



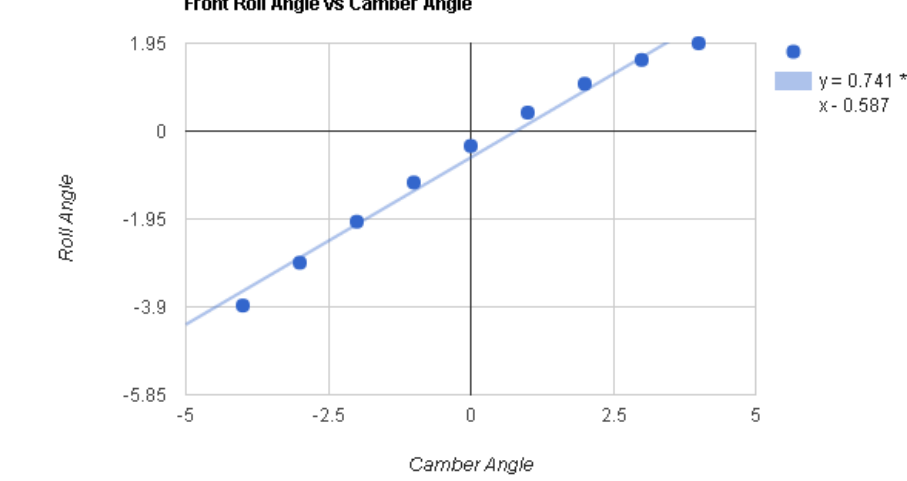
FSAE Racecar: AR-12 "Mantis"

Advisers: Dr. Michael McCarthy, Robert "Smitty" Smith, Phil Chipman

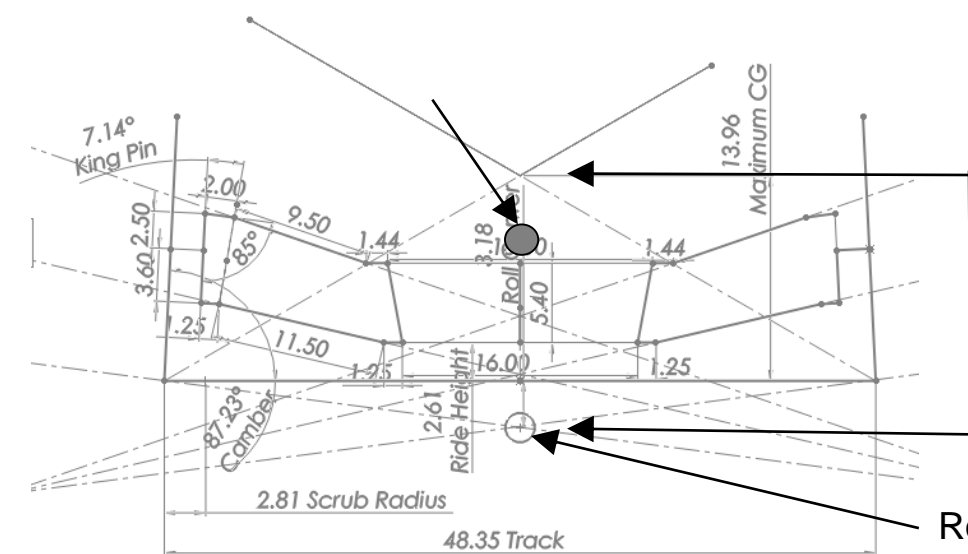
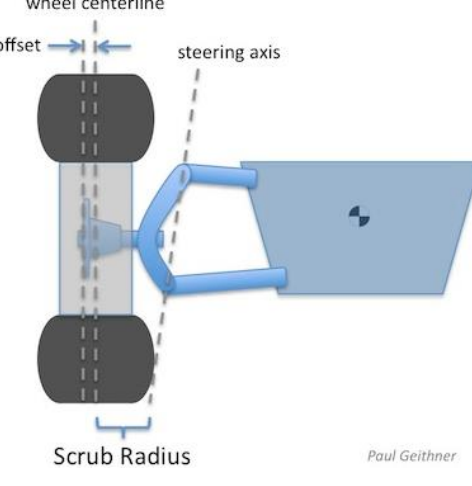


Suspension: Suspension design for AR-12 Mantis began with identifying the problems with last year's car, AR-11 Savage. A high vertical center of gravity was the vehicle's biggest enemy, which resulted in disqualification from competition after the car nearly rolled over under high cornering loads. Many of the 2014-2015 catastrophic design results had been addressed with Savage last year, which provided a great starting point for this year's design. Design goals for Mantis include; lowering the vertical c.g., reducing the force required to turn steering wheel, Incorporation of anti-roll bars (reducing body roll and adjustable handling characteristics), optimizing suspension geometry to utilize as much contact patch as possible.

