

HPC Data-Center Cooling Performance and Design

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Introduction

Cooling performance and design in a data-center is critical to its successful operation. There are many contributing factors to the efficiency and effectiveness of the cooling in data centers, both in the design phase, and in the post-analysis to determine and improve performance. The visualization covers the Holland Computing Center's (HCC) data-center cooling design and various ways cooling is affected.

Goals and Objectives

- Visualize airflow of the current data center structure
- Visualize air flow of the prior structure and modifications
- Compare designs to optimize airflow and cooling performance of the datacenter in a simulation environment.

Software and Simulation Parameters

Design: Autodesk Fusion 360

Simulation: Autodesk CFD

Server Racks: 30-35 Racks with 7000W of heat output and 800ft³/hr of airflow

CRAC Units: 14000-15500ft³/min of airflow with a setpoint of 60.1F

Procedure

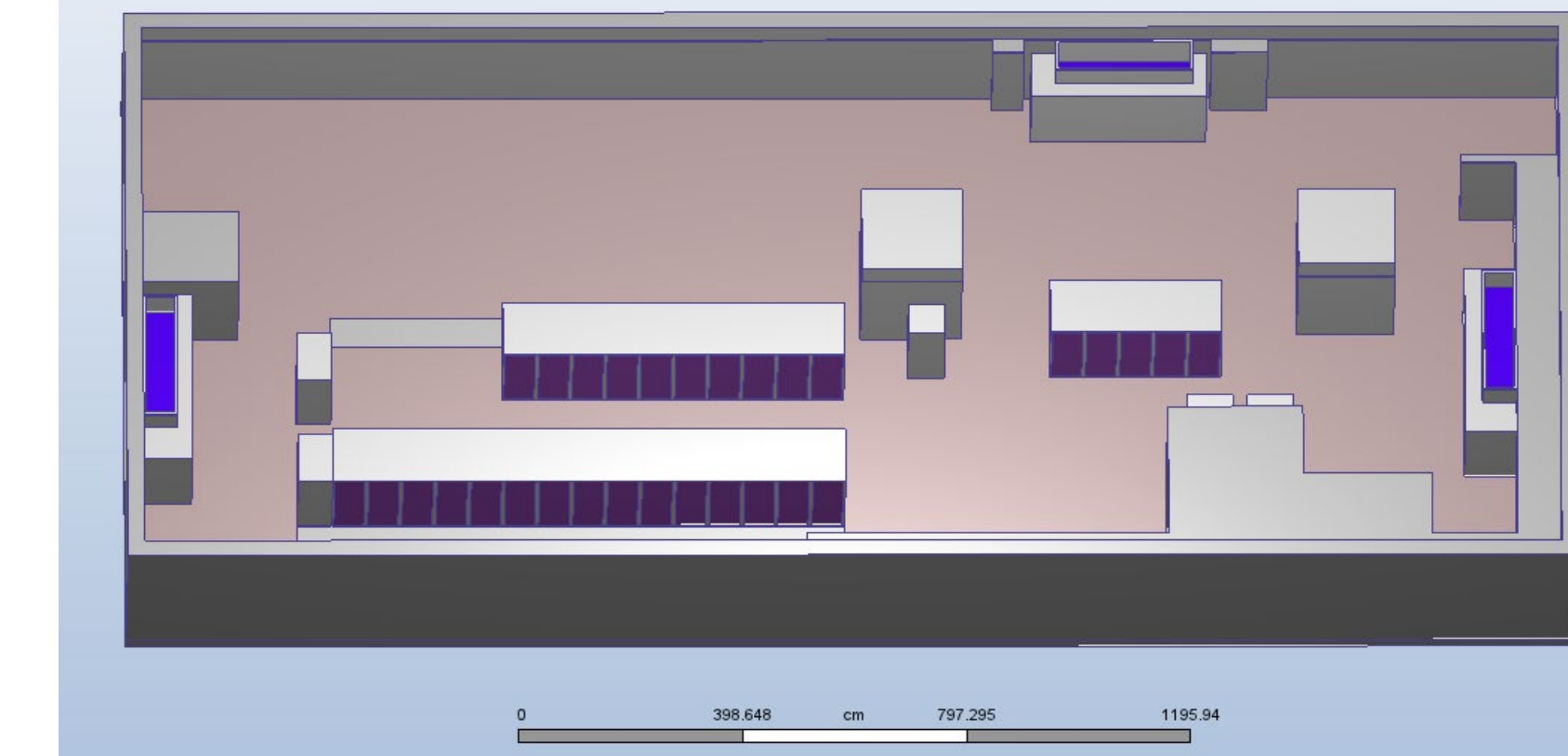
For the testing of airflow changes, each of the designs was tested using the defined parameters in Autodesk CFD. The results were then saved and later analyzed. The analysis looked at the shifts in airflow from each of the different designs.

