

Smoke Extractor Plant Flow Simulation at Max Efficiency Regime

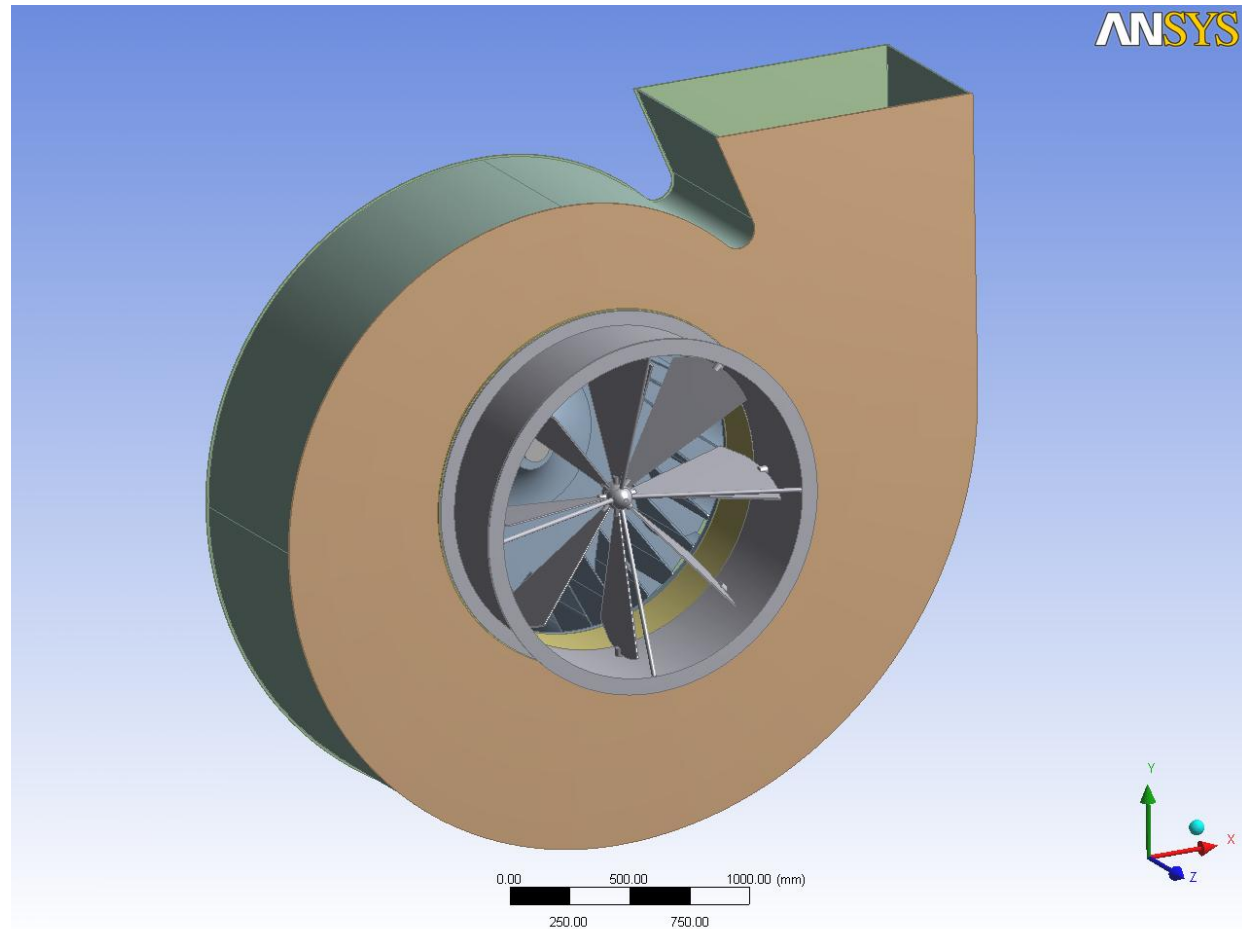
M.A. Starodubtsev

CAE SERVICES

Moscow 2008

Problem Description

- Geometry was Supplied by Customer in “Parasolid” Format
- Work Conditions:
Rotor Revolution Rate
740 [rev/min],
Air Consumption
157760[m³/hour]
- Guide Vane Angle 10°
- Pressure Head and Plant Efficiency are to be Find

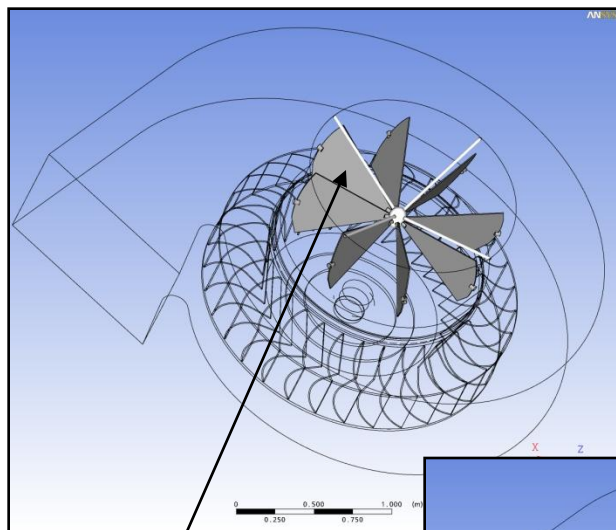


Solution Steps

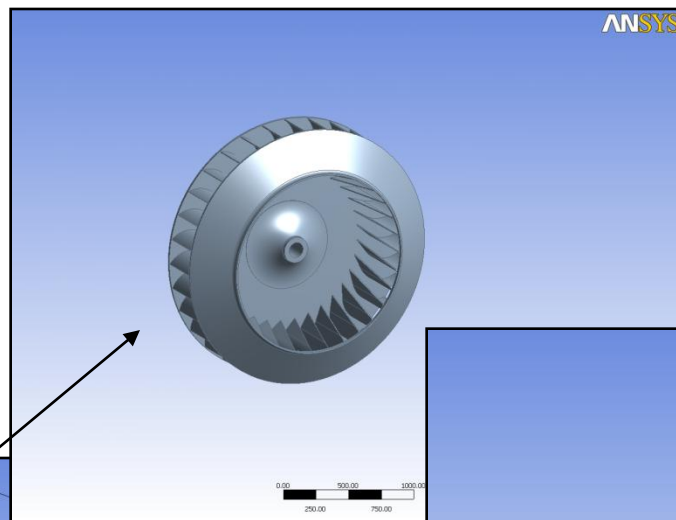
- Computational Domains Construction (Based on Supplied Geometry)
- Mesh Building by ANSYS \ ICEM CFD Hexa + Tetra
- Problem Setup with ANSYS \ CFX Pre
- Problem Solution with ANSYS \ CFX Solver (8 Nodes Cluster)
- Result Presentation ANSYS \ CFX Post

