



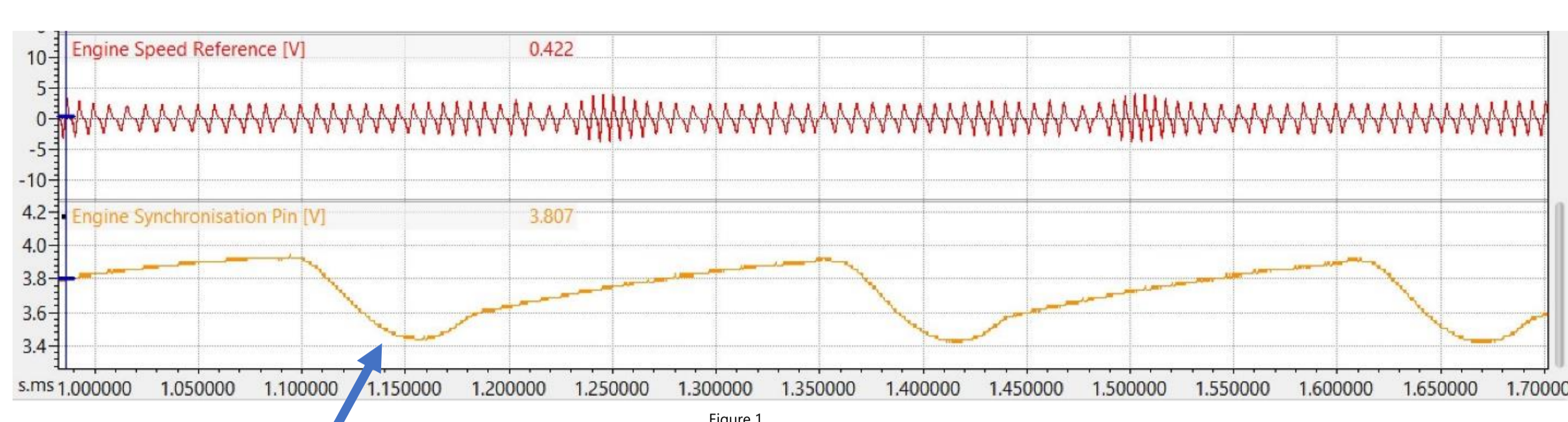
FORMULA TECHNIION 2019

Powertrain & Drivetrain

Engine Control Unit (ECU)

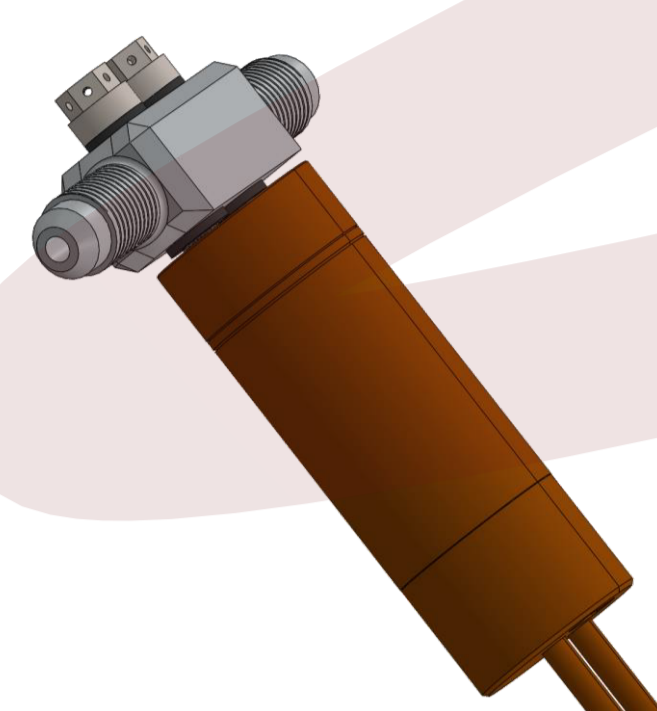
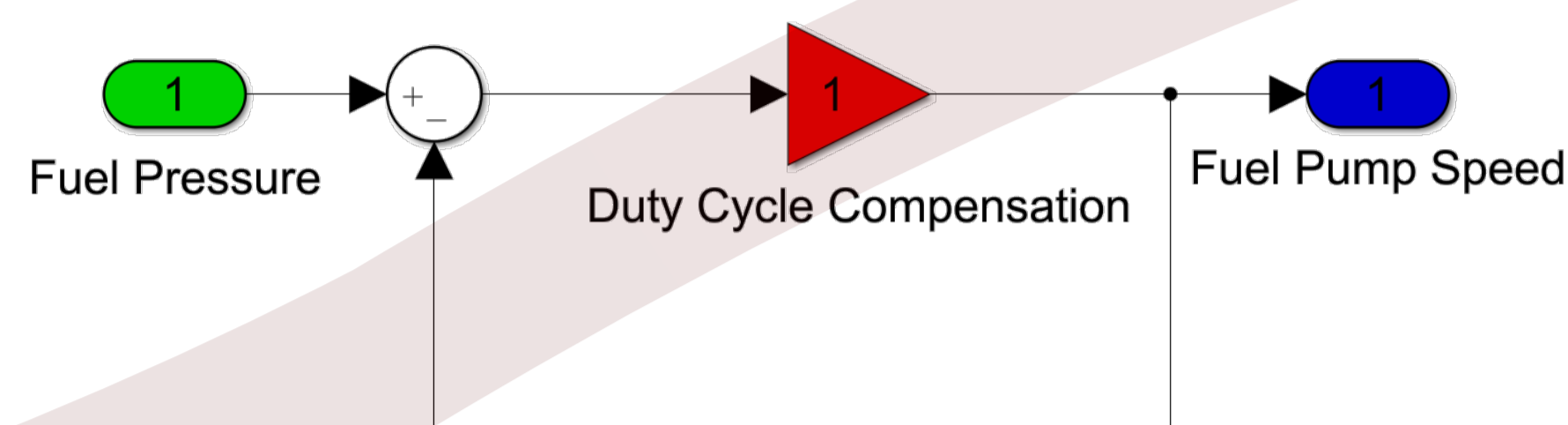