The regions focused on were the ends of the hot aisle and on the current version, where the five racks were removed.

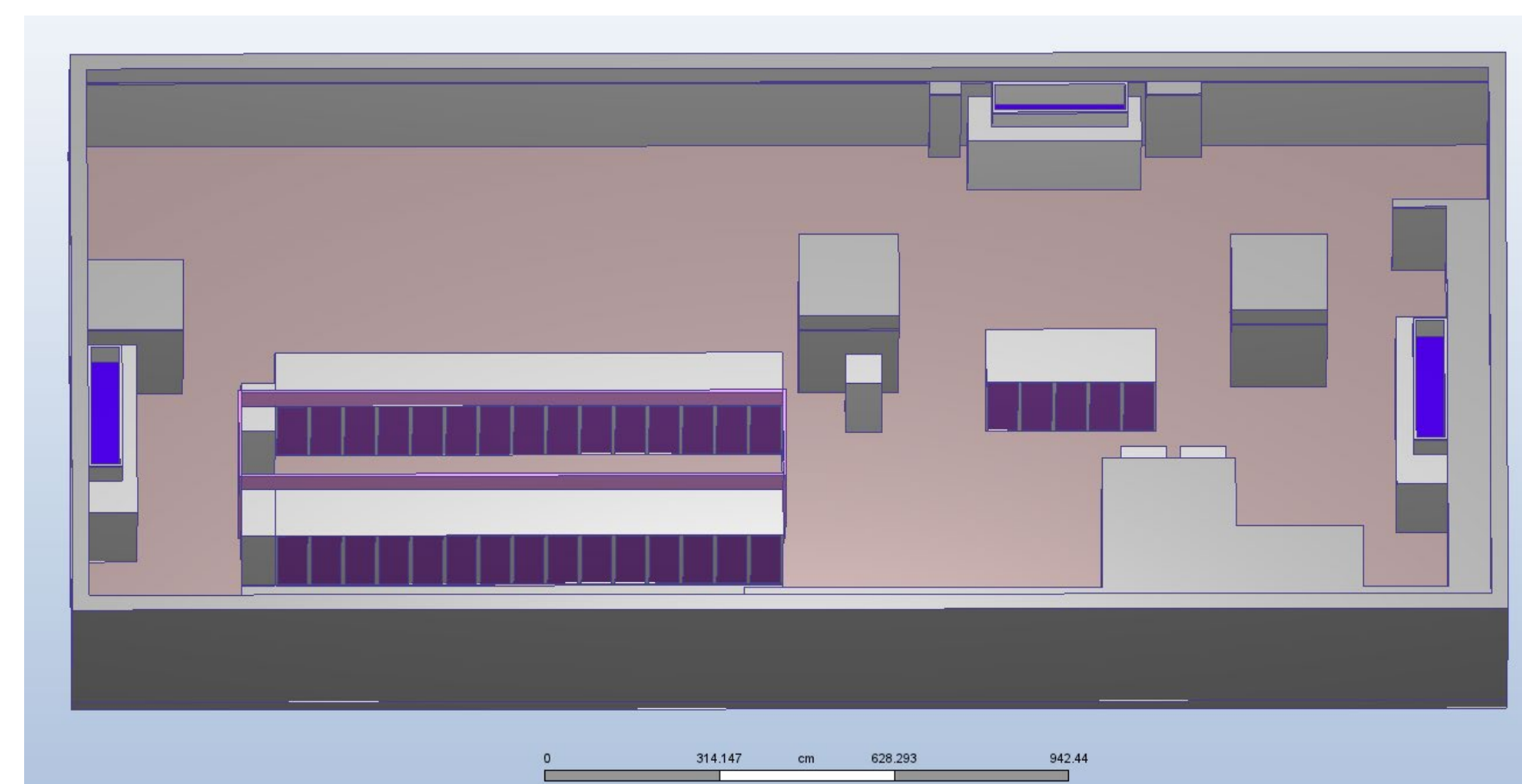
Layouts



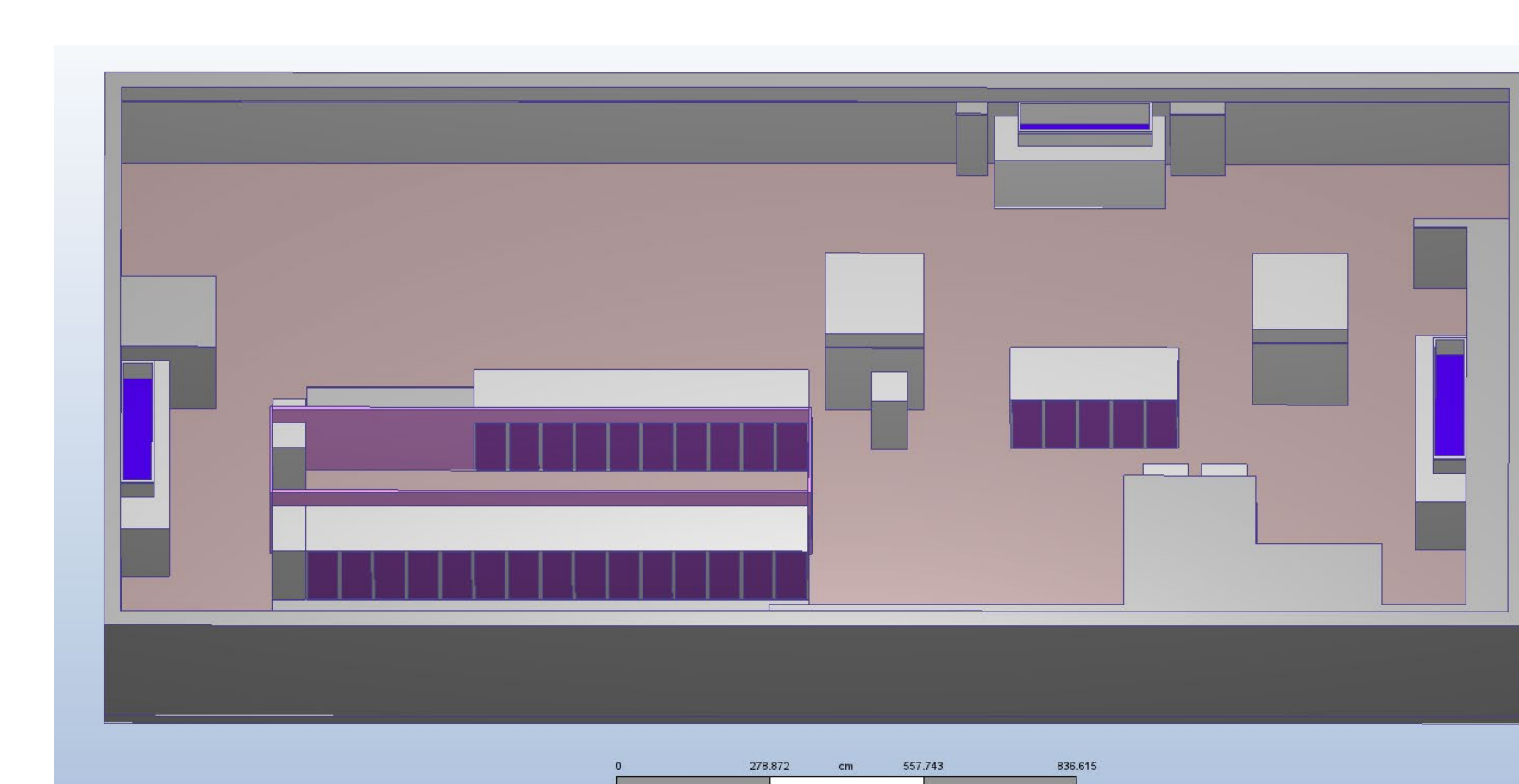