WORKBENCH ONLY

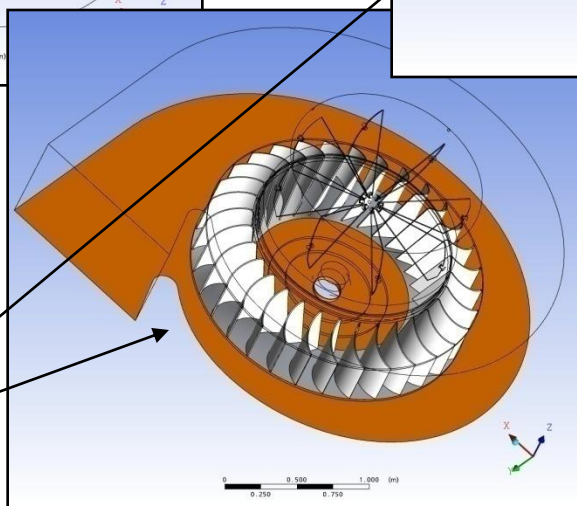
Geometry Model



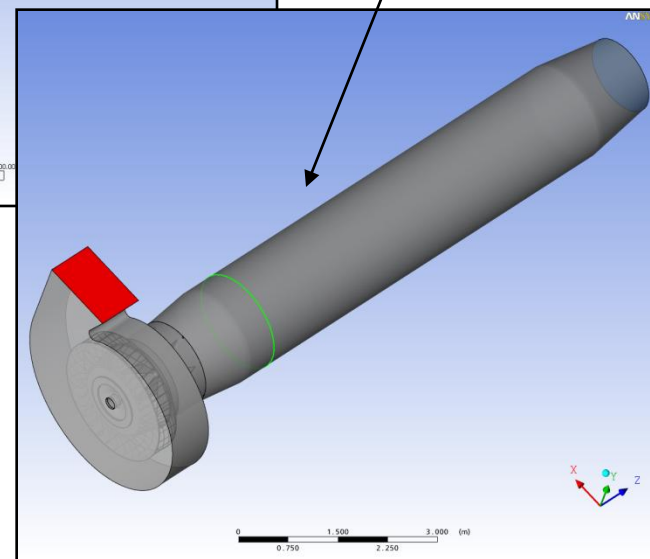
Guide Vanes



Rotor Wheels

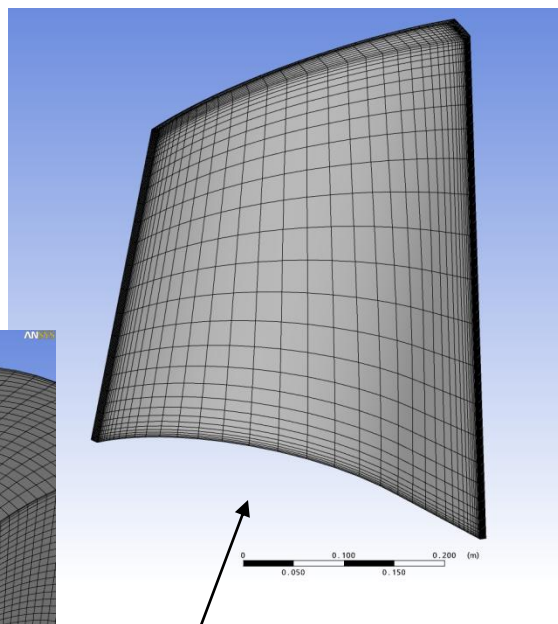
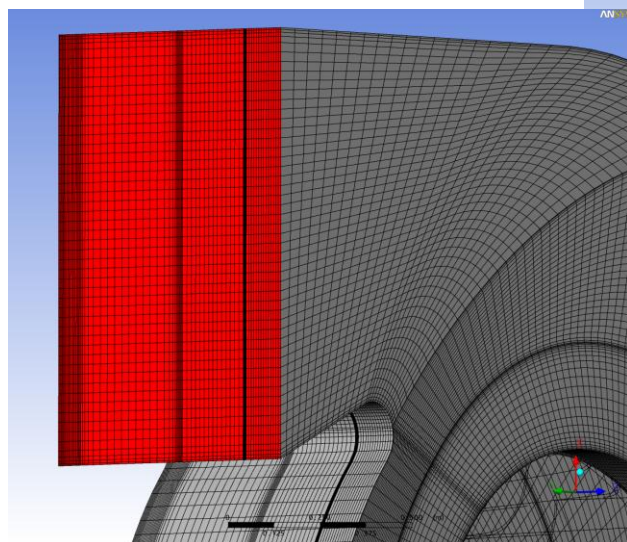