MAP-based Synchronization



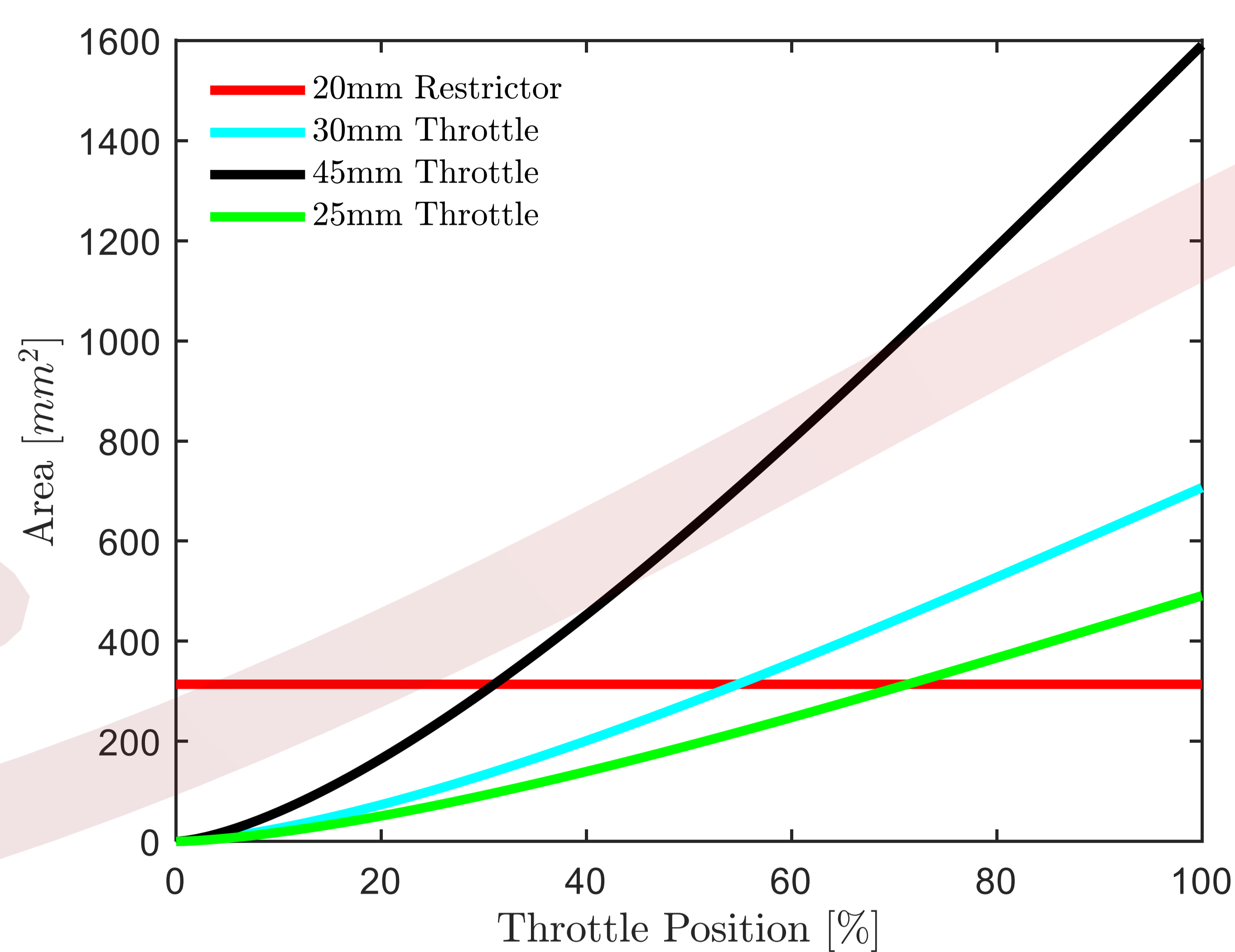
Intake pressure drops during cranking

