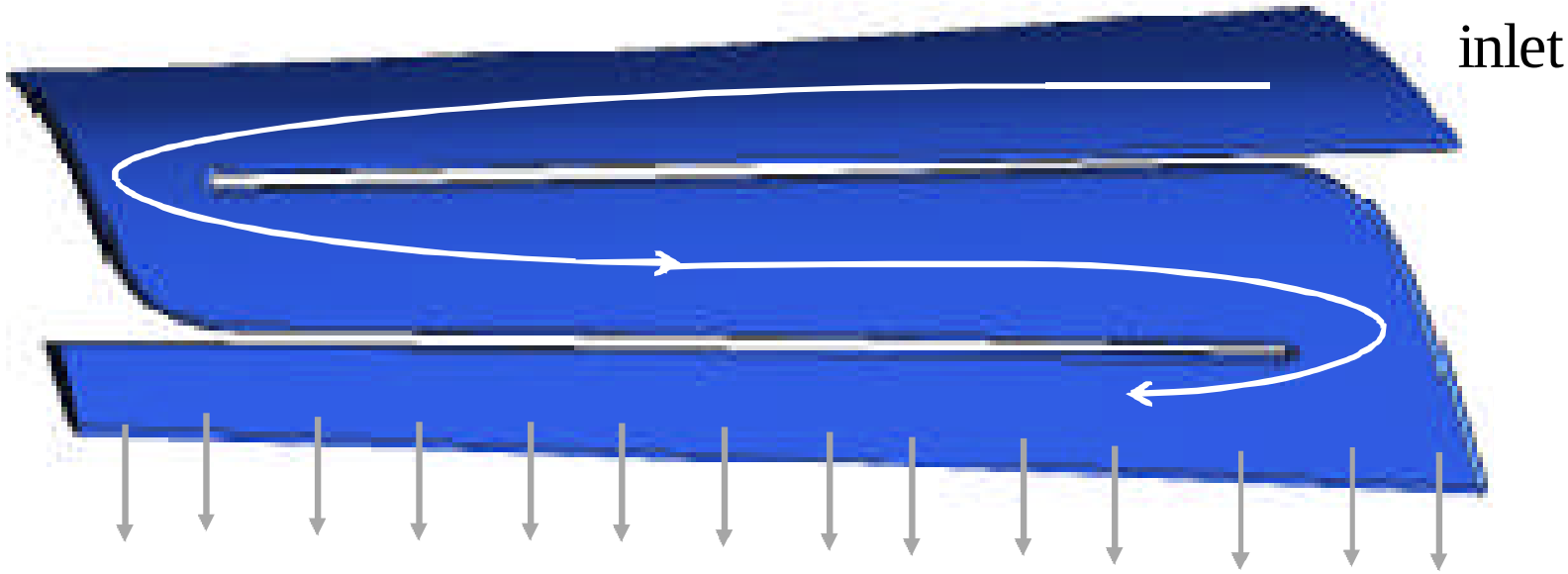
UTSR Project

Industrial Gas Turbine Vane Internal CFD

July 28, 2012

Garret Vo

My role: CFD analysis to evaluate turn-losses in the three-pass serpentine design for the inlet vane



Summary for the initial geometry

-Multiple areas create problems for the geometry to be meshed.