Supply Channel
& Smoke
Extractor Plant



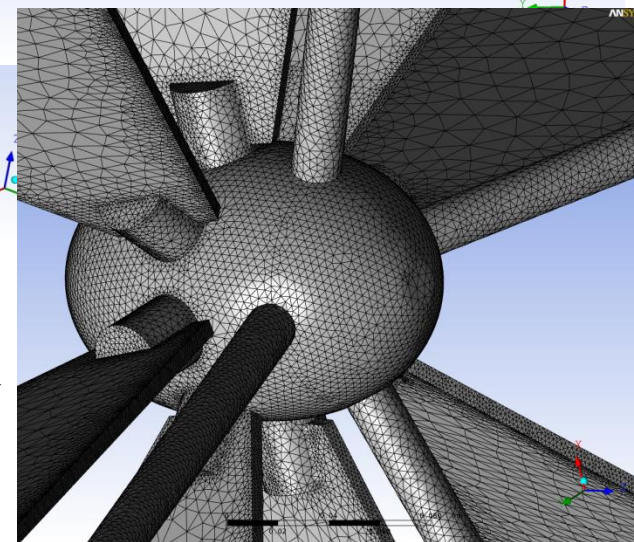
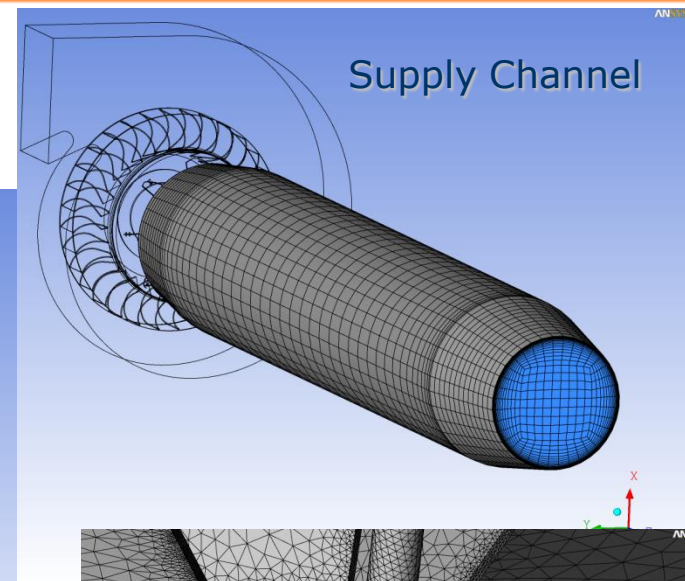
Mesh Model

- Hybride Mesh:
- Hexa = 4.6mln.
- Tetra = 5.4mln.
- Pyra = 2325
- Nodes = 6.3mln.

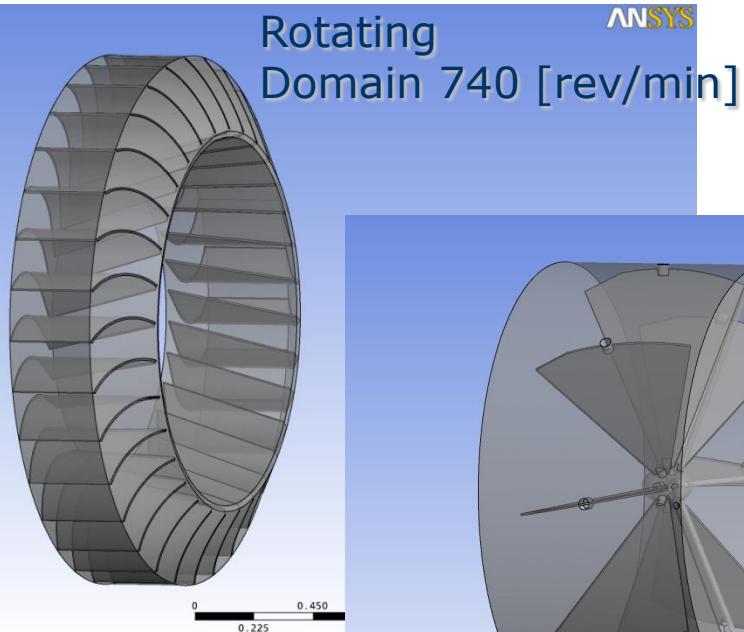


Rotor Blade

Guide Vanes

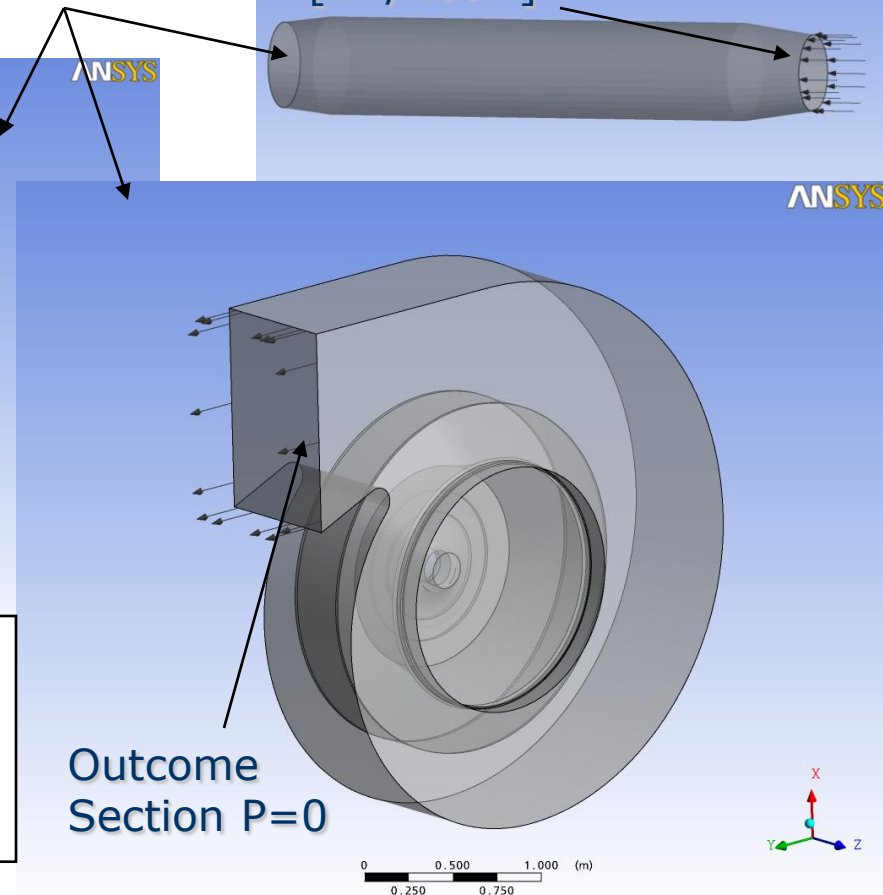
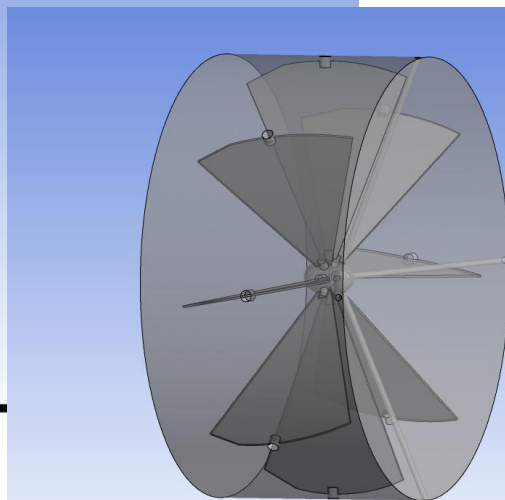