Fuel Pressure Control

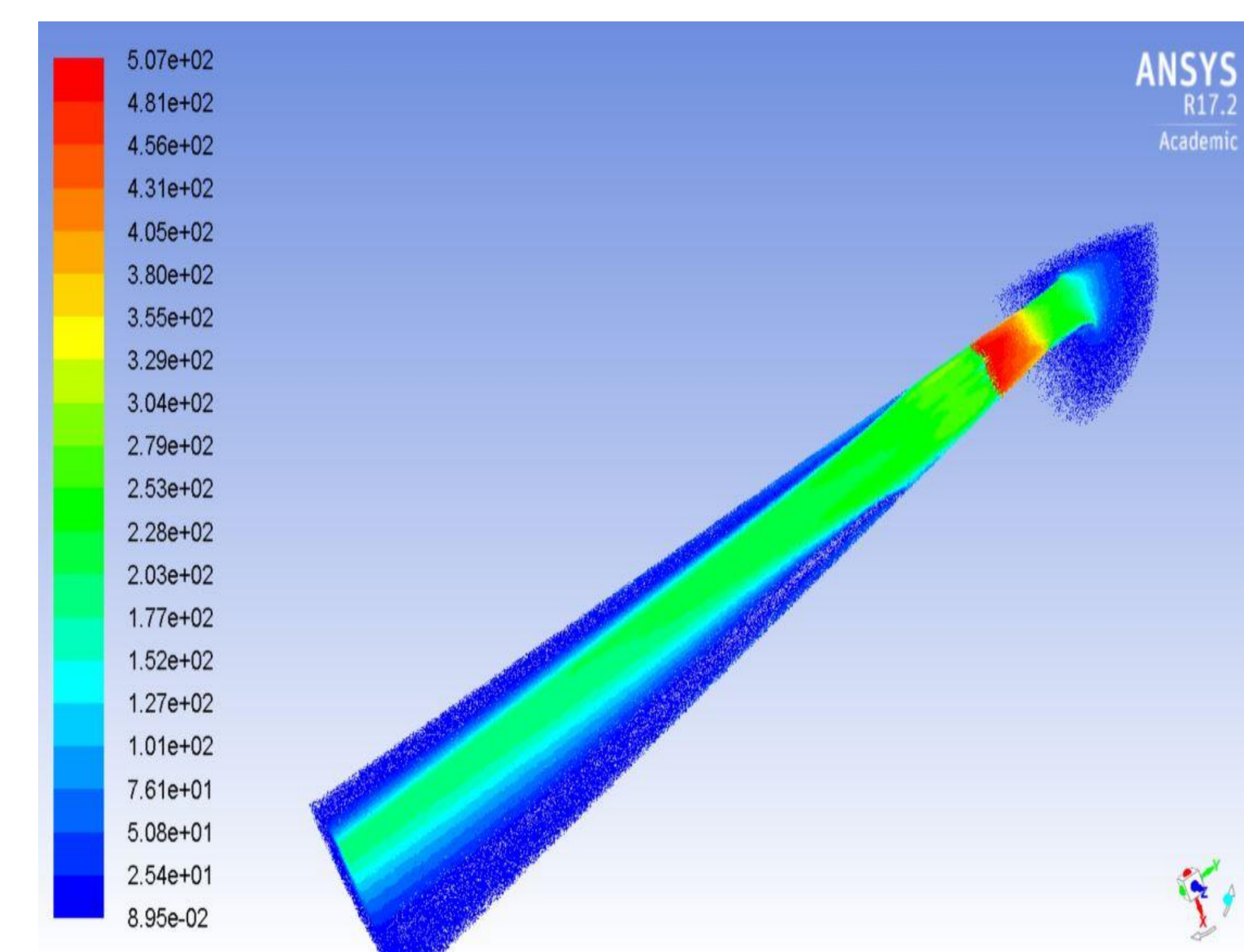
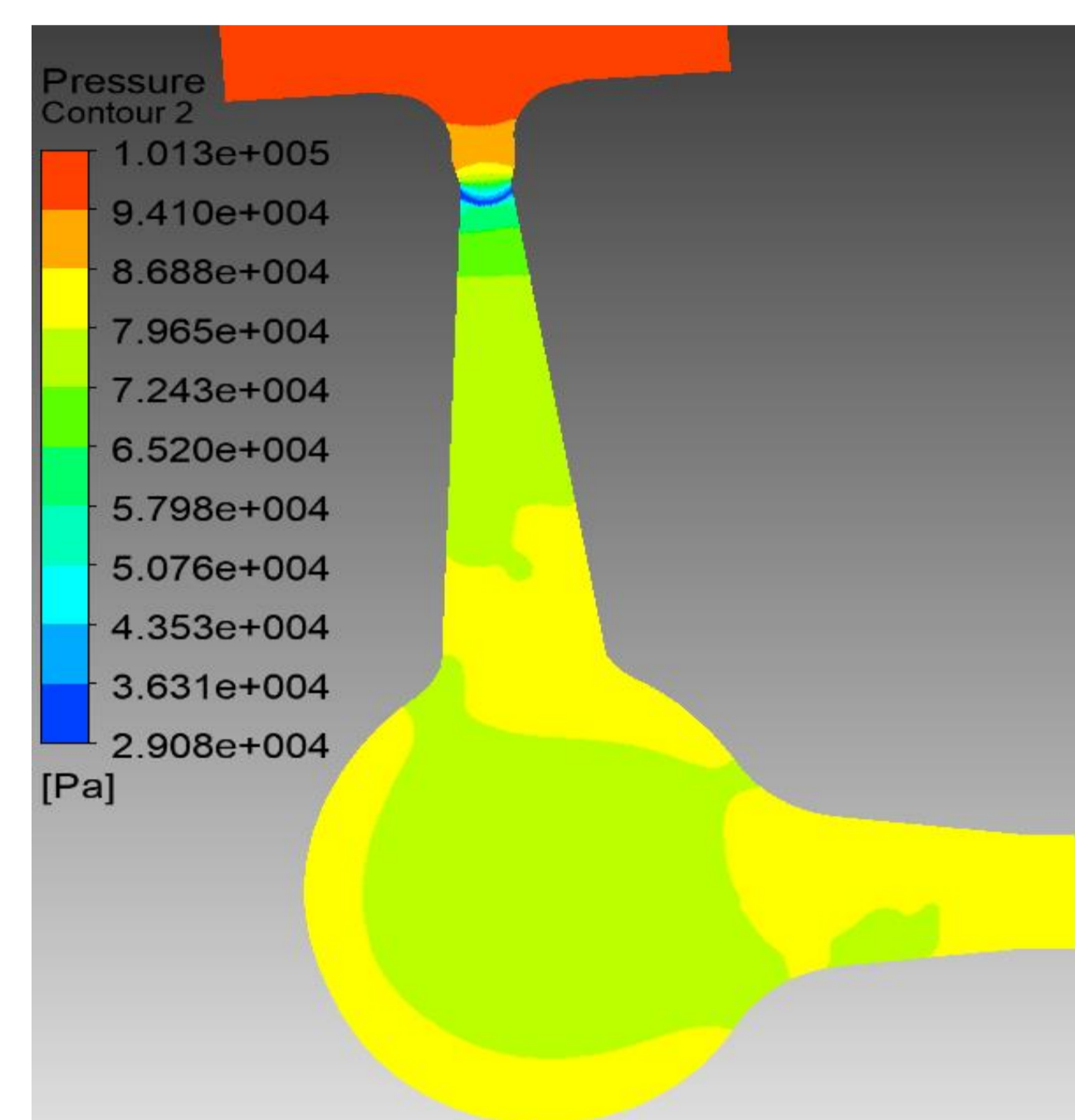