Base layout without boards



Current layout without boards



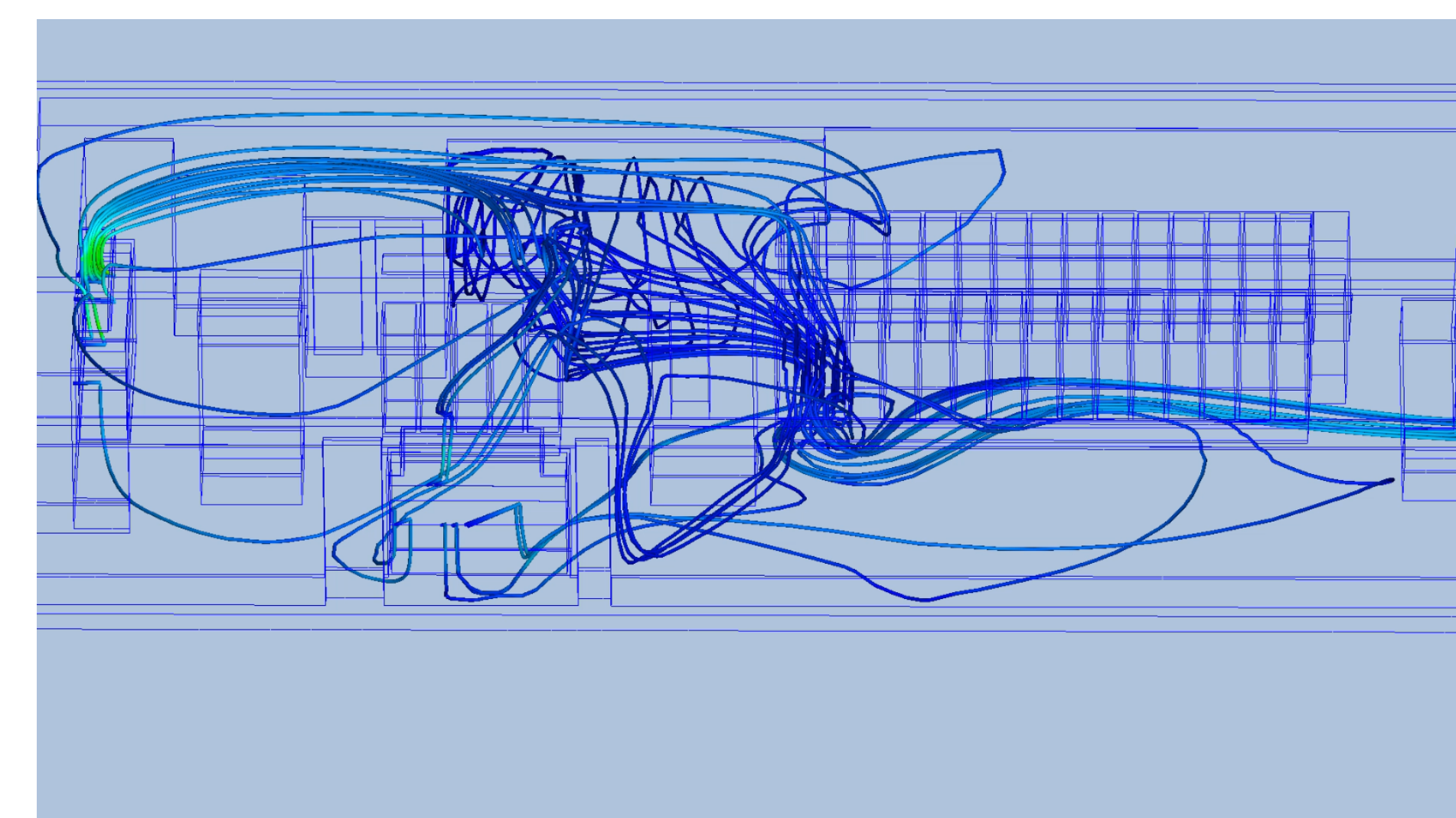
