

## Background

Methane from dairy farms is a major greenhouse gas. Current systems miss low-level emissions, leaving small farms at risk of penalties.



Figure 1: Methanotroph, methane consuming microorganisms, under a microscope

## Problem

Methane capture is not scalable or economical. We built a system that uses methanotrophic bacteria to convert lagoon emissions into high-protein feed, cutting costs and reducing methane.

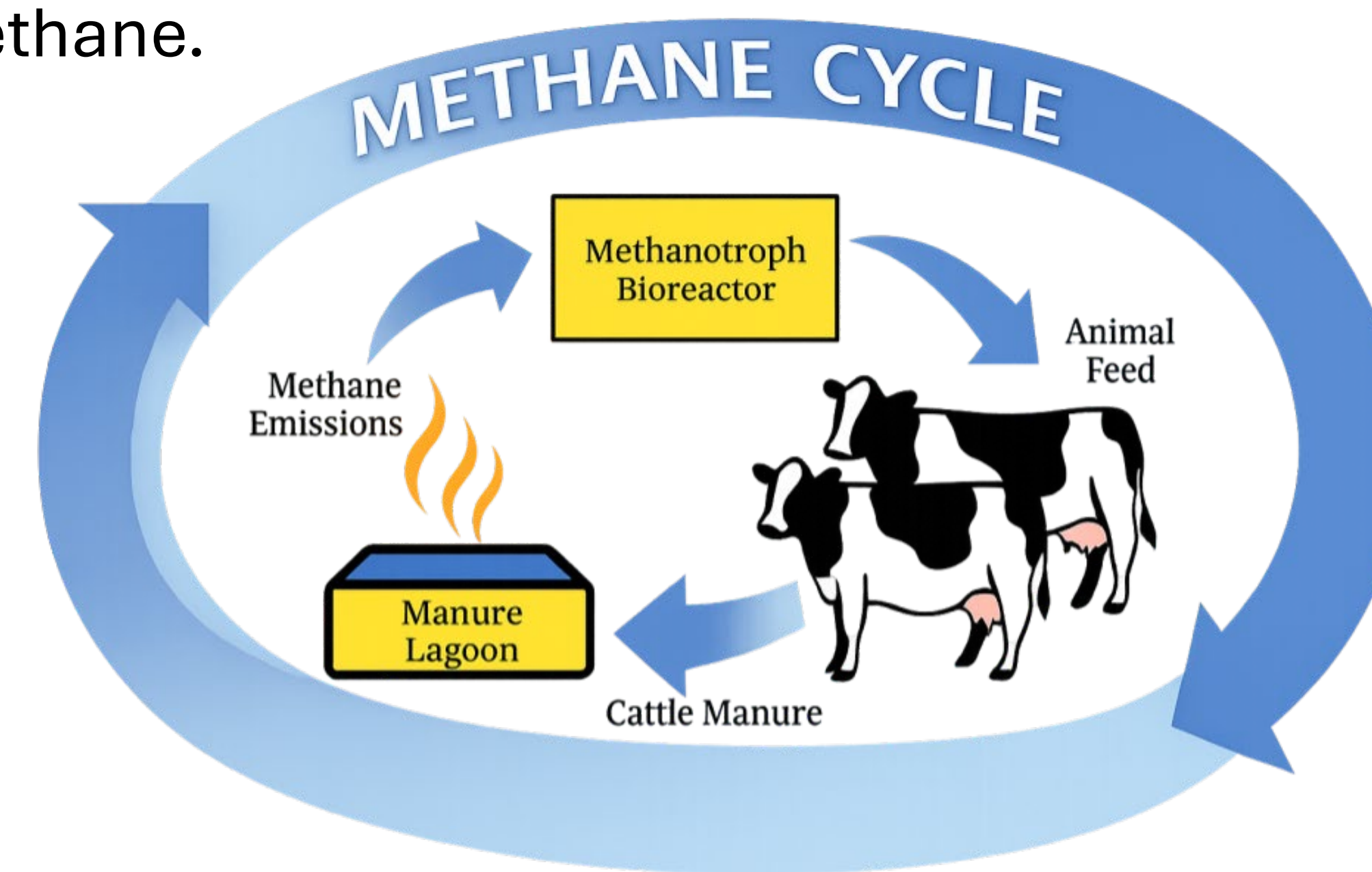


Figure 2: Digital representation of using methane emissions as a cyclical financial source or resource, rather than allowing emissions into the atmosphere.