Intake System

Throttle Area Comparison



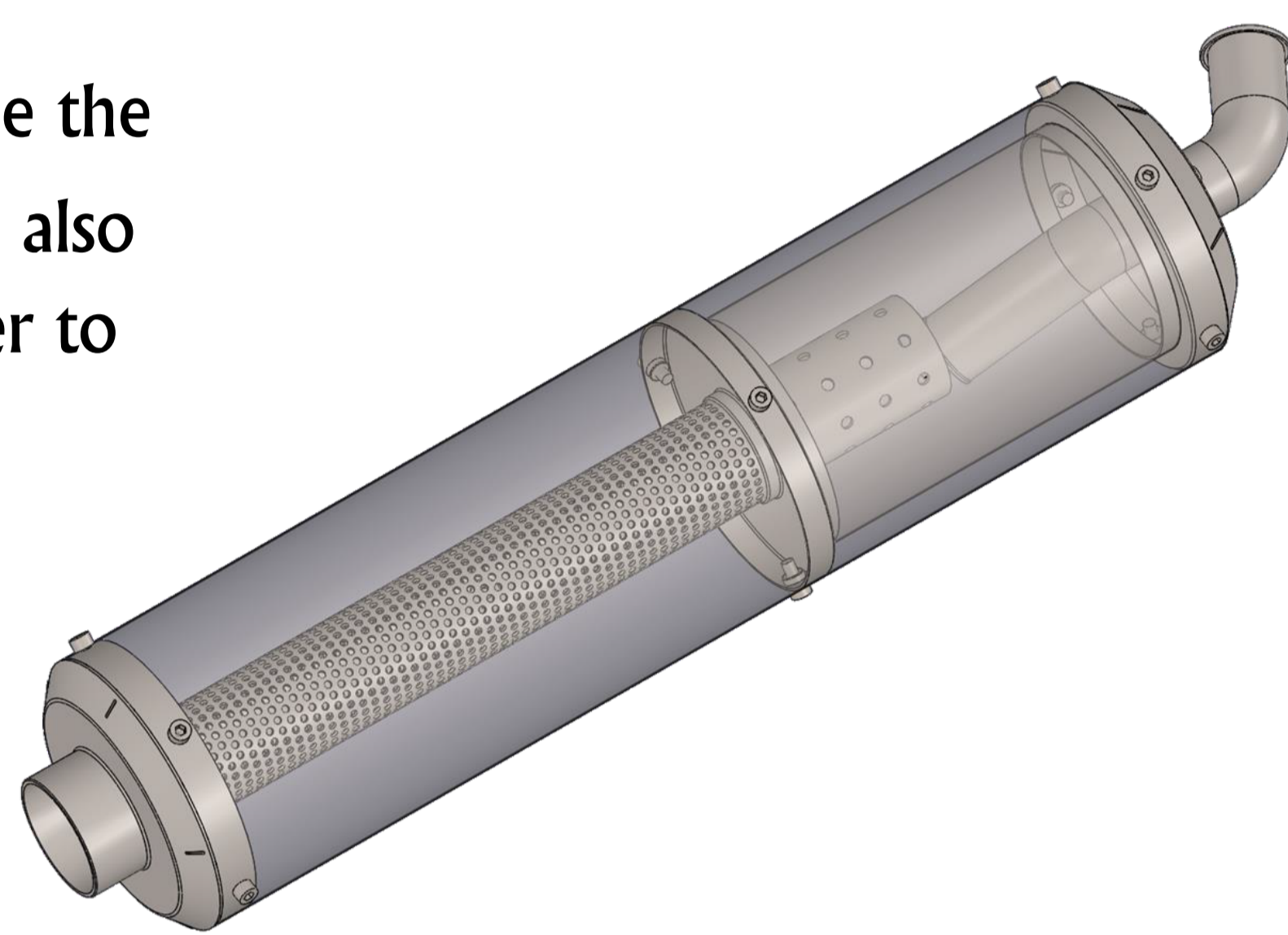
Ansys Fluent Simulations



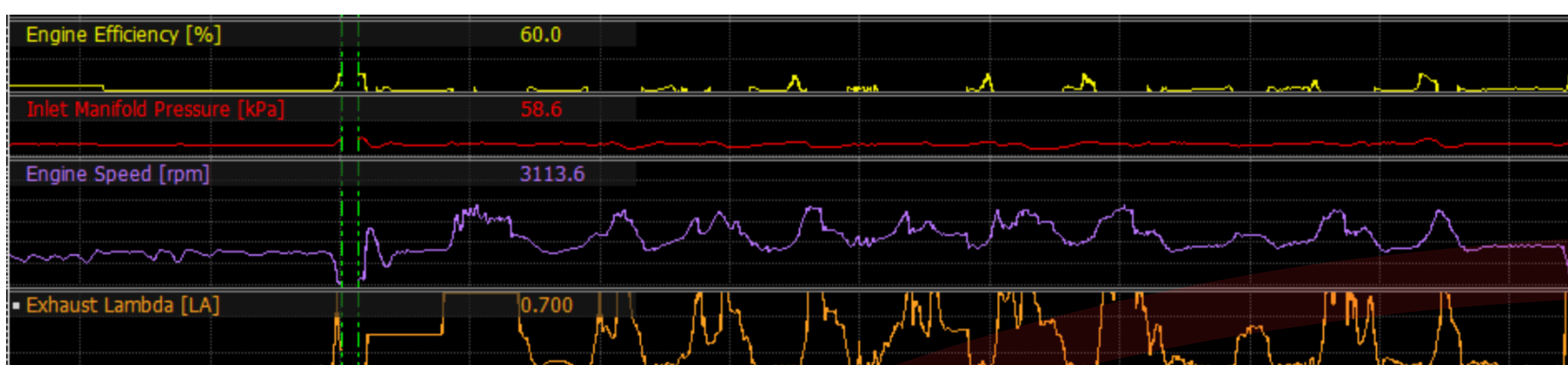
Exhaust System

Custom Titanium Muffler

The team designed a titanium muffler to reduce the original muffler weight from 2.5kg to 1.5kg and also allowing for custom points to attach the muffler to the vehicle.



Engine Tuning



Piston Upgrade

Main Goal:
Increasing the compression ratio by replacing the engine piston

Reason for replacement:

1. KTM piston for increased reliability
2. Increasing the compression ratio will improve the engine performance.

Advantages of the new piston:

- The geometric structure of the SX-F piston is different from the EXC-F piston, it reduces the TDC volume.
