

Oscillating Water Column Wave Energy Generator Anchor & Frame

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DMT Vision

Project Objective:

- Design, make and test a scale prototype Oscillating Water Column (OWC) wave energy generator.

Subassembly goal:

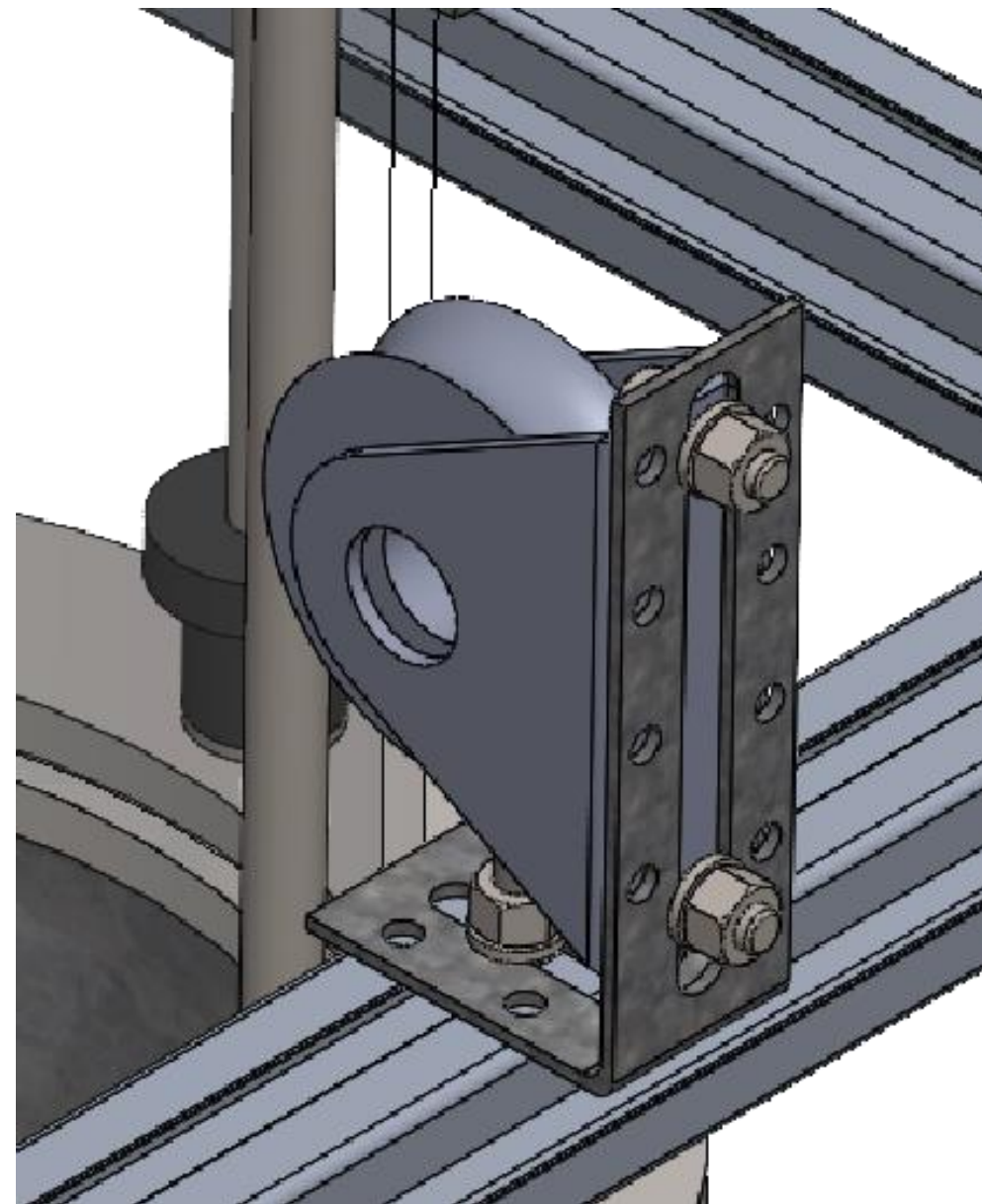
- Design the anchor and frame, including the buoy

Design Overview

Frame - Houses internal generation subassemblies & manages airflow. Formed of nozzles attached to a clear section of pipe.