## Design

Our team developed a Vertical Dowel Reactor (VDR) with pneumatic controls, removable growth rods, and fully autonomous, industry-standard operation.

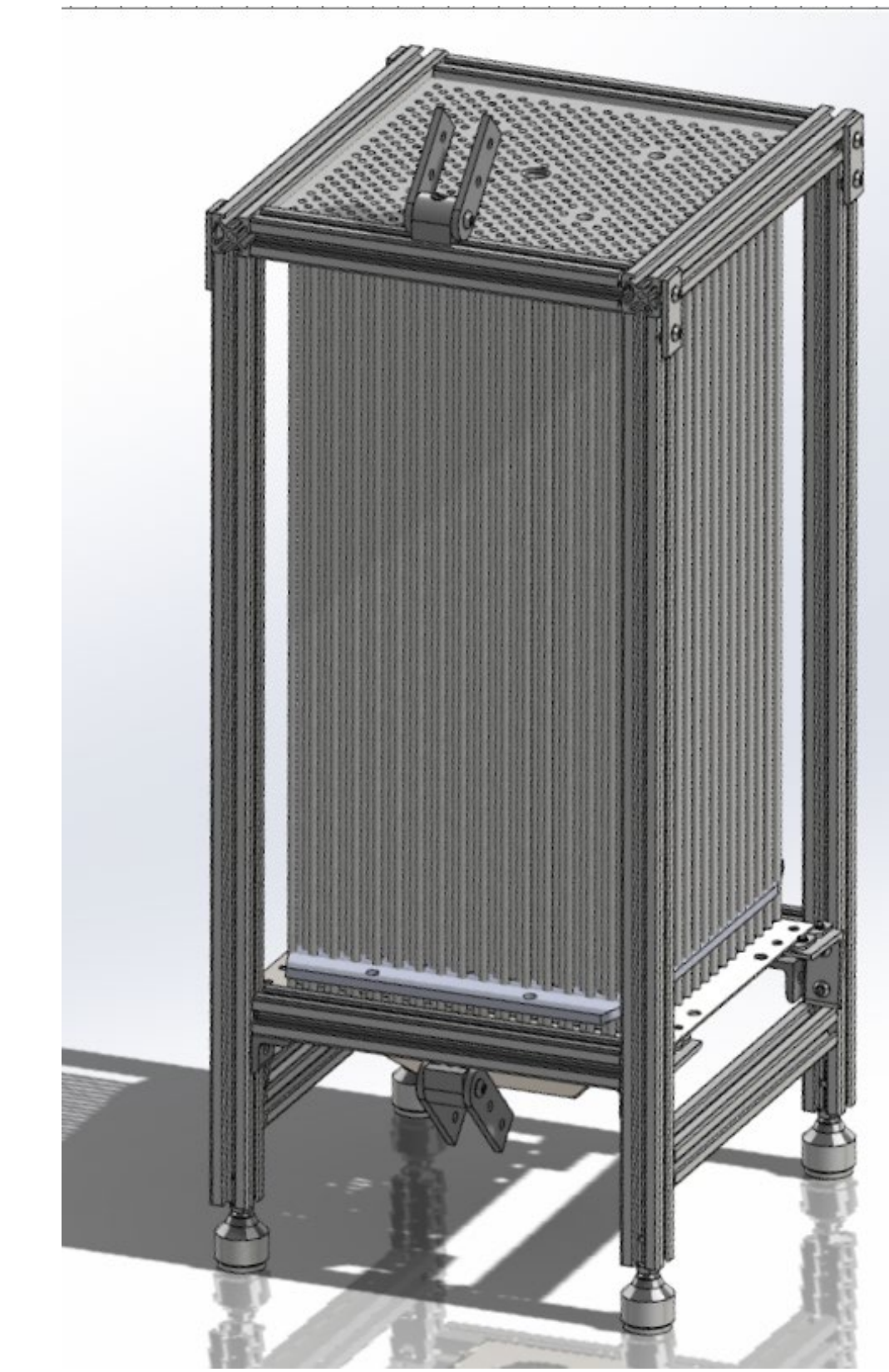


Figure 3: Digital model of Vertical Dowel Reactor (VDR)