- Produces 7% more power in cylinder.



EXC-F piston



SX-F piston

GT-Power Simulation

GT-POWER Simulation

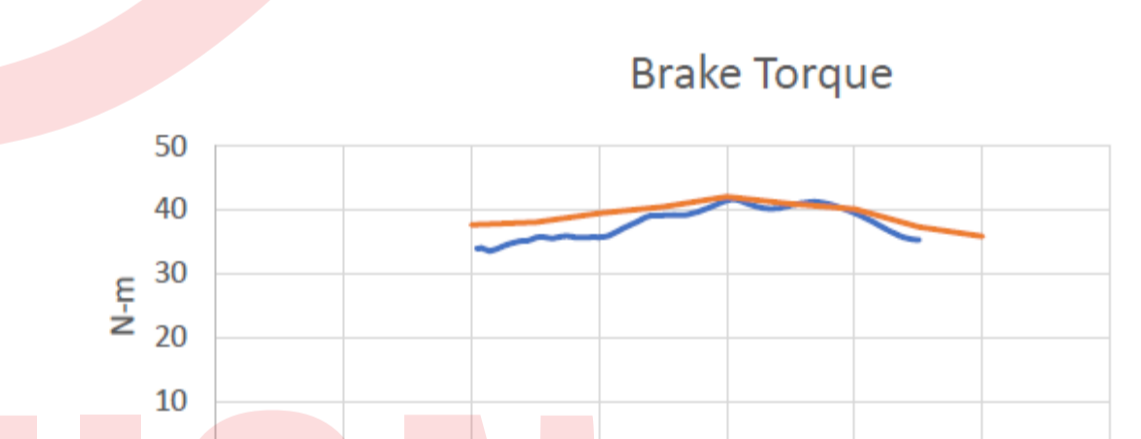
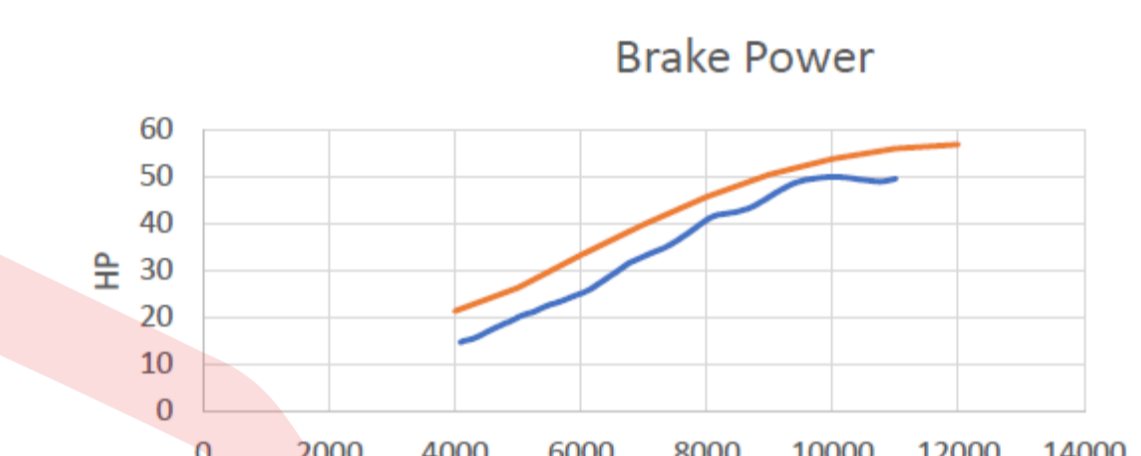
- Helps us to predict the engine performance with the new piston
- Allows us to make some optimization to the engine analysis
- Help simulate intake, exhaust and fuel systems to optimize performance

GT Assumptions:

1. Simulating one cylinder gasoline engine.
2. Using theoretical information about small gasoline engines regarding in-cylinder temperatures and pressure order.
3. Using KTM similar engines geometric details at first and after engine disassembly.

