SIMULATION PROJECT

Project Title

Proposal

Client	Project ID
Client Name	PRJ-001

Author	Date	Version
Juan Ignacio Doval Roque	January 2025	v1.0

Simulation Proposal

Problem Statement

Define the Engineering Problem

What physical system is being analyzed?

What decision will this simulation support?

What is explicitly out of scope?

Objectives

ID	Objective	Measurable Target
O1		
O2		
O3		

Deliverables

Item	Description	Format
Geometry Variants	Number of configurations:	STEP / Parasolid
Simulation Results	Metrics:	CSV / Excel
Visualization	Contours:	PNG / MP4
Report	This document with results	PDF

Modeling Approach

Physics

- **Regime:** Steady / Transient
- **Turbulence:** k-ω SST / k-ε / Laminar
- **Compressibility:** Incompressible / Compressible
- **Energy:** Isothermal / Conjugate Heat Transfer
- **Multiphase:** No / VOF / DPM

Domain

- **Dimensionality:** 2D / 3D
- **Symmetry:** None / Half / Quarter
- **Mesh Type:** Poly-Hexcore / Tetrahedral
- **Target y^+:**
- **Approx. Cell Count:**

Assumptions & Limitations

Assumptions

1.
2.
3.

Limitations

- Not suitable for certification
- Not a substitute for testing
- Expected accuracy: ±X% on key metrics

Schedule & Acceptance

Timeline

Kickoff:

First Results:

Draft Report:

Final Delivery:

Acceptance Criteria

- ◯ All runs converged (residuals < 1e-5)
- ◯ Mesh independence verified
- ◯ Results reviewed with client
- ◯ Final report delivered

Project Traceability

Version History

Version	Date	Changes	Author
v1.0		Initial proposal	JDR
v1.1			
v2.0			

Decision Log

Purpose: Record all modeling decisions with rationale for future reference and client transparency.

ID	Date	Decision	Rationale	Impact
D1		Turbulence model: k-ω SST	Industry standard for separated flows	Medium
D2				
D3				
D4				
D5				

Issue Tracker

ID	Date	Issue	Resolution	Status
I1				Open / Closed
I2				

Client Communication Log

Date	Type	Summary / Action Items
	Email / Call / Meeting	

Model Definition

Geometry

Source & Processing

- **Source:** Client CAD / Parametric / Public
- **Original Format:**
- **Defeaturing:**
- **Simplifications:**

Key Dimensions

Characteristic Length:

Inlet Diameter:

Domain Extent:

Insert geometry image / schematic here

Mesh

Parameter	Value	Notes
Element Type		Poly-Hexcore / Tet / Hex
Total Cell Count		
Inflation Layers		
First Layer Height		For target y^+
Growth Rate		Typically 1.2
Surface Mesh Size		Min / Max

Mesh overview

Boundary layer detail

Physics Setup

Category	Setting	Value / Choice
Solver	Software	
	Precision	Double / Single
	Solver Type	Pressure-Based / Density-Based
Flow	Regime	Steady / Transient
	Turbulence Model	
	Near-Wall Treatment	Enhanced / Standard
Fluid	Material	
	Density	
	Viscosity	
Energy	Equation	On / Off
	Thermal BC	

Boundary Conditions

Boundary	Type	Value	Notes
Inlet	Velocity / Mass Flow		
Outlet	Pressure		
Walls	No-Slip	—	
Symmetry	Symmetry	—	

Verification & Convergence

Residual Convergence

Equation	Target	Achieved	Status
Continuity	1e-5		◯ / ◯
X-Momentum	1e-5		
Y-Momentum	1e-5		
Z-Momentum	1e-5		
Energy	1e-6		
Turbulence (k)	1e-5		
Turbulence (ω/ε)	1e-5		

Residual plot

Monitor Convergence

Quantity	Location	Final Value	Variation (last 100 iter)

Mesh Independence Study

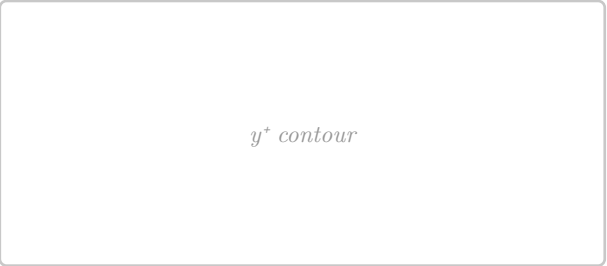
Mesh	Cells	Key Metric	Δ from Fine	Selected
Coarse				
Medium				
Fine		—	—	✓

Grid Convergence Index (GCI)