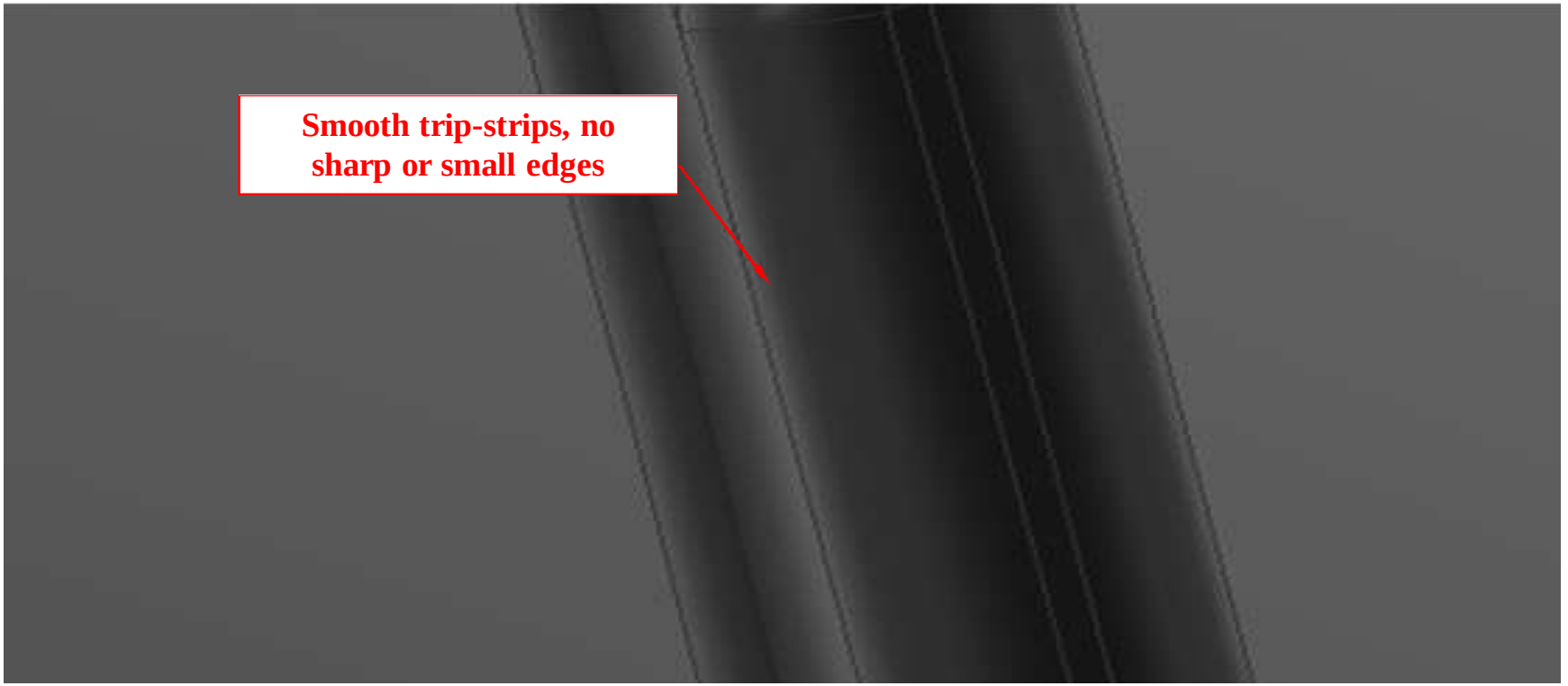
- Significant amount of manual repair for the geometry before it is meshed for CFD analysis

Process improvement for the CFD geometry

1) Determine optimal geometry for meshing software.