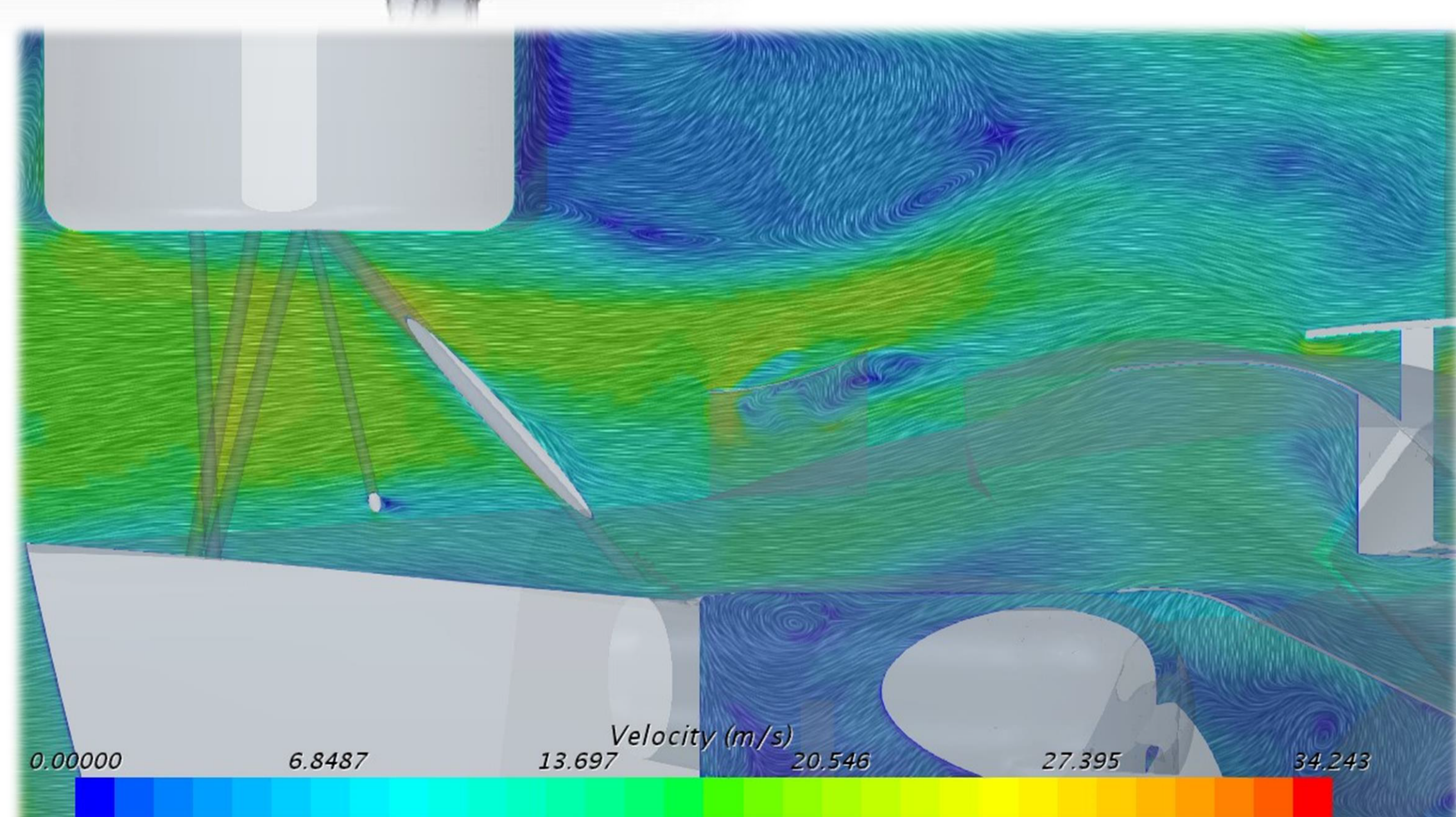
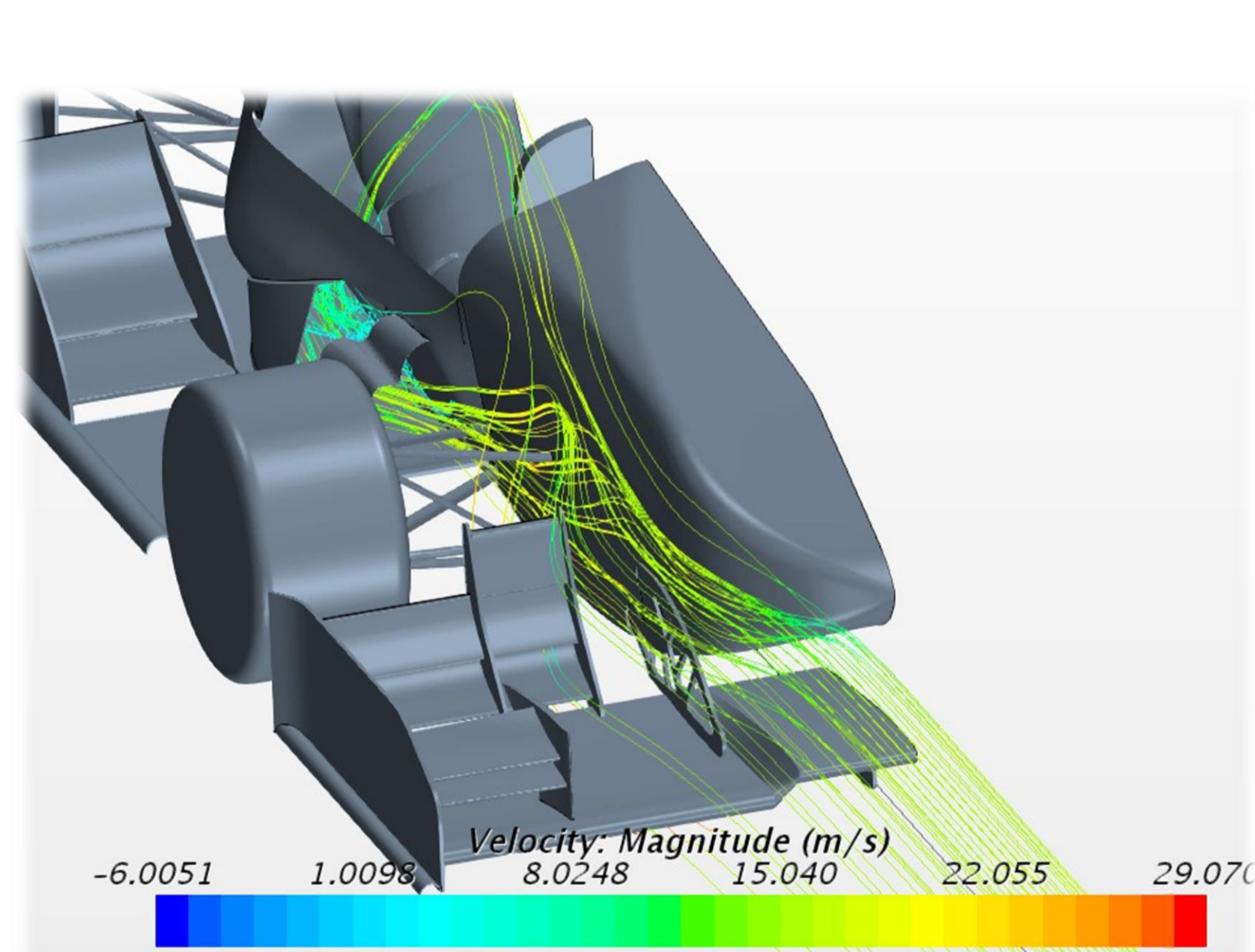