Problem Setup



Situational Domains

Incoming Section: Air
20°C $Q=157766$
[m³/hour]



Equations: URANS
Turbulence Model: SST

Domain's Interfaces:

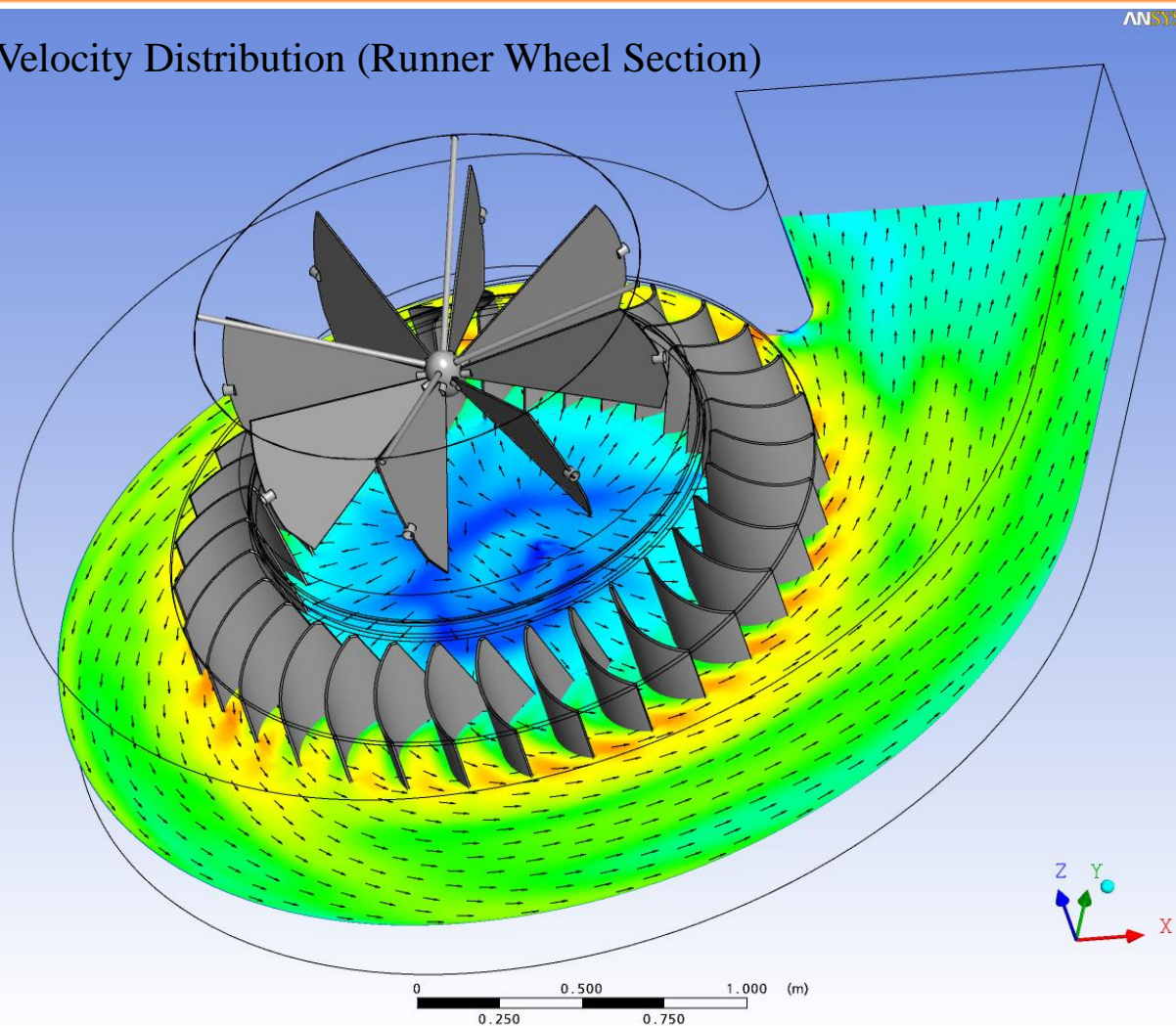
2 Interfaces "Transient Rotor-Stator"

2 Interfaces "Stator-Stator GGI"

Outcome
Section $P=0$

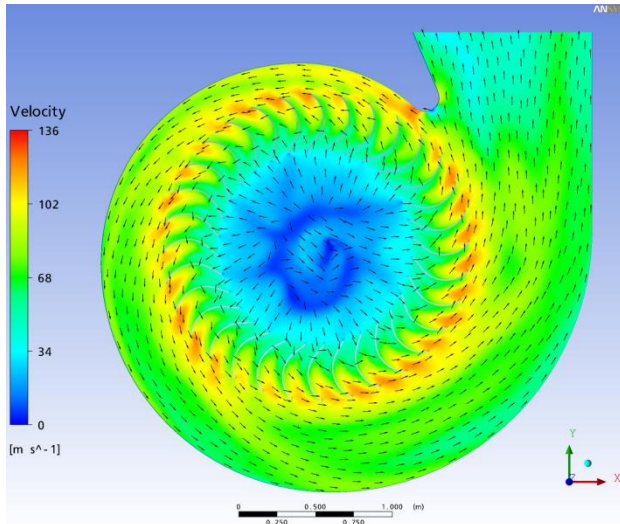
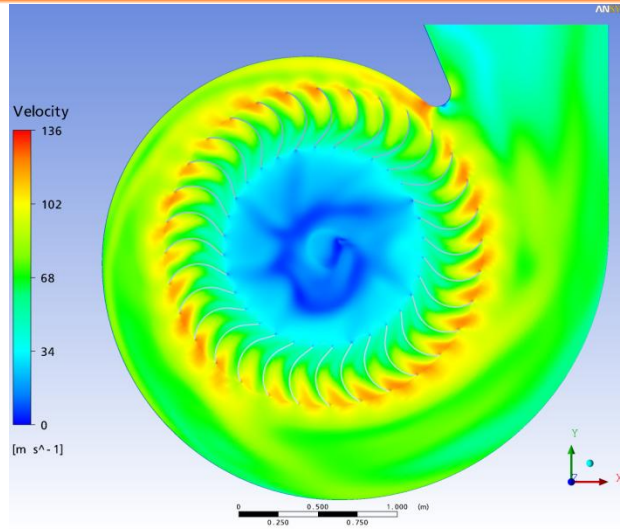
Simulation Results