Base layout with boards



Current layout with boards

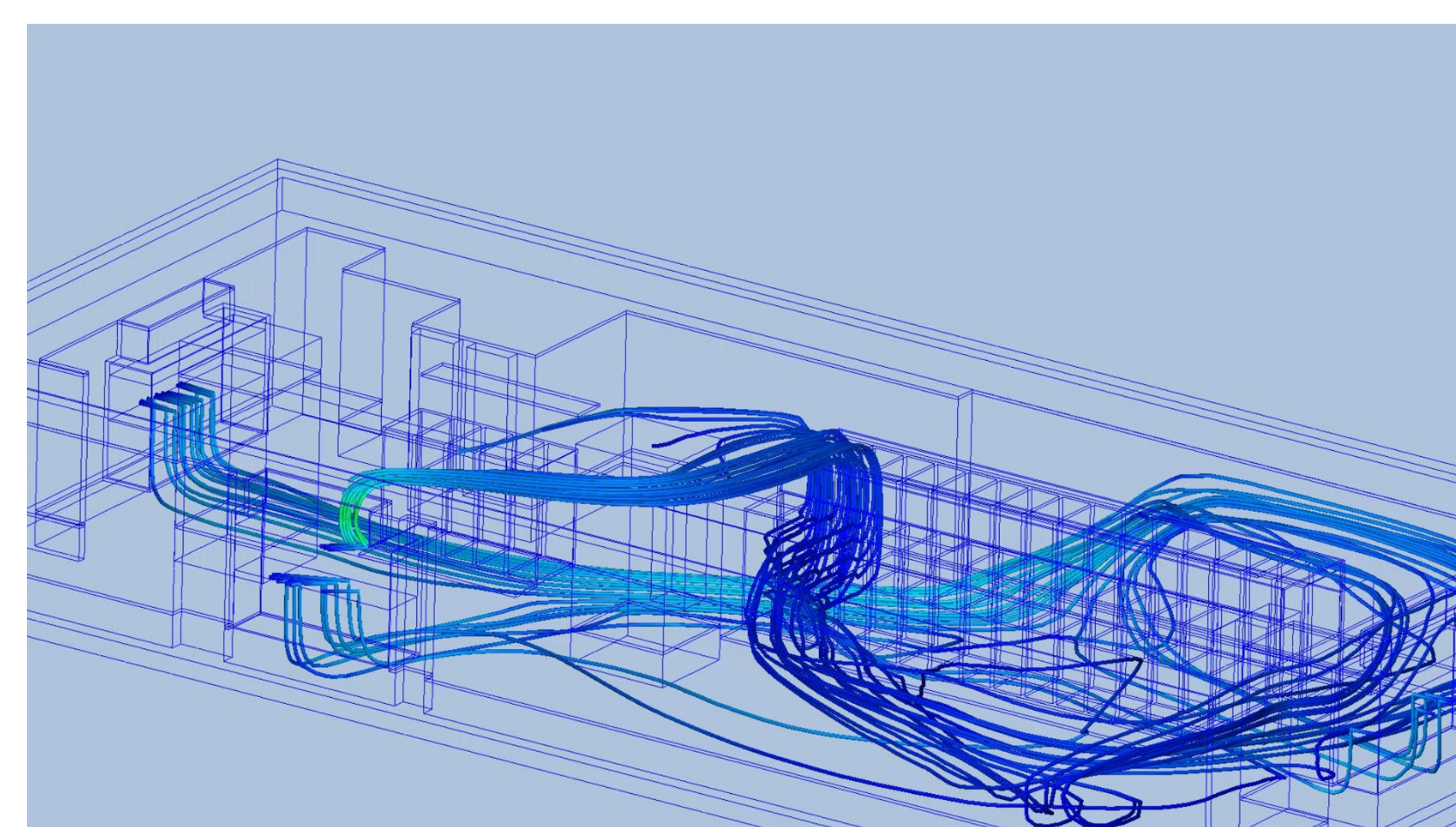
Results

Base model:



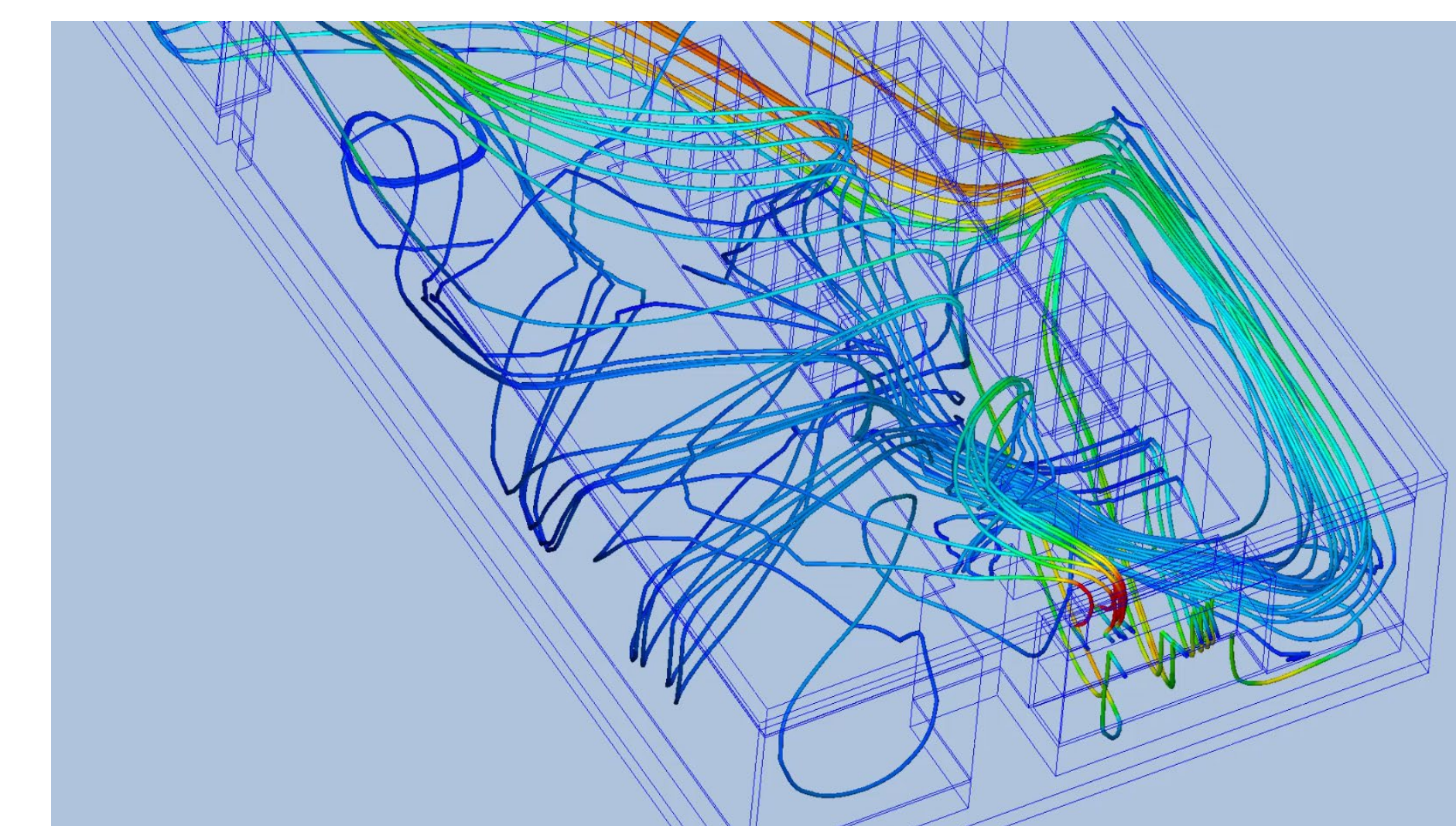
The original design displays air escaping the hot aisle and being recirculated into the cold aisles.