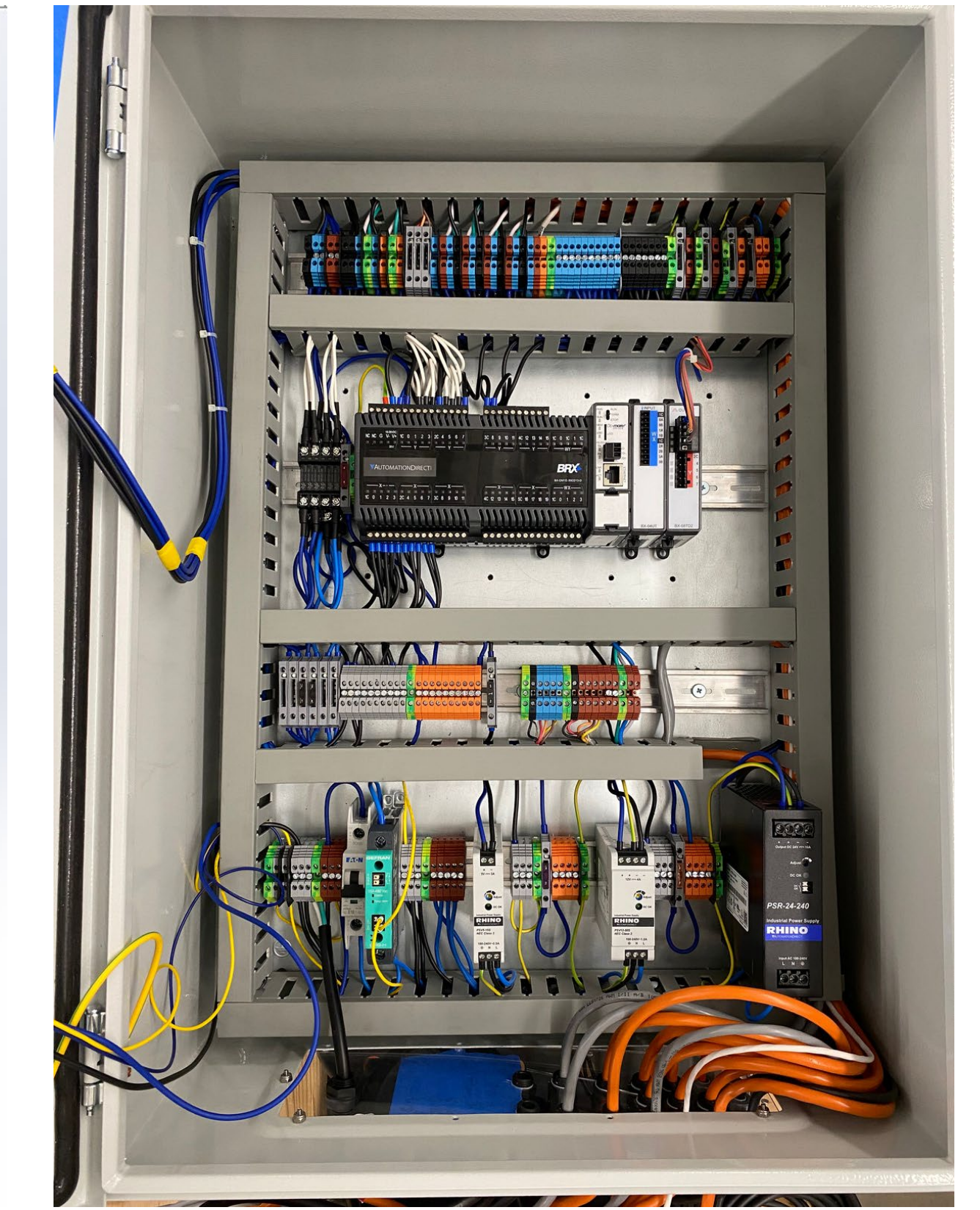


Figure 4: PLC cabinet internals

## Testing Methods and Results

FEA of the growth-rod mounting plate confirmed negligible deformation. CFD verified consistent methane flow despite rod interference. Overall results show the prototype meets key objectives for autonomous operation, methane-capture efficiency, cost-effectiveness, and low-maintenance performance.