Velocity Distribution (Runner Wheel Section)



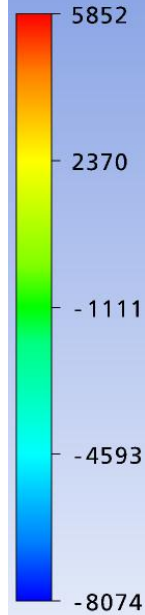
- Head: 7240 [Pa]
- Torque: 5175 [N*m]
- Efficiency: 79%
- Gap Leakage: 0.76%

Simulation Results



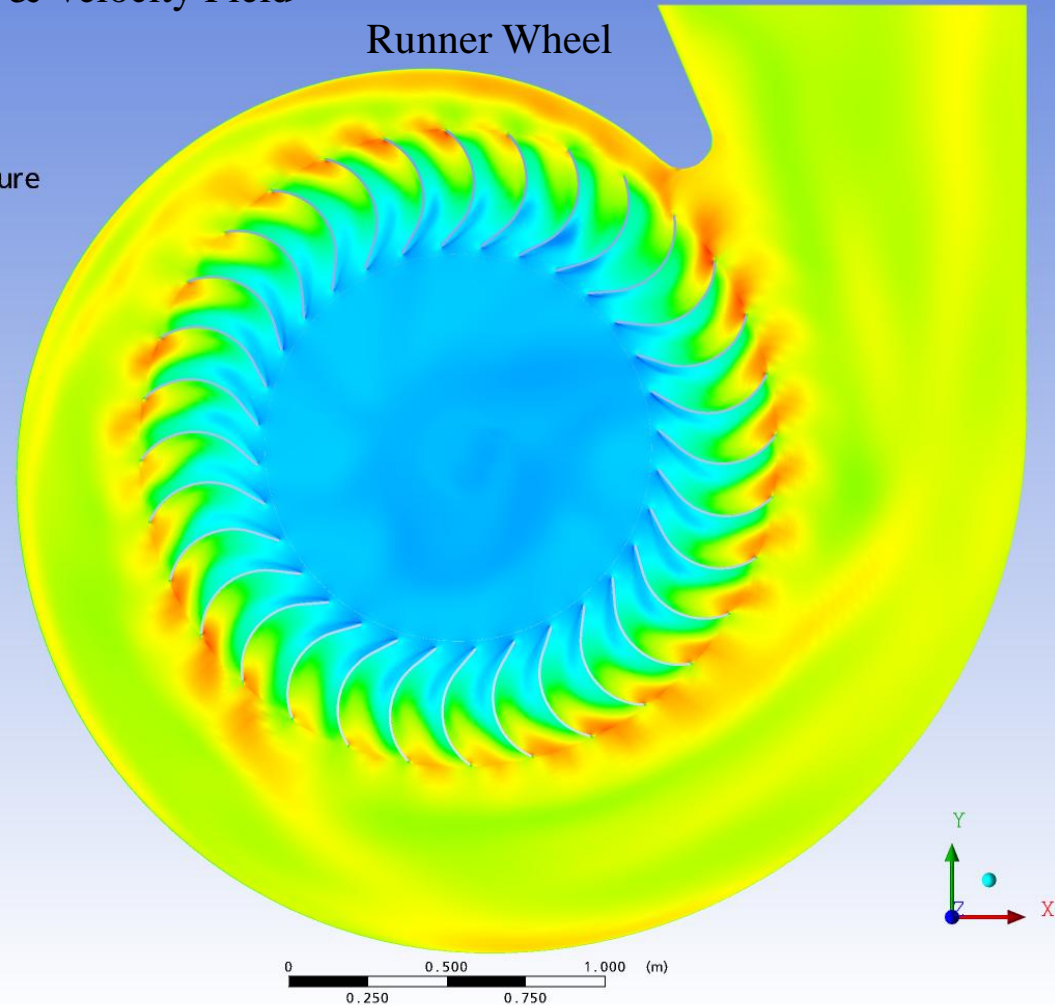
Pressure & Velocity Field

Total Pressure

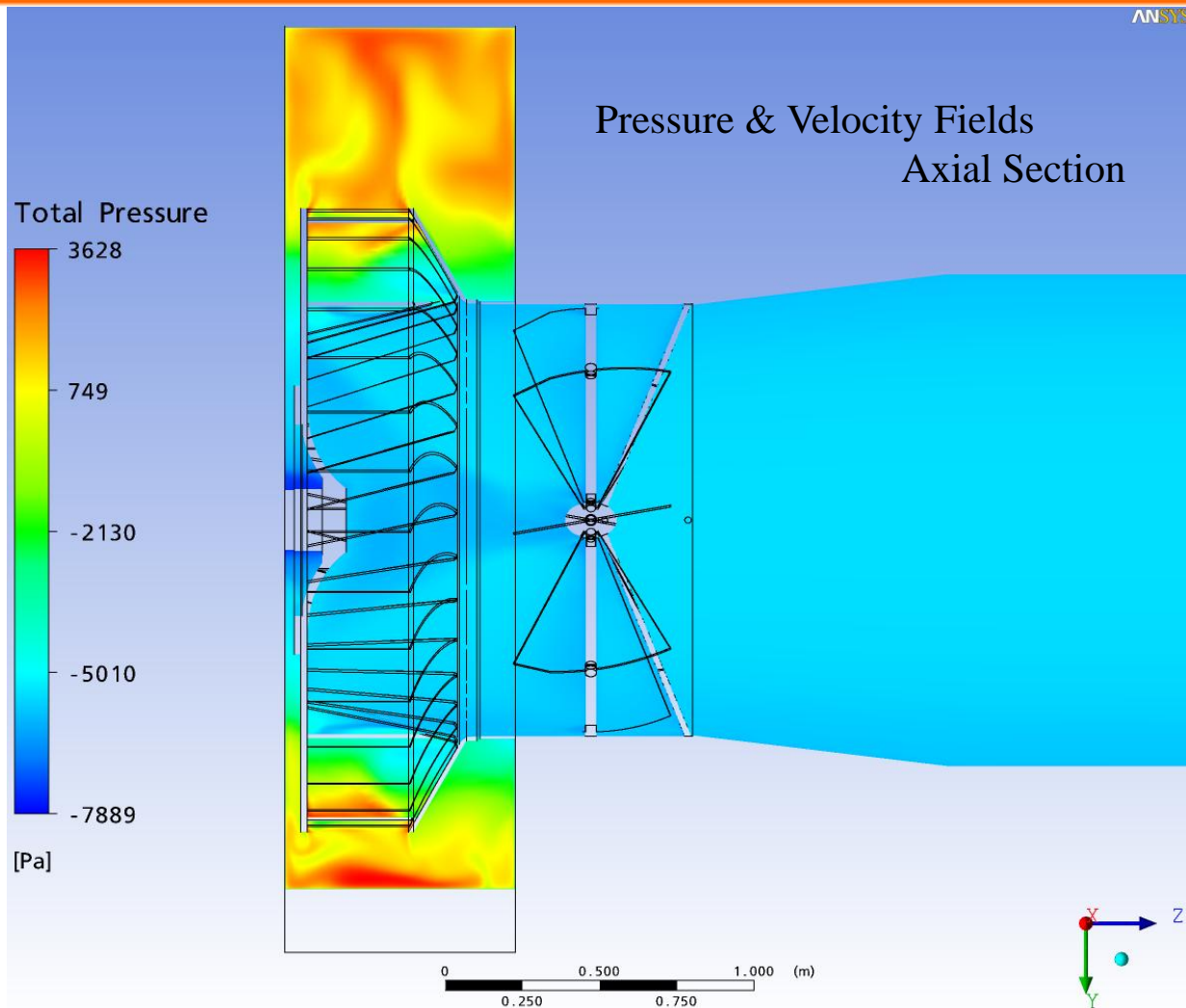
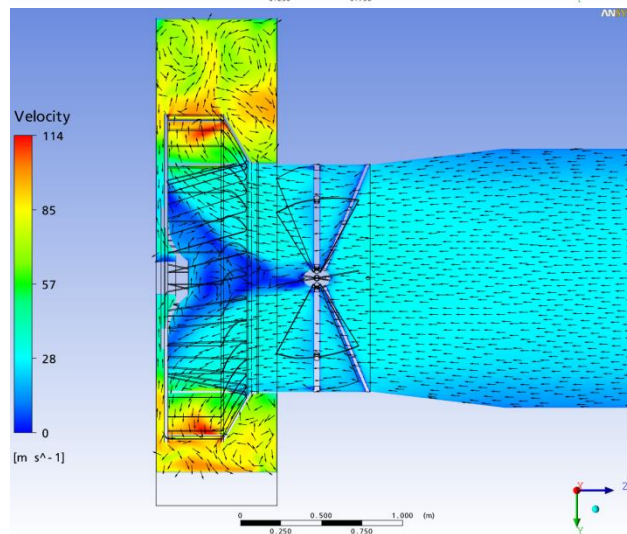
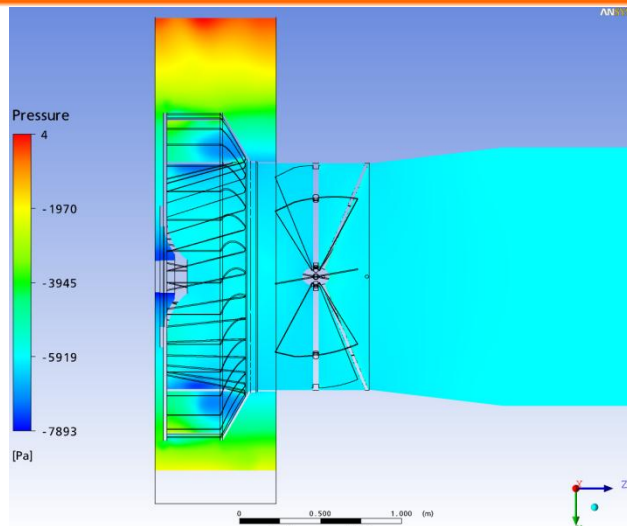


[Pa]