Rig - Enables 1 man testing of frame in both air and water conditions. Constructed of aluminium extrusion in a pyramid shape for best torsional and axial strength for least amount of material.

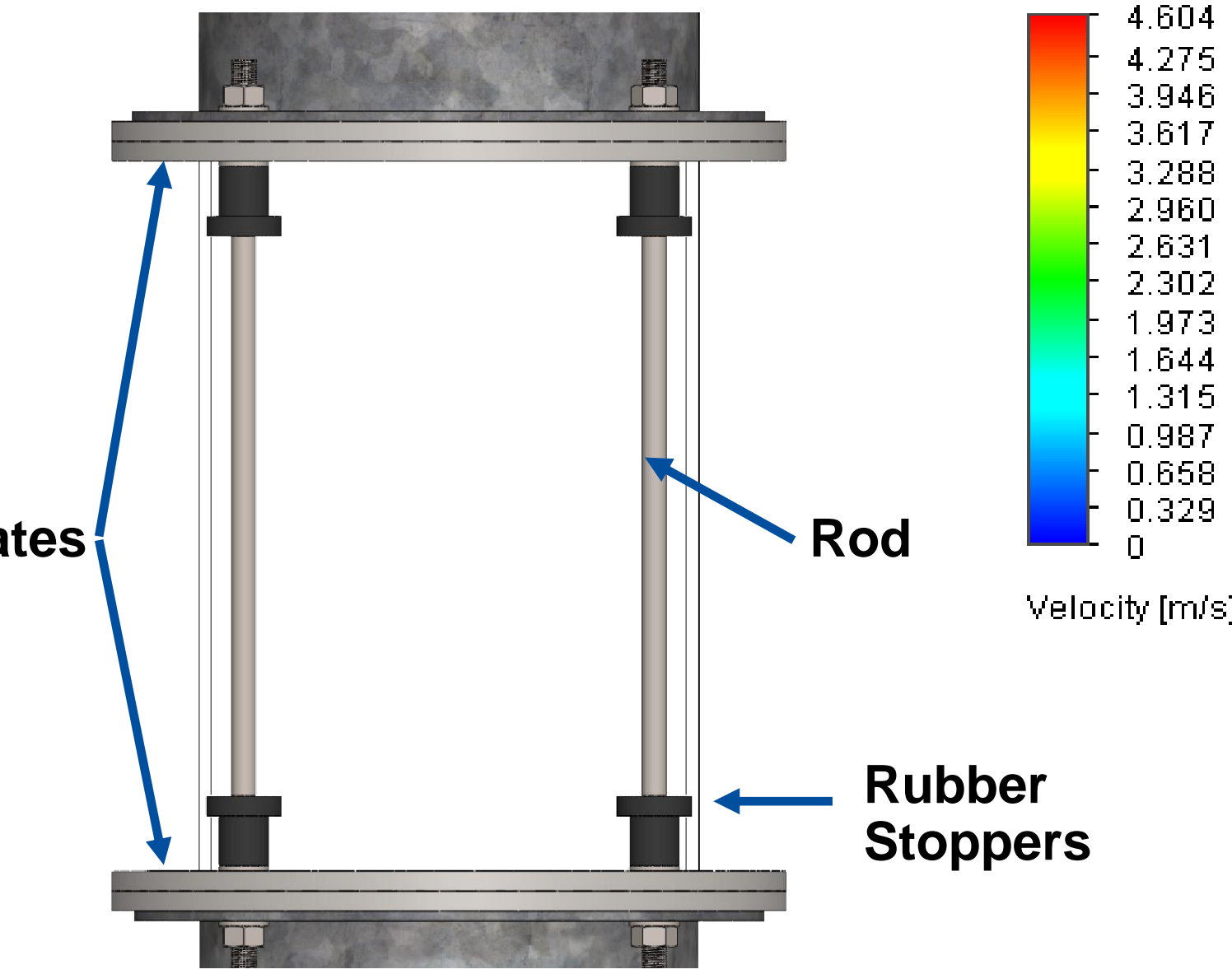
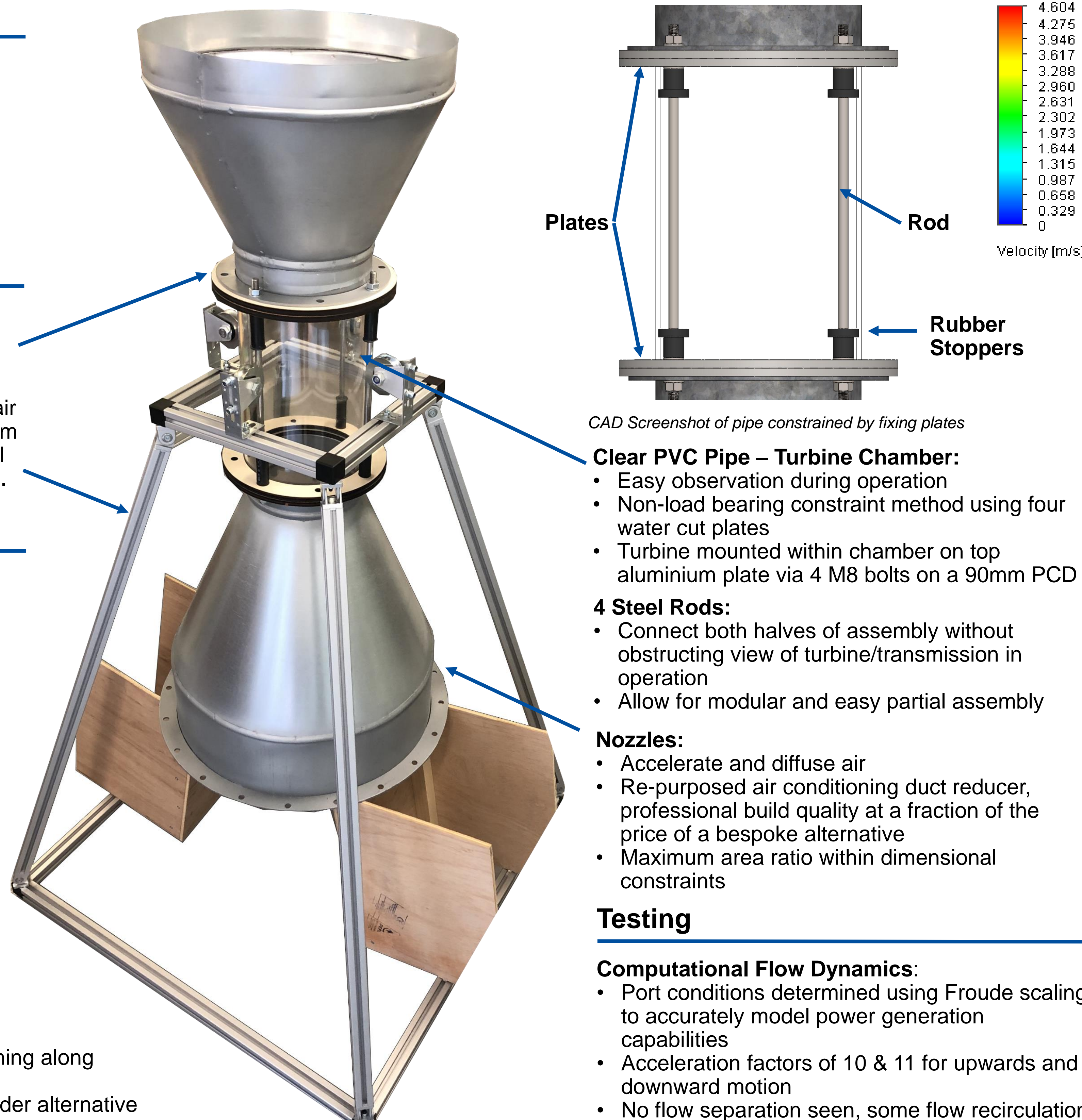
Design Features:



Close up of frame and rig interface from CAD

Rig-Frame Interface:

- Grooved pulleys on adjustable mounts running along steel rods
- Cheaper and lower tolerance than linear slider alternative



CAD Screenshot of pipe constrained by fixing plates

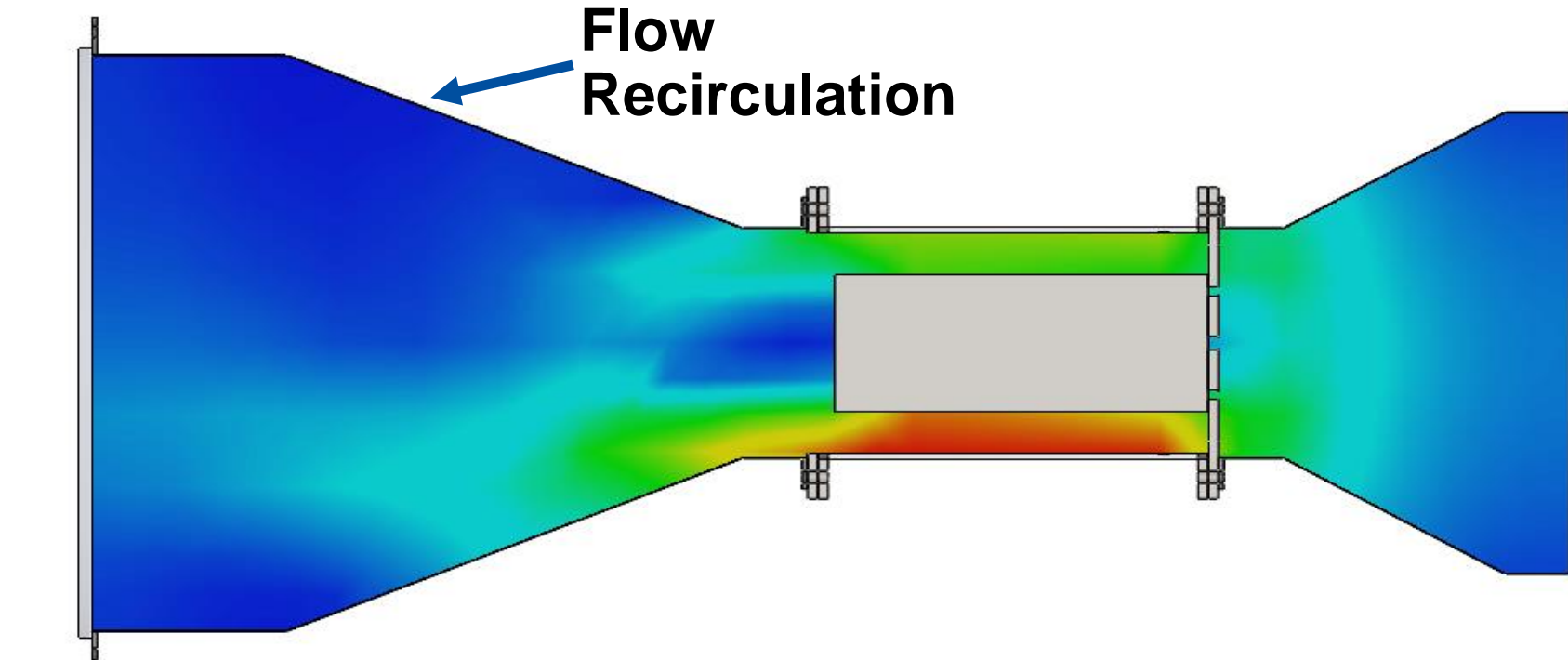
- Clear PVC Pipe – Turbine Chamber:**
- Easy observation during operation
 - Non-load bearing constraint method using four water cut plates
 - Turbine mounted within chamber on top aluminium plate via 4 M8 bolts on a 90mm PCD

- 4 Steel Rods:**
- Connect both halves of assembly without obstructing view of turbine/transmission in operation
 - Allow for modular and easy partial assembly

- Nozzles:**
- Accelerate and diffuse air
 - Re-purposed air conditioning duct reducer, professional build quality at a fraction of the price of a bespoke alternative
 - Maximum area ratio within dimensional constraints

Testing

- Computational Flow Dynamics:**
- Port conditions determined using Froude scaling to accurately model power generation capabilities
 - Acceleration factors of 10 & 11 for upwards and downward motion
 - No flow separation seen, some flow recirculation at outlet boundary causing non-symmetrical flow due to low speed, negligible