- Refinement ratio (r):
- Order of convergence (p):
- GCI: % (target < 5%)

y^+ Verification

Surface	y^+ (avg / max)
Wall 1	
Wall 2	

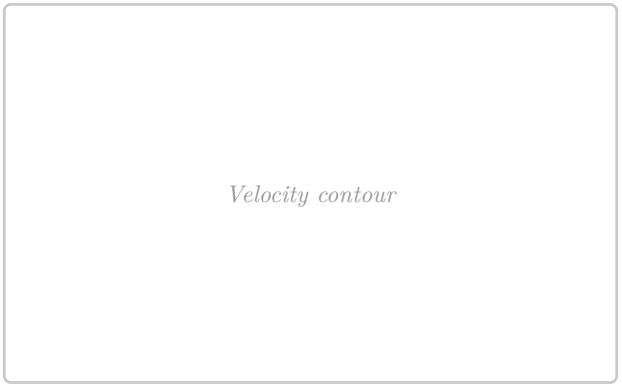


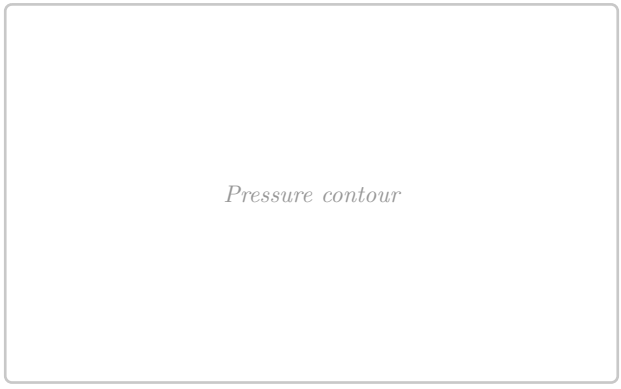
Results

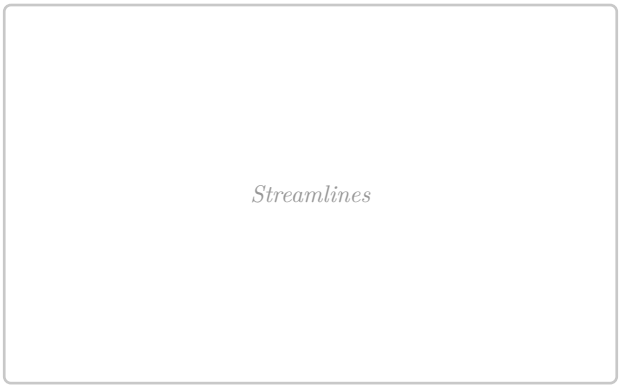
Key Performance Indicators

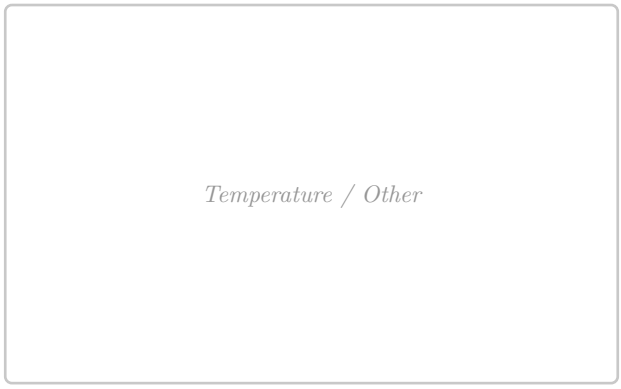
Metric	Unit	Baseline	Case 1	Case 2	Case 3
Pressure Drop (Δp)	Pa				
Mass Flow Rate	kg/s				
Max Temperature	°C				
Uniformity Index	—				

Visualization









Observations

Key Findings

1.
2.
3.

Engineering Interpretation

Analysis

What the Results Mean

Explain in plain engineering language:

Dominant Physics:

Why Design X Outperforms Design Y:

Sensitivity:

Recommendation

Recommended Configuration

Design:

Expected Improvement:

Confidence Level: High / Medium / Low

Key Trade-offs:

Risks & Uncertainties

Risk	Likelihood	Mitigation
	Low / Med / High	

Next Steps

Recommended Follow-On Actions

- [ ]
- [ ]
- [ ]
- [ ] Experimental validation if required

Appendix

A. Solver Settings

Parameter	Value
Pressure-Velocity Coupling	SIMPLE / SIMPLEC / Coupled
Spatial Discretization (Pressure)	Second Order
Spatial Discretization (Momentum)	Second Order Upwind
Spatial Discretization (Turbulence)	Second Order Upwind
Under-Relaxation (Pressure)	
Under-Relaxation (Momentum)	
Time Step (if transient)	
Number of Iterations	

B. File Traceability

Purpose: Enable exact reproduction of results. Store files with version control (Git) or archive with hashes.

Type	Filename	Hash / Commit
Geometry		
Mesh		
Case File		
Results		
Post-Processing Script		

C. Reference Standards

- ASME V&V 20-2009: Standard for Verification and Validation in CFD
- AIAA G-077-1998: Guide for Verification and Validation of CFD Simulations
- ISO 9001: Quality Management Systems

D. Notes

Technical notes, observations, lessons learned