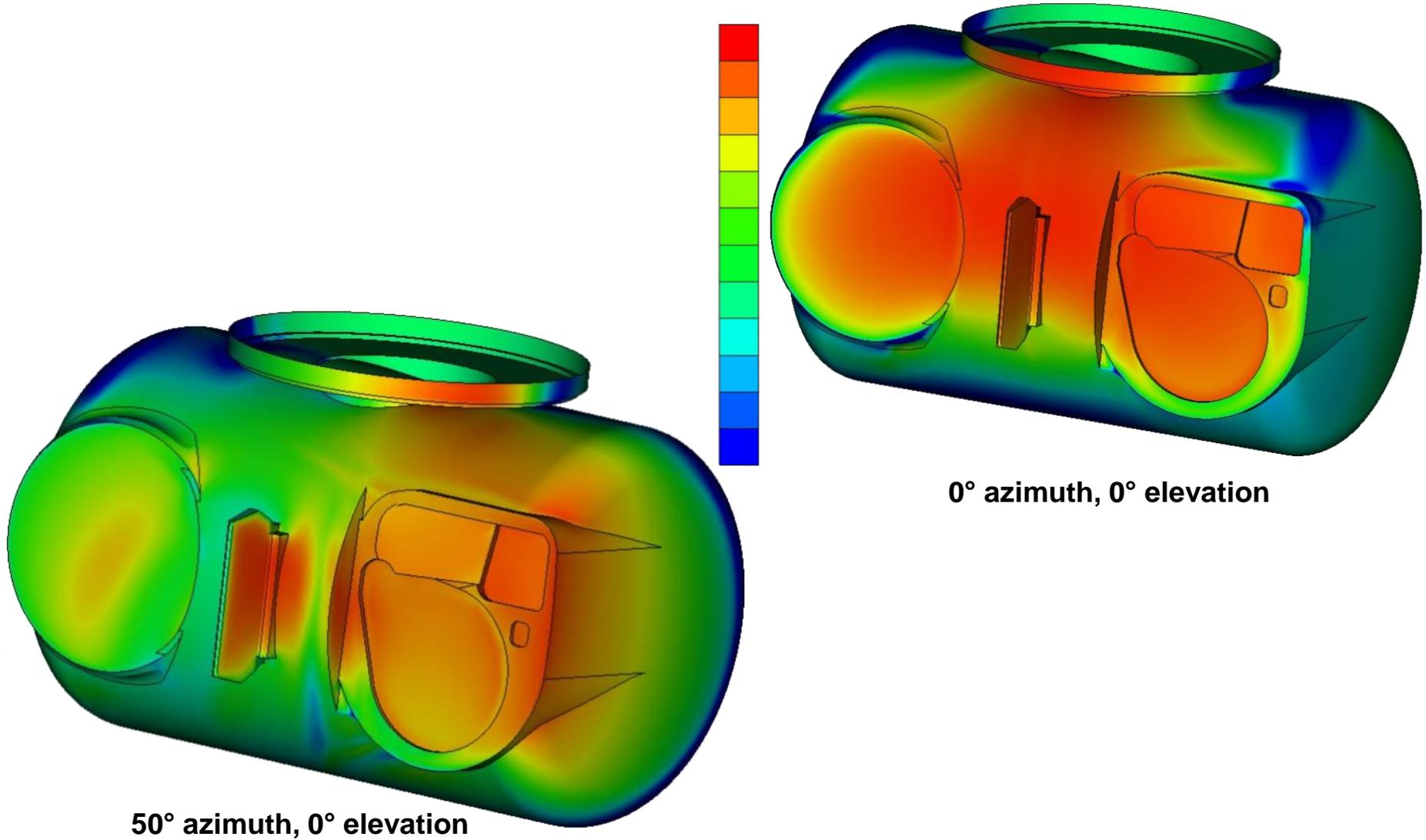
Results – con't

Flow lines around the Gimbal:



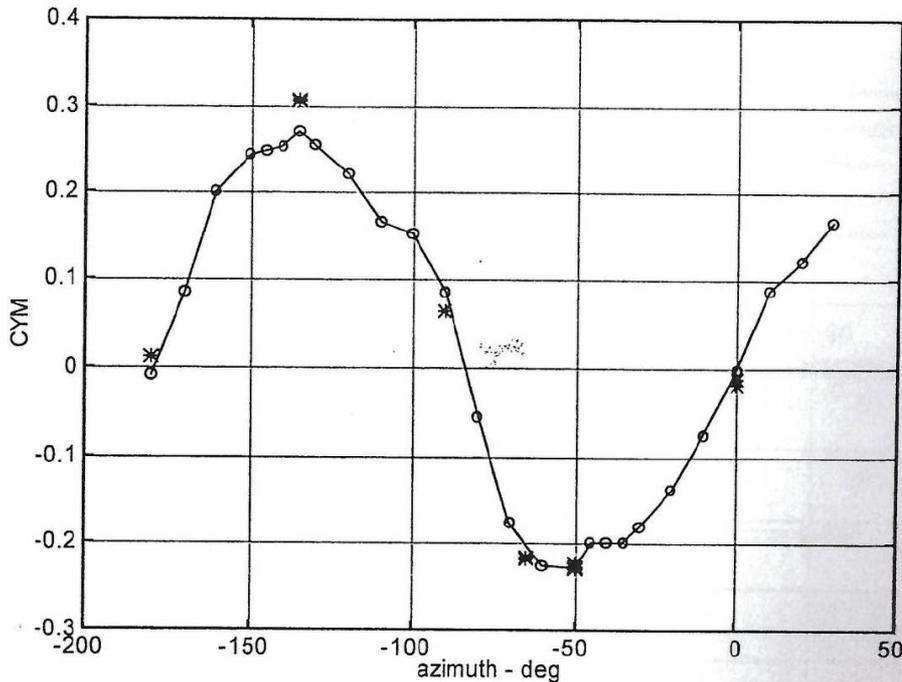
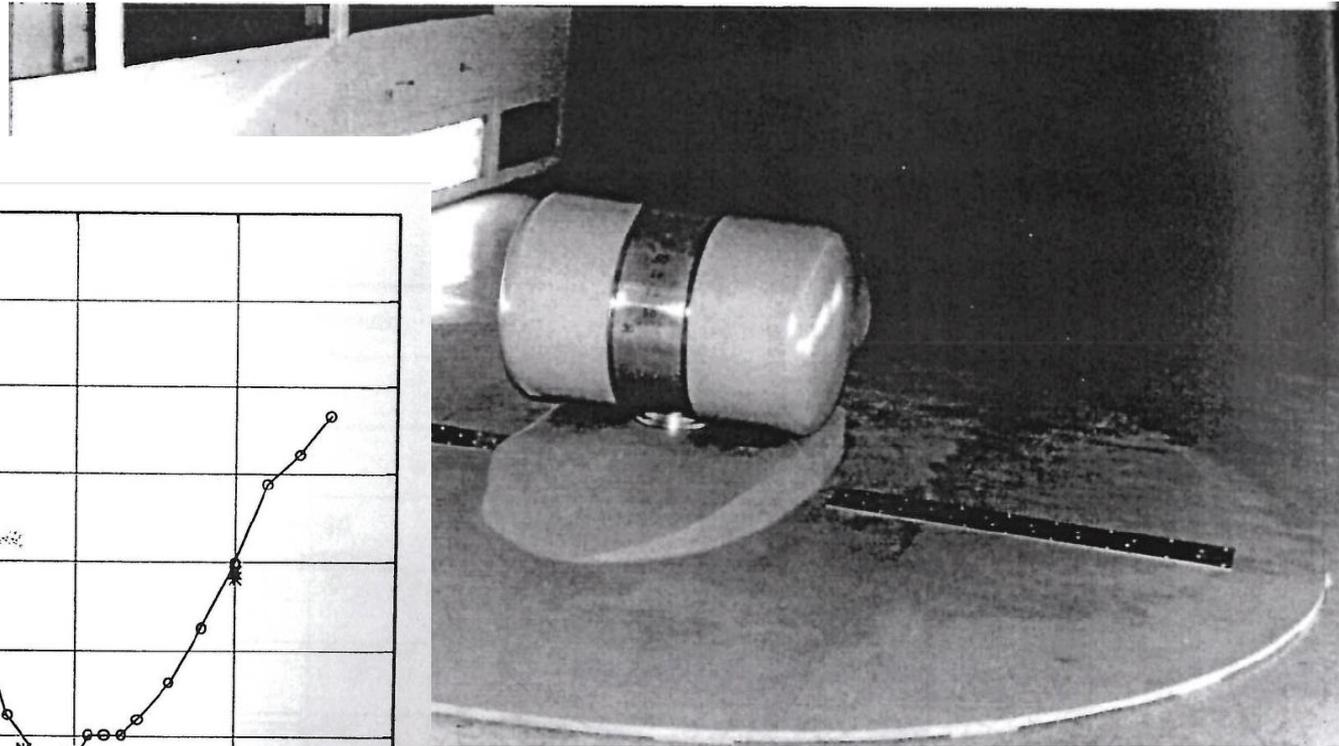
Results – con't

Pressure coefficient



Results – Can We Count On?

