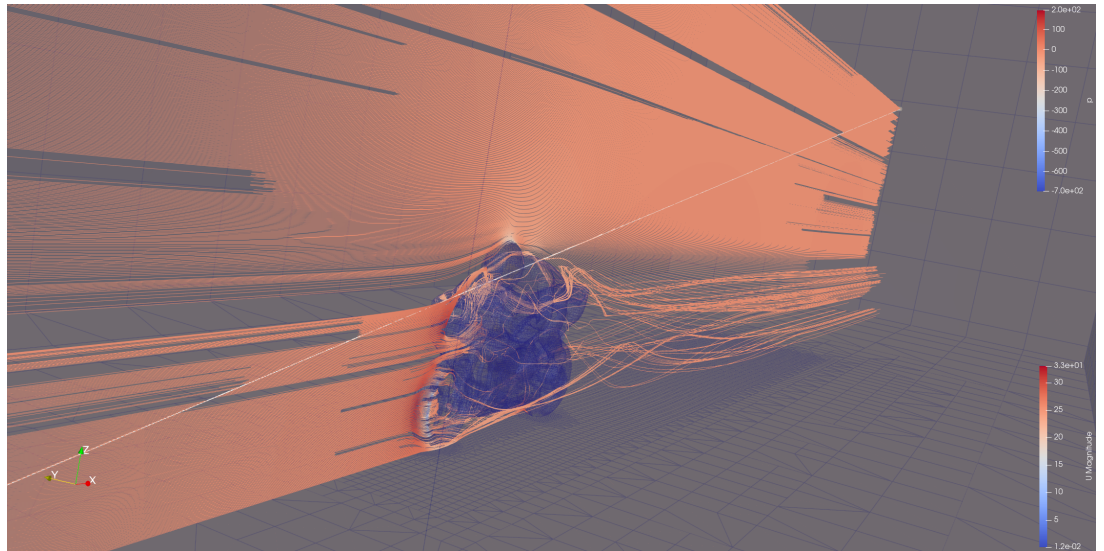


Final Project Progress Report

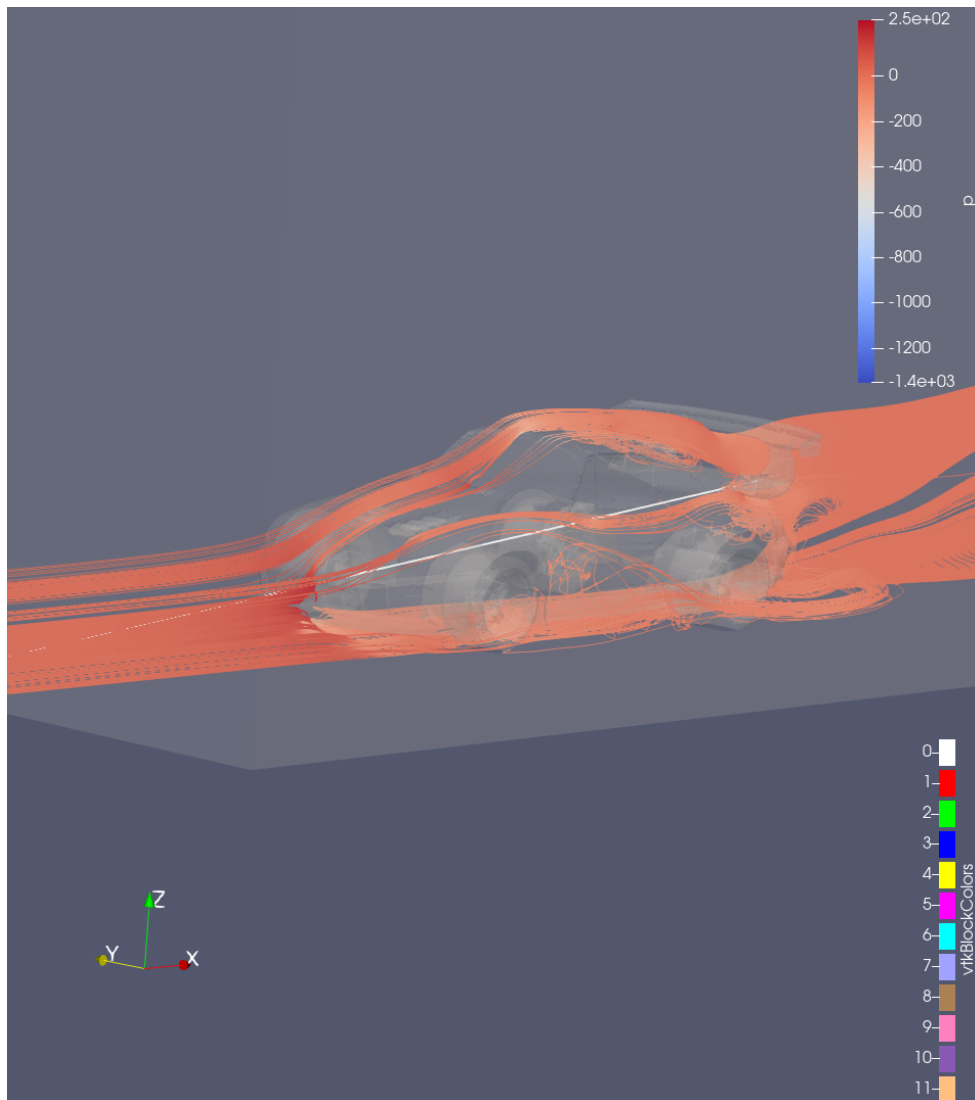
Student Name(s): Jack Wilburn, Pranav Rajan, and Jacob Haydel