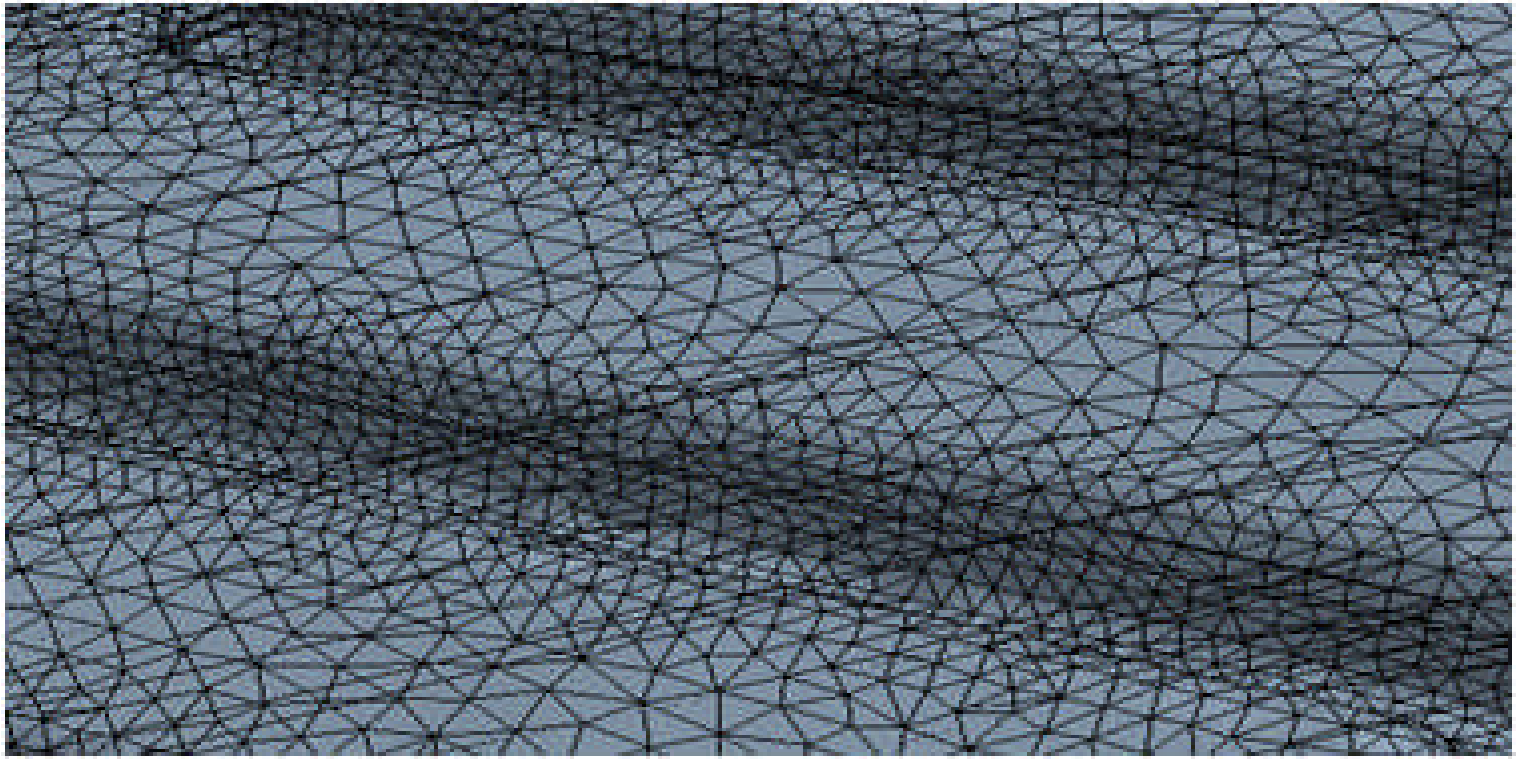
2) Automate geometry creation process to reduce manual operations.

Better Geometry
Sharp edges are eliminated and analyzed geometry more realistically represents the hardware.