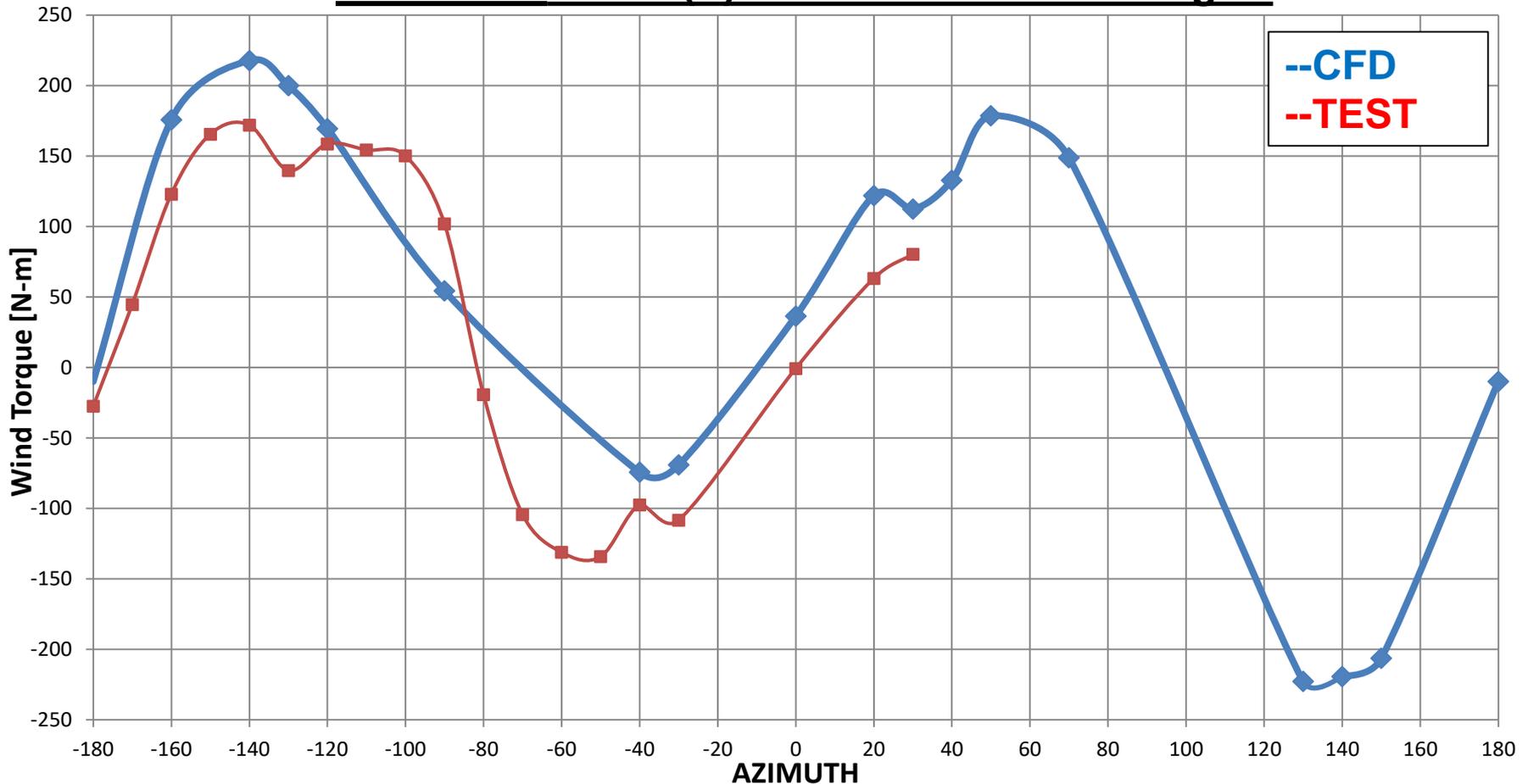
Comparison was done between CFD analysis and a wind tunnel test for a similar product



Results – con't

In order to validate analysis results, we compared between wind tunnel test and the analysis results performed for current project.

Rotation Moment (Y) at different Azimuth angles



- ▶ **Complicated project with demanding schedule**
- ▶ **More than 50 different analyses were performed**
- ▶ **With the help of ANSA automatic modeling tool (batch mesh), we succeed to shorten the CFD analysis task within the project from ~4 months to 1.5 months**
- ▶ **The comparison to the wind tunnel test for the similar product, helped us to validate the analysis results.**

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Thank You