Base model with boards:



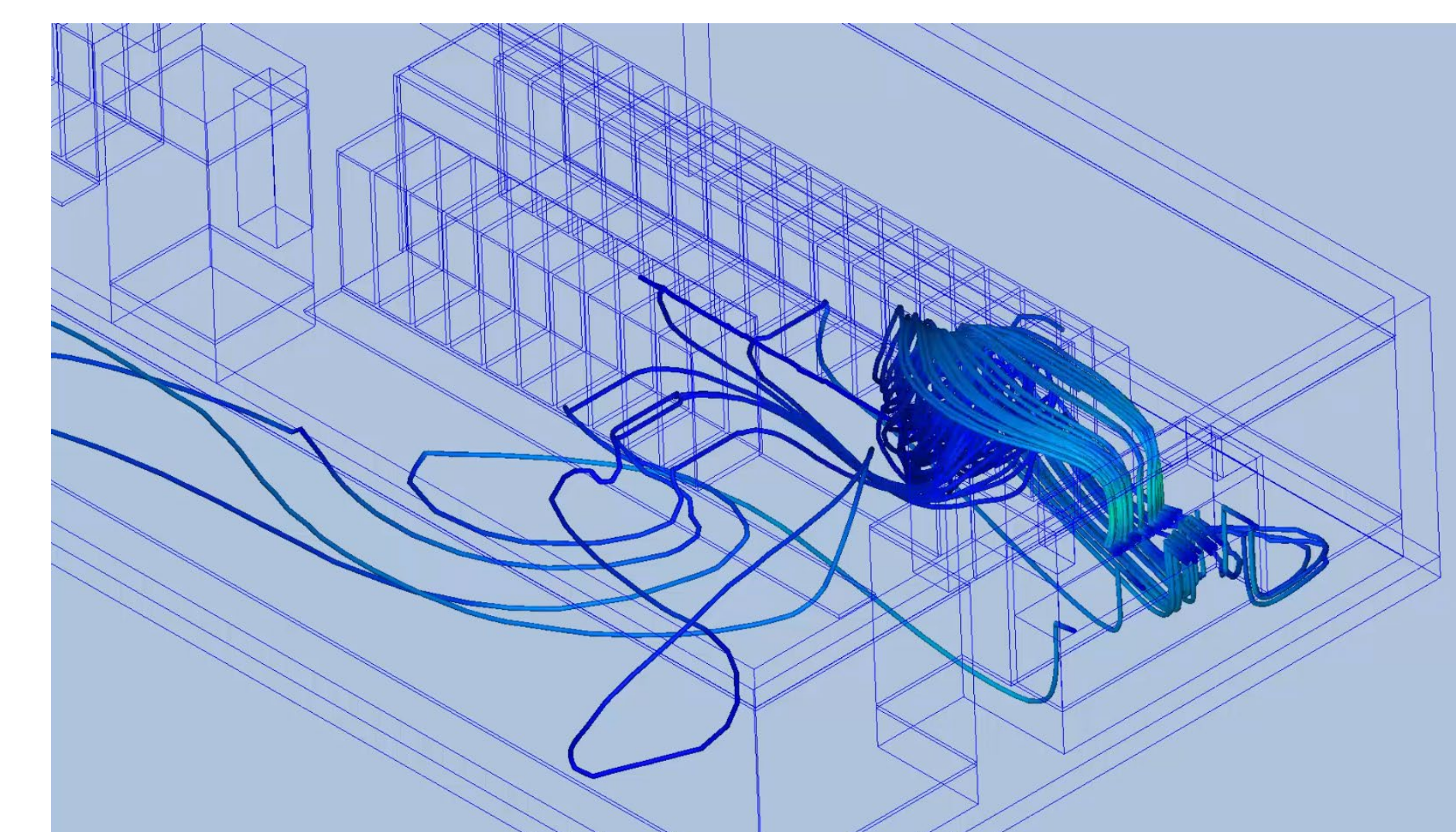
The addition of foam boards to contain the hot aisle helped contain the hot aisle and in theory a higher thermal efficiency.

Current version:



The current design of the data center has five racks removed from a row, changing the airflow from the original design.

Current version with boards:



The addition of foam boards reinstates the design to the same idea as the original design with foam and resolves the issues created by the openness of the hot aisle.

Videos

Current Design – No Foam



Current Design – Foam Barrier



Base Design – No Foam



Base Design – Foam Barrier

References

Autodesk. "09.03_Data Center_Exercise_Part-1" Autodesk. <https://knowledge.autodesk.com/support/cfd/learn-explore/caas/simplecontent/content/0903data-centerexercisepart-1.html> (accessed June 2020)

Acknowledgements

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