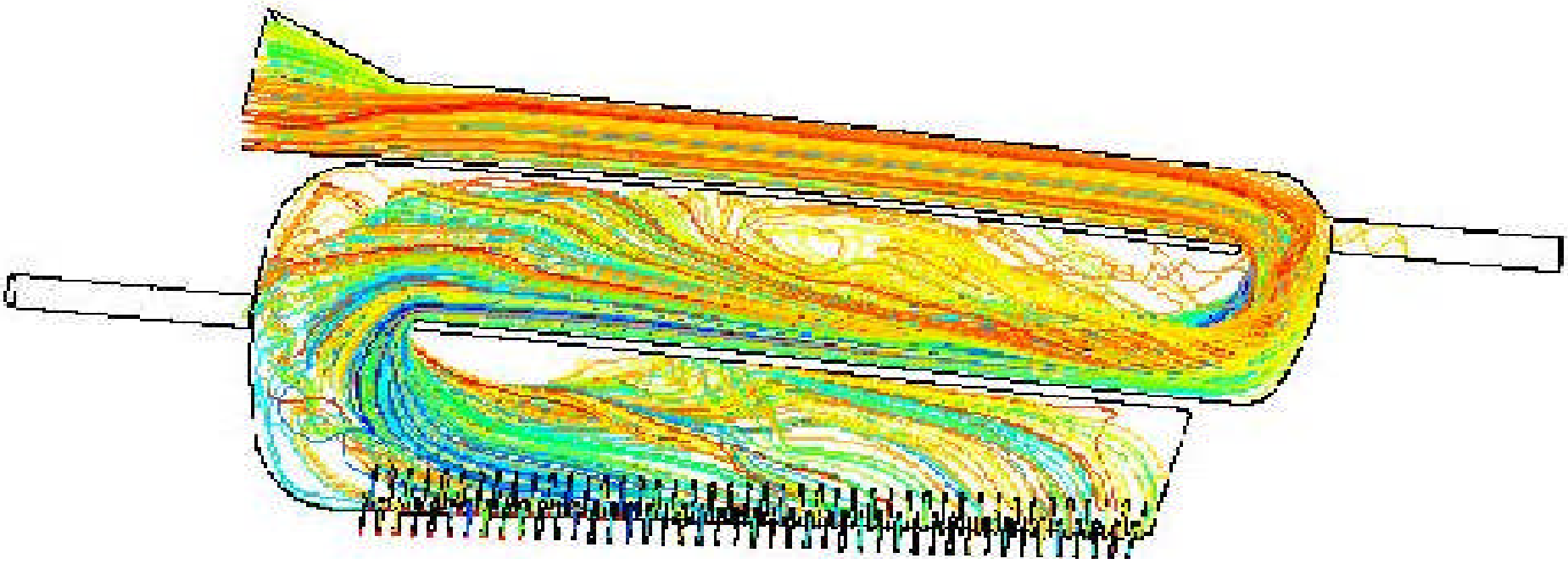


BETTER MESH

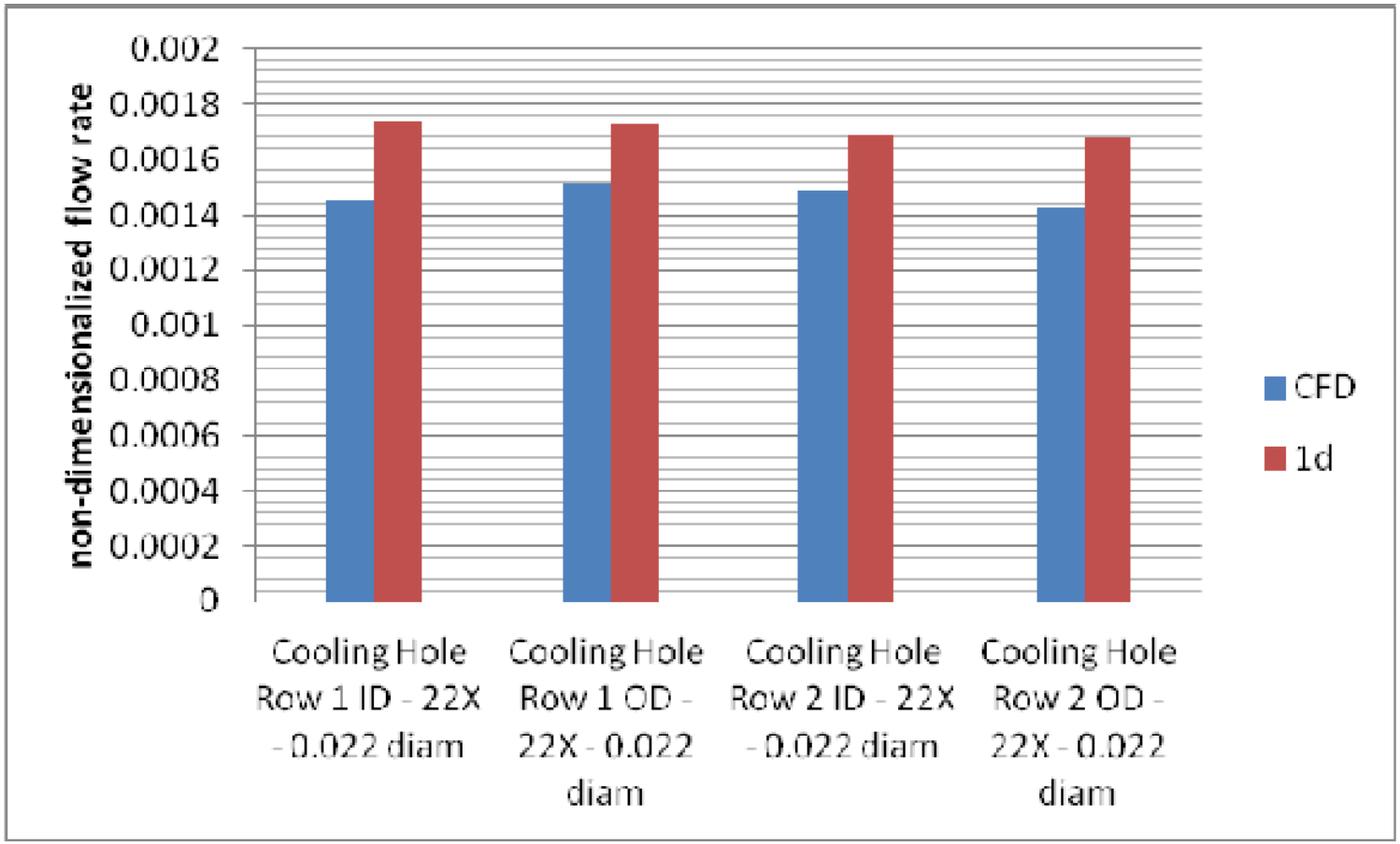
Mesh is refined around trip and includes more than 10 elements across each trip strip.