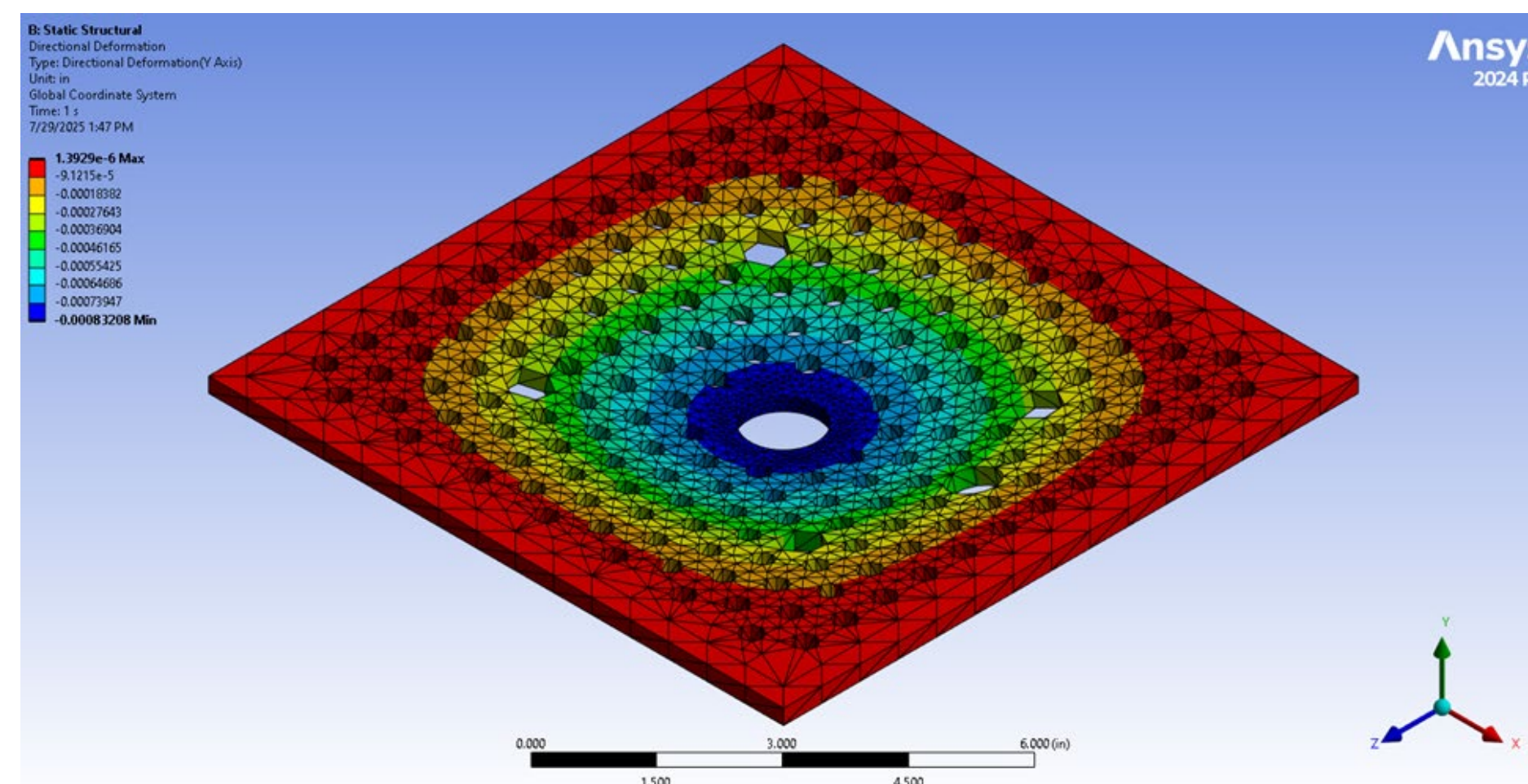


Figure 5: FEA Structural Analysis for deflection of growth rod mounting plate.