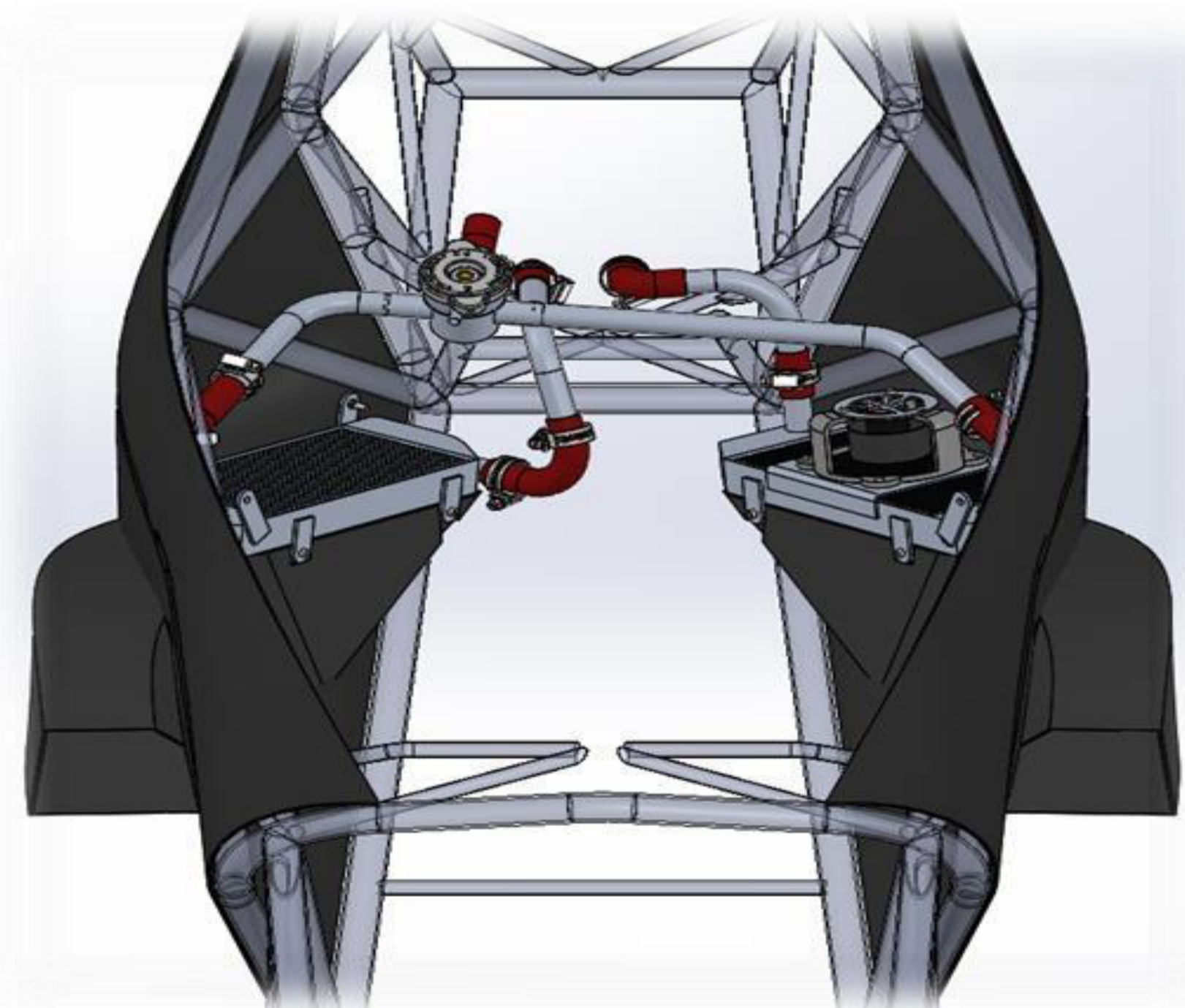
GT- POWER Simulation – Comparison between the old and new engine piston