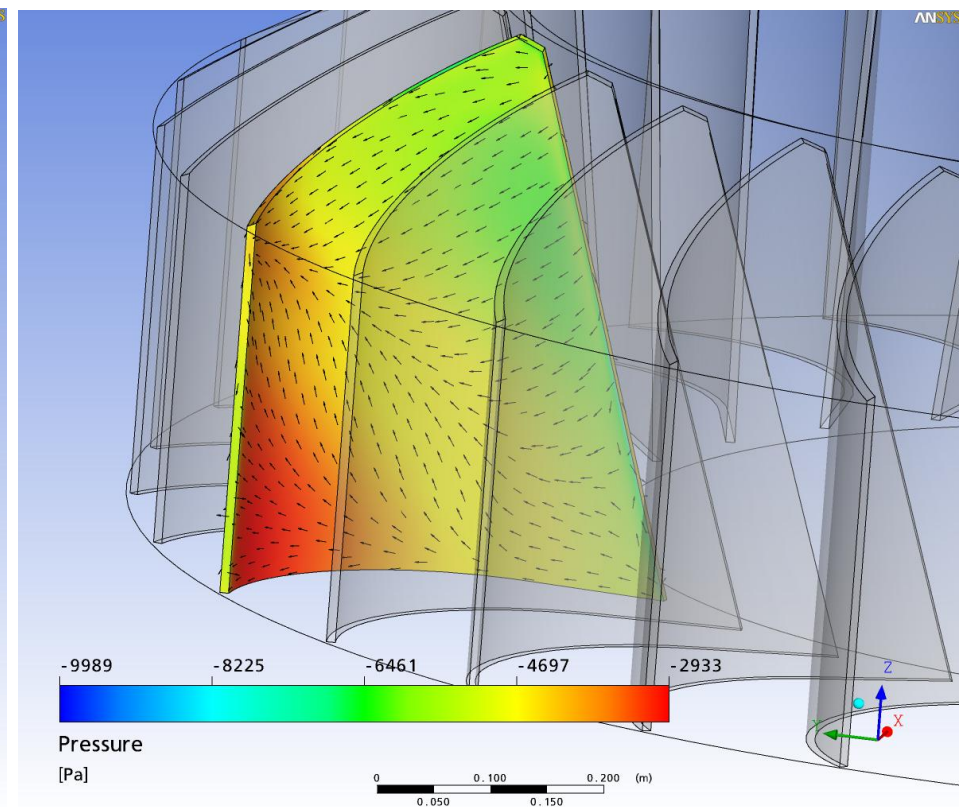
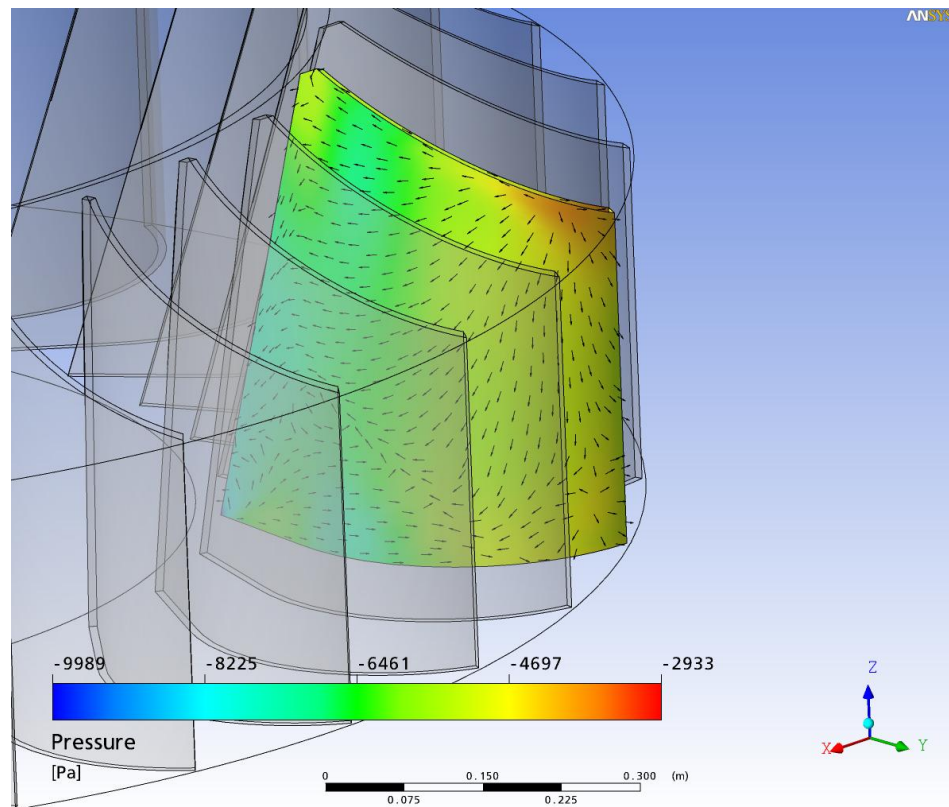
Runner Wheel