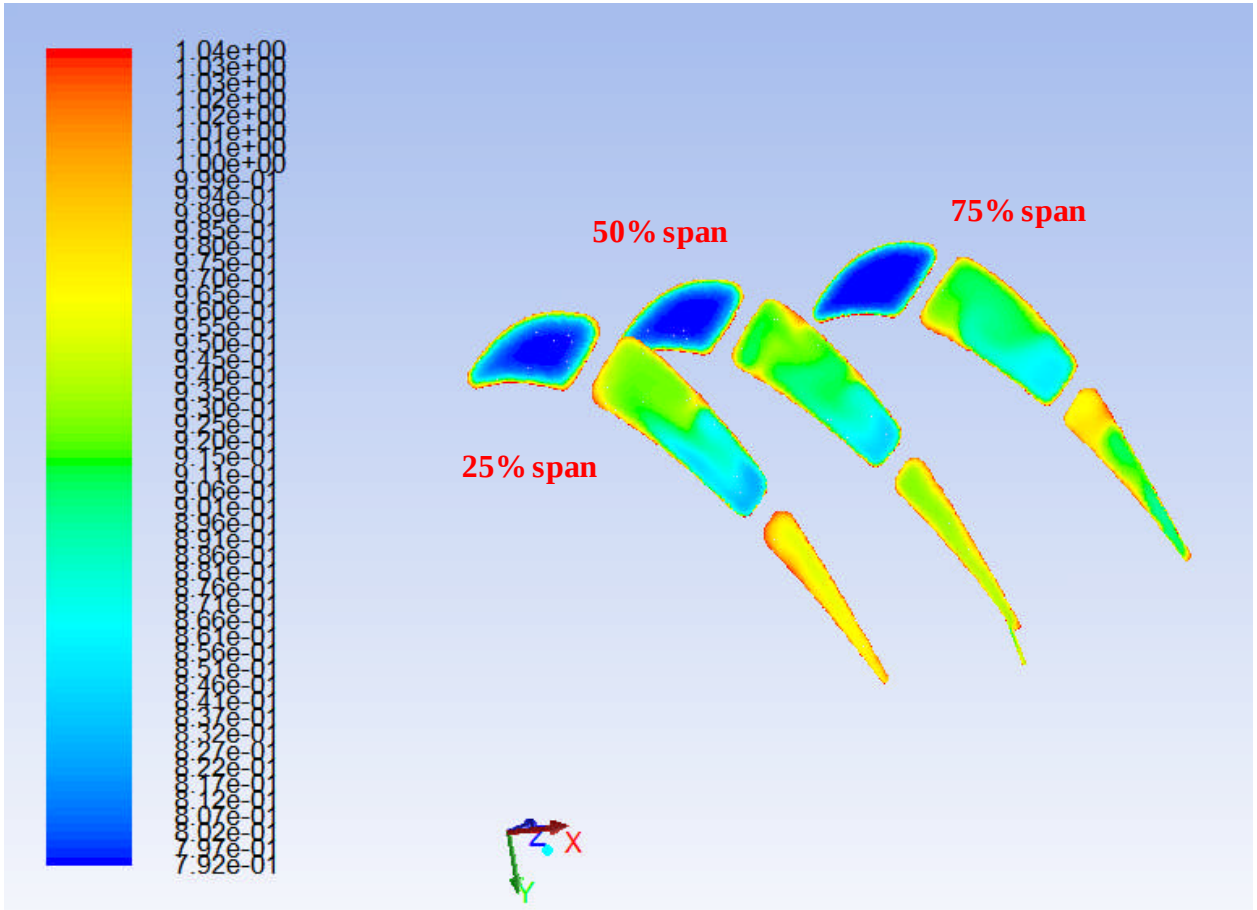
Flow Visualization for no trip strips geometry
The flow is well-distributed in third up-pass cavity.
No major problem areas found.