The GT figures below shows the improvement of the engine performance when using a "high compression" piston.



Cooling System

- Cooling system mounted under seat with inlet ducts
- Calculated radiator angle for optimal cooling and integration

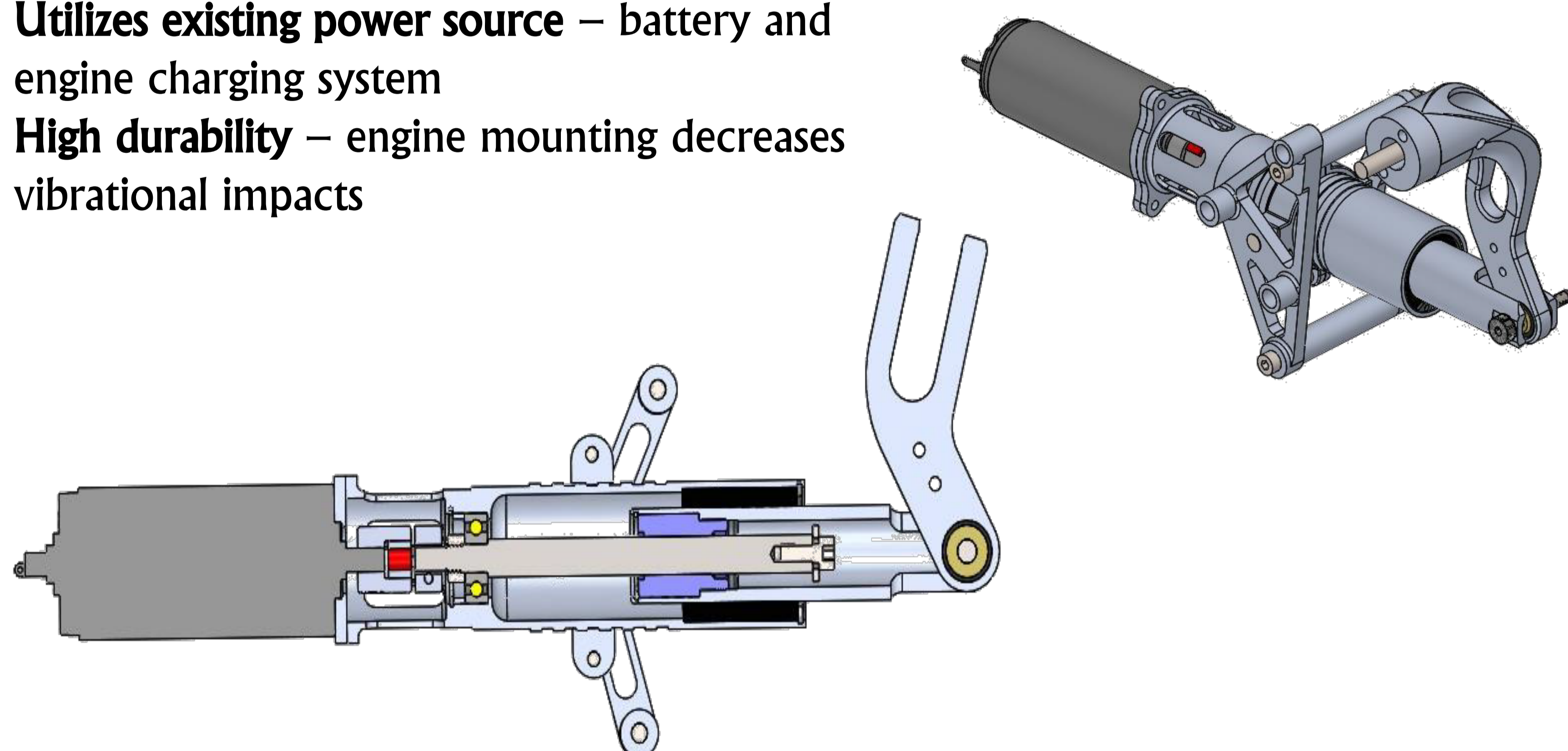


EGSS - Electric Gear-Shifting System



Design advantages:

- **Fast gear shifting** – less than 60msec – improves performance
- **Light weight** – increases power to weight ratio
- **No added controller is needed** – controlled by ECU
- **Utilizes existing power source** – battery and engine charging system
- **High durability** – engine mounting decreases vibrational impacts



Specifications:

- Motor: Faulhaber 3257 DC Electrical: 13V / max 11A
 Up-Shift time: 50ms Torque: 25Nm
 Down-shift time: 60ms Weight: 600gr

Drivetrain

Design:

- o Drexler Limited-Slip Differential
- o Titanium mounts
- o Final Drive Ratio: 30/11

Final Drive Ratio vs. Slip Ratio