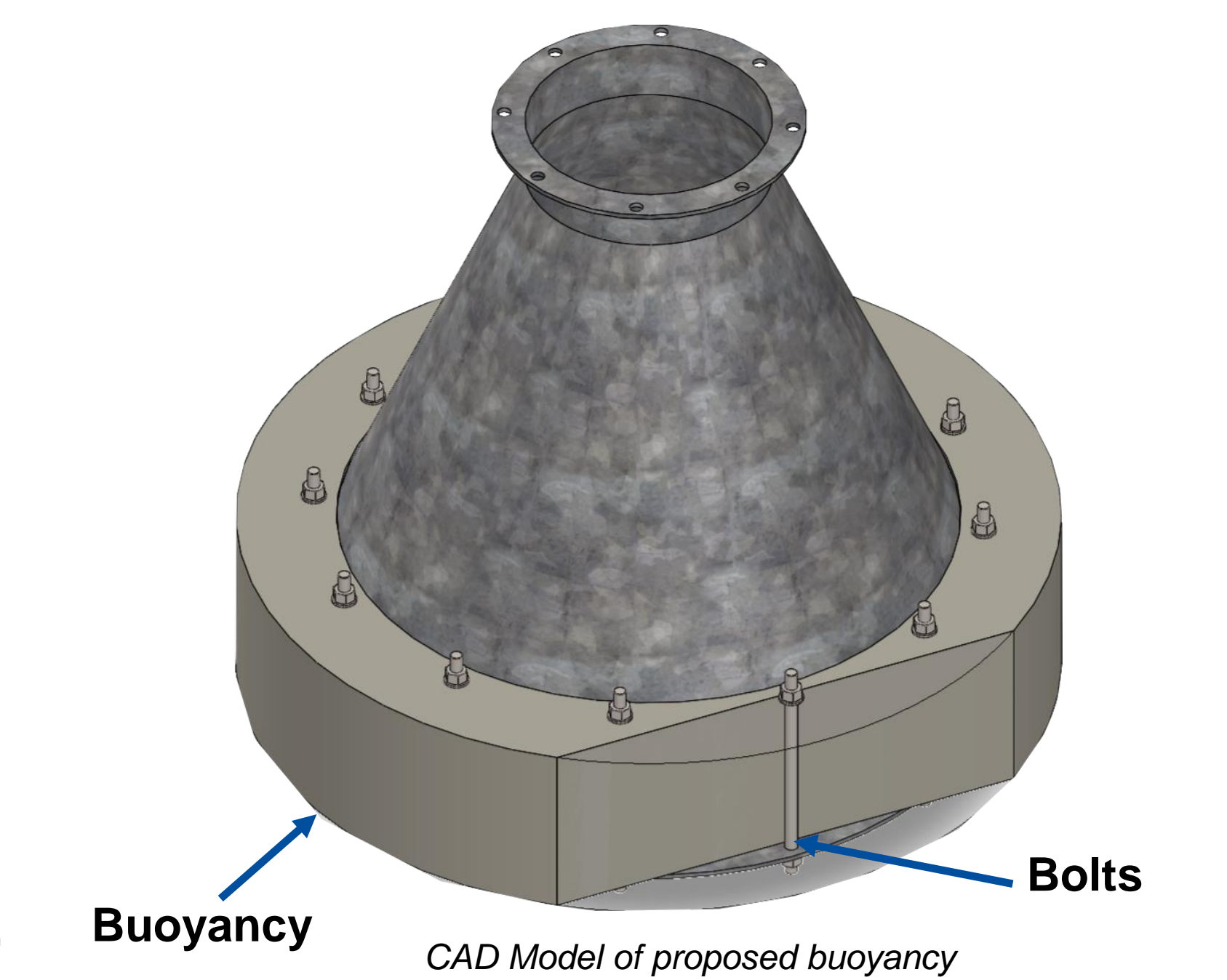


Screenshot of velocity contour for downwards motion at t=0.81s

Full Assembly Test in Serpentine:

- All subassemblies successfully combined
- Significant airflow acceleration was noted
- Demonstrated need for rig due to difficulty in achieving purely vertical movement

Design Progression



CAD Model of proposed buoyancy

- Foam based buoyancy module – closed cell Divinycell
- Mounting provisions present (bolt holes in nozzle)
- Ballasting rods/bolts to control mast distribution below water level
- Mooring eye for a hanging chain anchor as well as acting as sacrificial anode.

Frame supported by wooden blocks (not part of the DMT) within the rig