Project title: Visualization of Car Fluid Flow

- Estimate the percentage of the overall project you have completed thus far.
 - We're roughly 30% of the way through this project so far. We've generated some data for a road car that we can use to develop our vis methodology and our vis scripting, and we've found our models that we'll be using for the final simulations. Since we now know OpenFoam well enough to run simulations, we've removed a blocker for working in parallel. This should speed us up for this remaining portion of the work. In essence, we've already done the hard work of learning OpenFOAM and getting non-trivial data out of the program, we just need to apply those same methods to some new cars and create compelling visualizations. We have also been investigating parameters and visualization methods for fluid flow, so that we're prepared to describe our assumptions for the simulations.
- What have you completed?
 - Found f1 car models to simulate (ferrari, williams, mclaren, and lotus). Each of these cars is from a different year so we will be able to compare the aerodynamics of all the cars.
 - Ferrari 2018 F1 (driven by Sebastian Vettel & Kimmi Raikonen):
<https://www.thingiverse.com/thing:2990512>
 - Red Bull Racing 2018 F1 (driven by Daniel Riccardo & Max Verstappen):
<https://www.thingiverse.com/thing:3424214>
 - Williams F1 (1991 & 1992):
<https://www.thingiverse.com/thing:3148478>
 - McLaren 1991 (driven by Ayrton Senna):
<https://www.thingiverse.com/thing:2799306>
 - Lotus F1 (1970) : <https://www.thingiverse.com/thing:2964860>
 - Ferrari (1970): <https://www.thingiverse.com/thing:2825544>
 - McLaren (1968): <https://www.thingiverse.com/thing:3219913>
 - Honda (1965): <https://www.thingiverse.com/thing:2980803>
 - Simulated the airflow of a Porsche 911 using openfoam:
<https://www.thingiverse.com/thing:2946486>
 - Made a visualization of a super bike (from the OpenFOAM tutorials) and visualized it in paraview



- Made a preliminary visualization of the air flow for the Porsche 911 data using paraview.



- The above images show that we're able to generate non-trivial data with OpenFoam and that there is a large potential for visualizing the resulting data.

- Create a list of what still needs to be done on the project and estimate the effort each item will take to complete.
 - We need to double check the initial condition for the flow simulation and run simulations for each of the cars we would like to visualize. We'll cross reference this information with flow simulation standards and adjust if we find it to be necessary. Things we might tweak are the speed that the air flows, the assumed This should take a week for one team member.
 - We need to figure out the exact visualization techniques we will use to visualize the data for each car and make python scripts for each. This will help us apply similar analyses across all the cars for our comparison. This is bulk of remaining work and should take 2 of our team about 2 weeks
 - Generate our report. This should take about a week with all members contributing.
- • Have you had to make any changes in your project description? If so, please list and justify the changes.
 - N/A. We've provided comments to your feedback, which are the only additions to that document.
- • Any additional information?
 - The highest quality models of F1 cars we could find still don't fully capture details of the cars aerodynamics, specifically the front and rear wings. These models are built for printing, not for doing fluid flow simulations. This means we won't be able to translate our findings directly to real F1 cars. However, we believe that these models will still make for interesting case studies in different car designs and will show us useful information, even if there are some details that are not quite perfect.