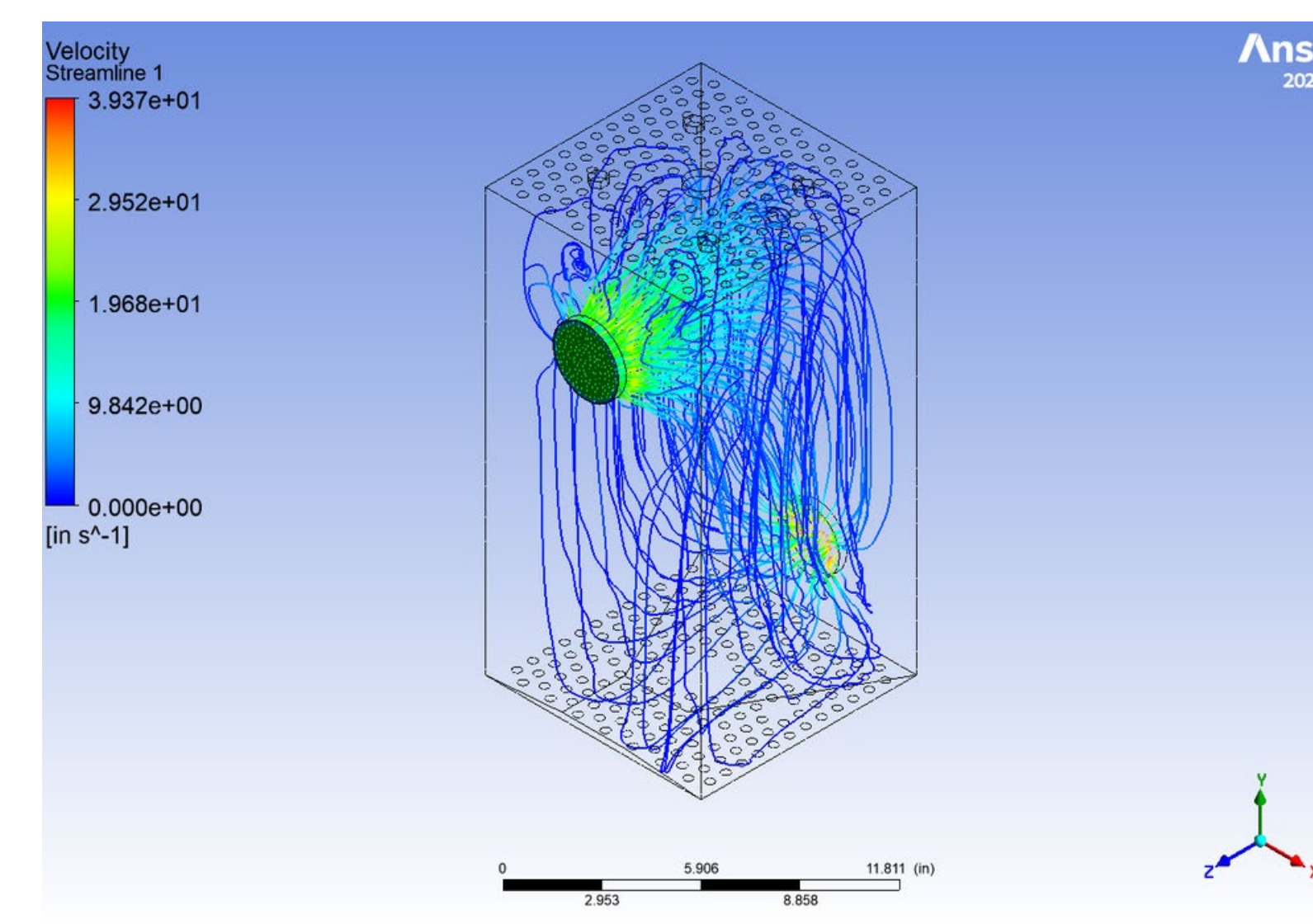
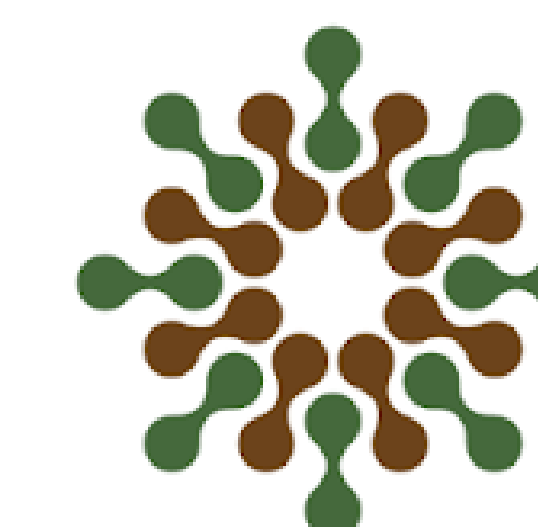


Figure 6: CFD Fluid Analysis for flow of methane throughout the reactor

## Conclusion

The VDR creates a fully autonomous, adjustable environment for methanotroph growth, allowing precise control of methane input, nutrients, collection, and discharge. This prototype will serve as a testing platform to identify optimal growth conditions and improve future methane-to-biomass conversion systems.



**METHANE CAPTURE**