Simulation Results

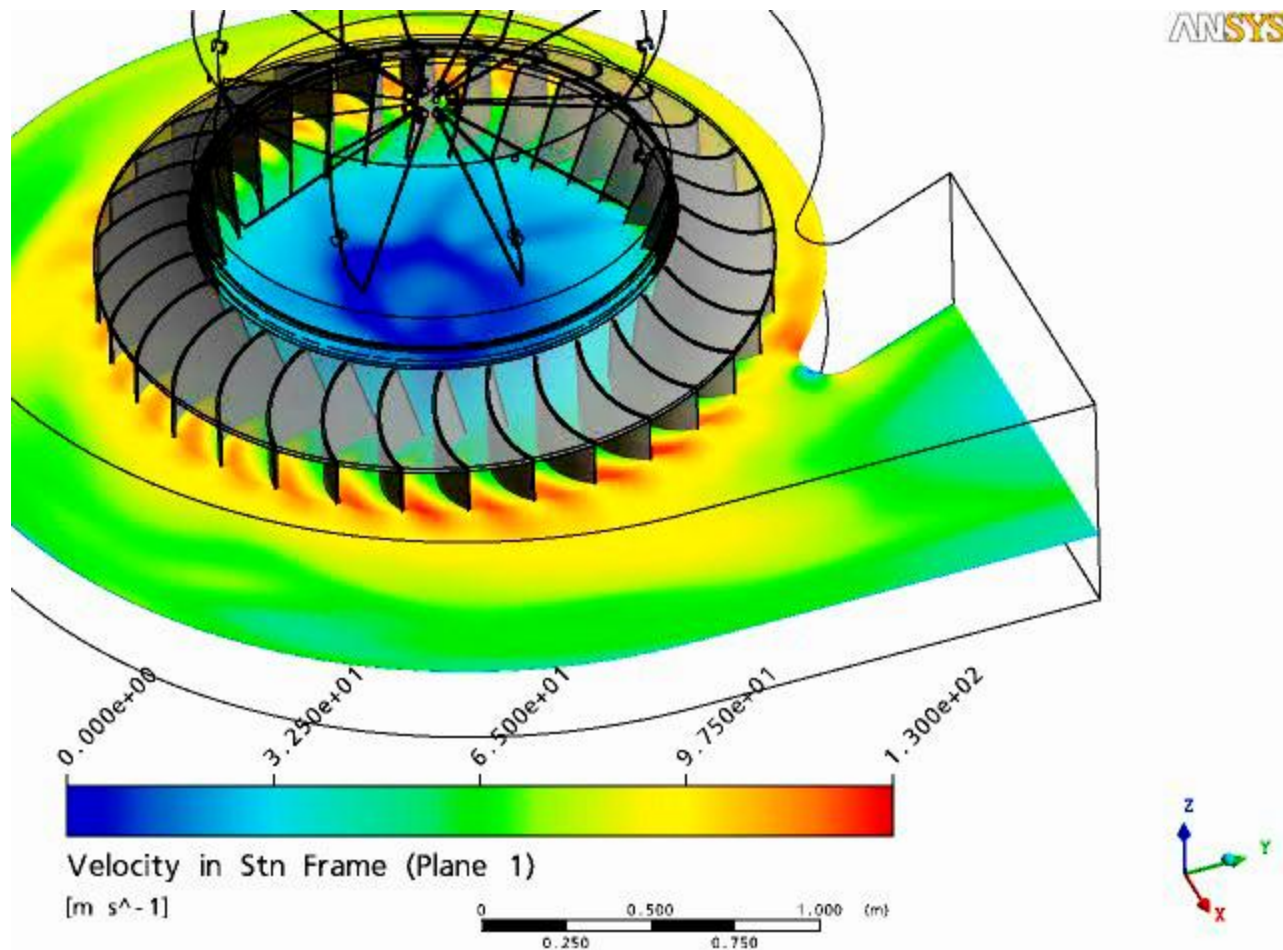


Simulation Results

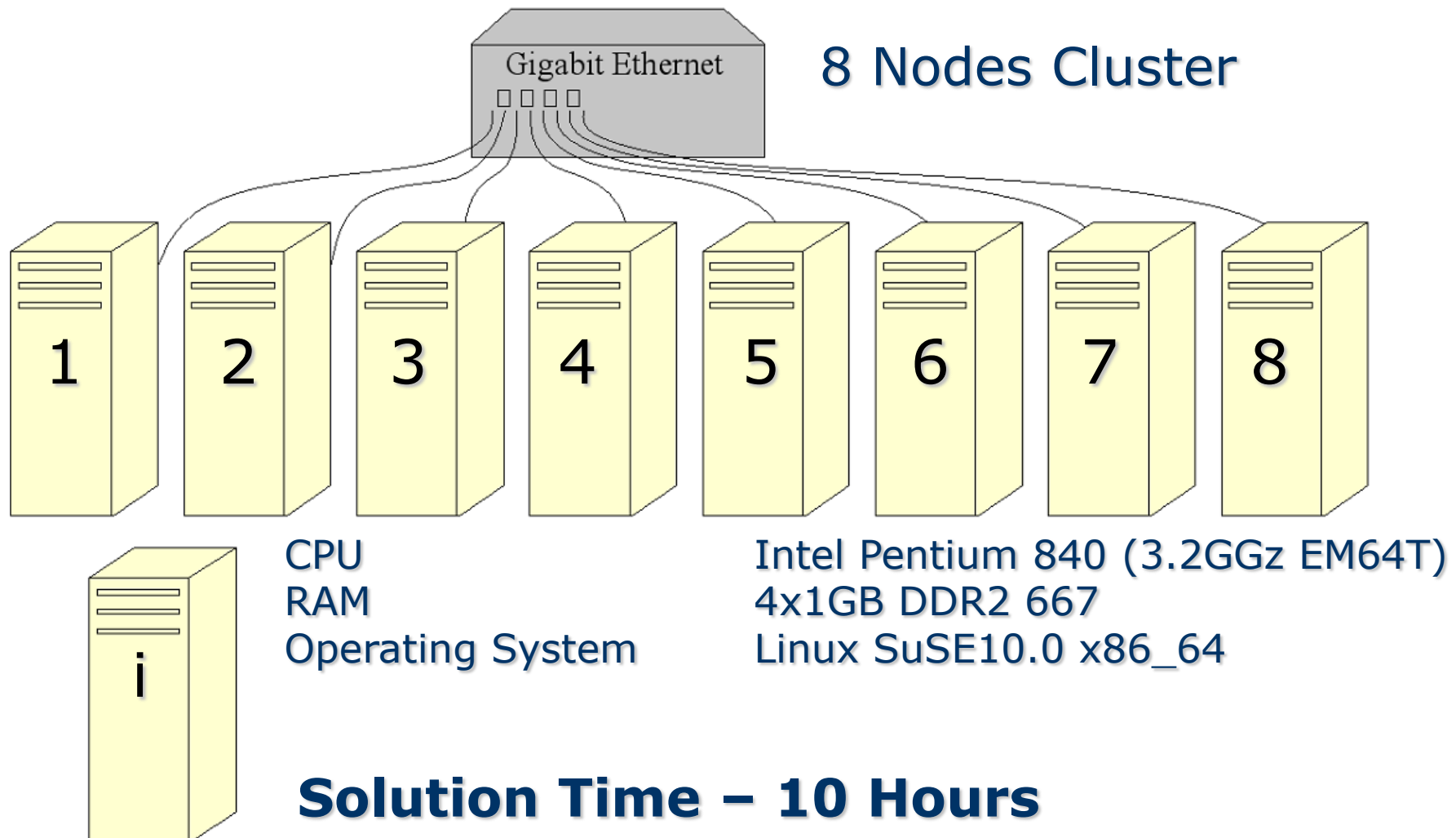


Pressure Distribution & Shear Stress Vectors along Blade Surface

Simulation Results (Movie)



Computing System



CAE SERVICES

- 107497, Moscow, Shelkovskoe Shosse, 77/79, Office 405
- Phone: (+7 495) 913-2300, 468-8175, 460-4722
- E-mail: info@cae-services.ru
- <http://www.cae-services.ru>