Mass Flow Rate Level

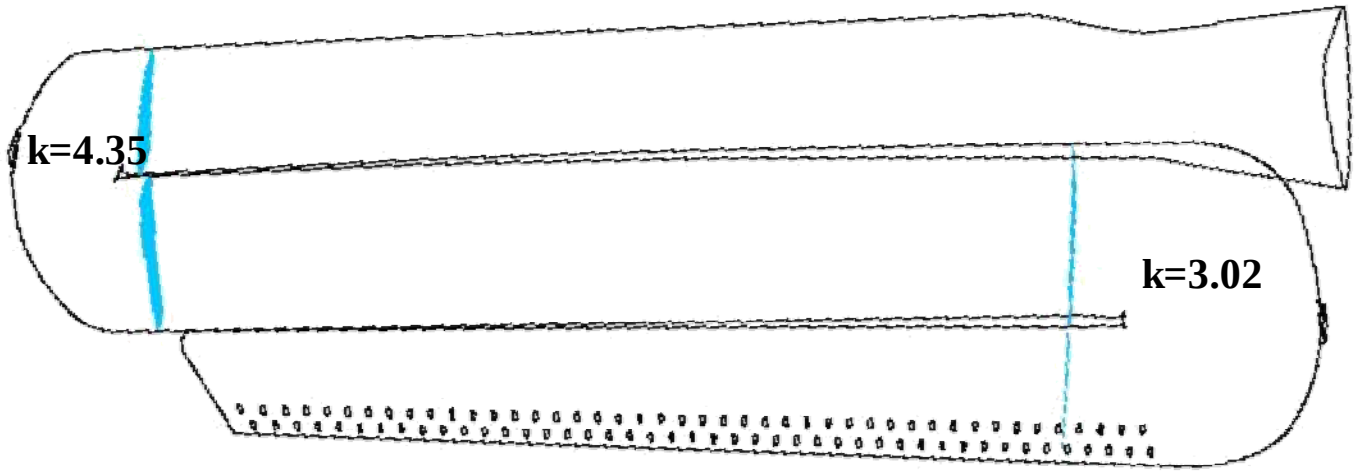


Temperature



Turning losses

$$\Delta P = k_{turning\_loss} * \frac{\rho V^2}{2}$$



Future Work

- ***Compare the CFD calculated turning loss with the 1D assumption.***

- ***Evaluate CFD model that includes trip strips.***

- ***Develop automated process for generating CFD friendly internal vane/blade geometry.***