Old Camber Angle VS. Body Roll



Savage's Scrub Radius- 2.8 inches, and car was heavy. Mantis' Scrub radius - 1.25 in. Wheel effort force is a function of scrub radius

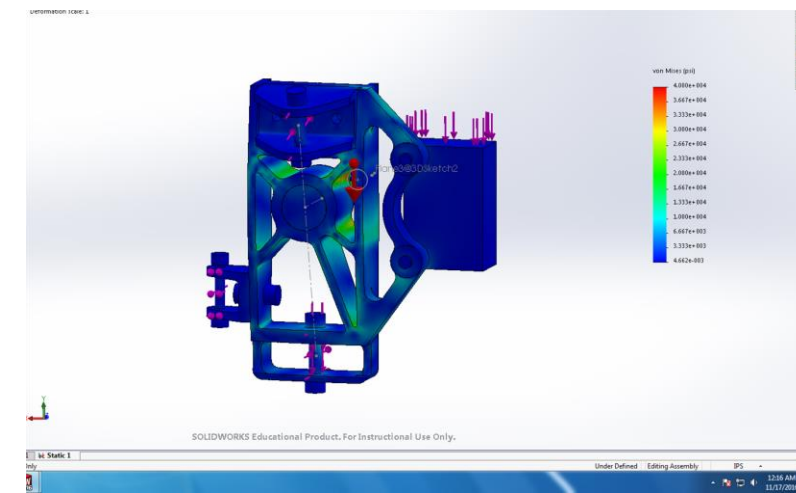


Roll Moment- This is the lever arm between C.G. and roll center

Roll Center - geometric point that the car rolls about

Savage had a vertical c.g. of 16 inches. Mantis' vertical C.G. is calculated to be 12.5 inches.

Finite Element Analysis is performed to validate part's strength, here on our front upright.



Chassis:

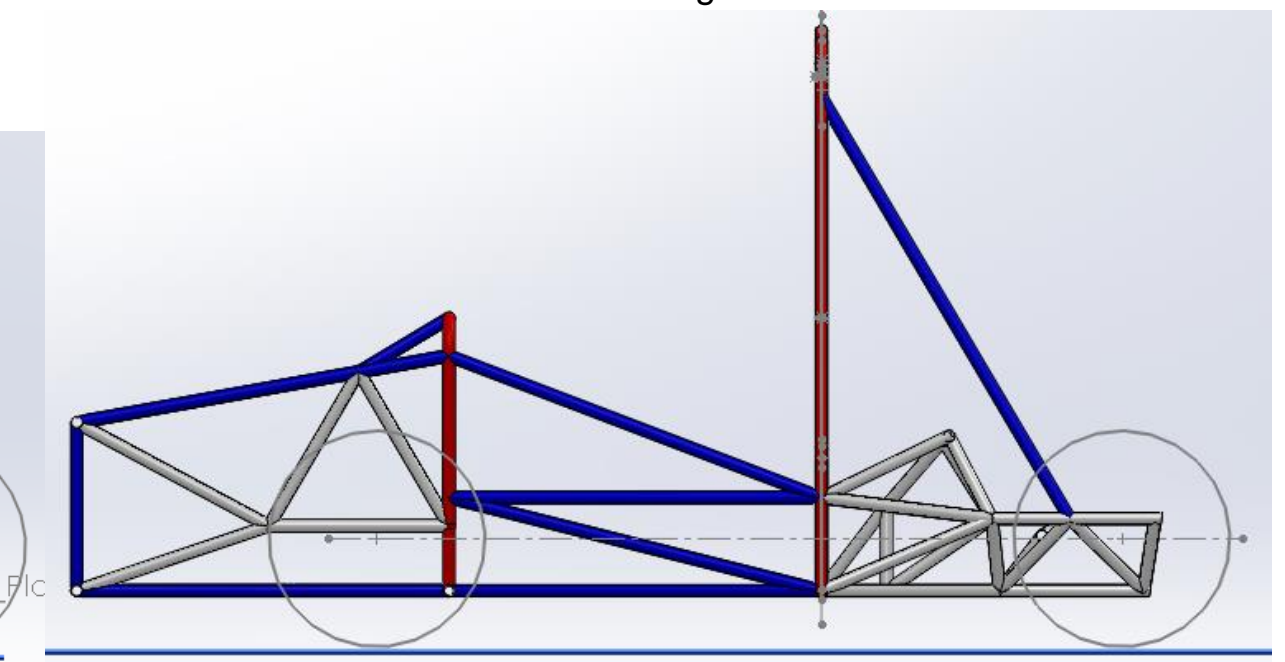
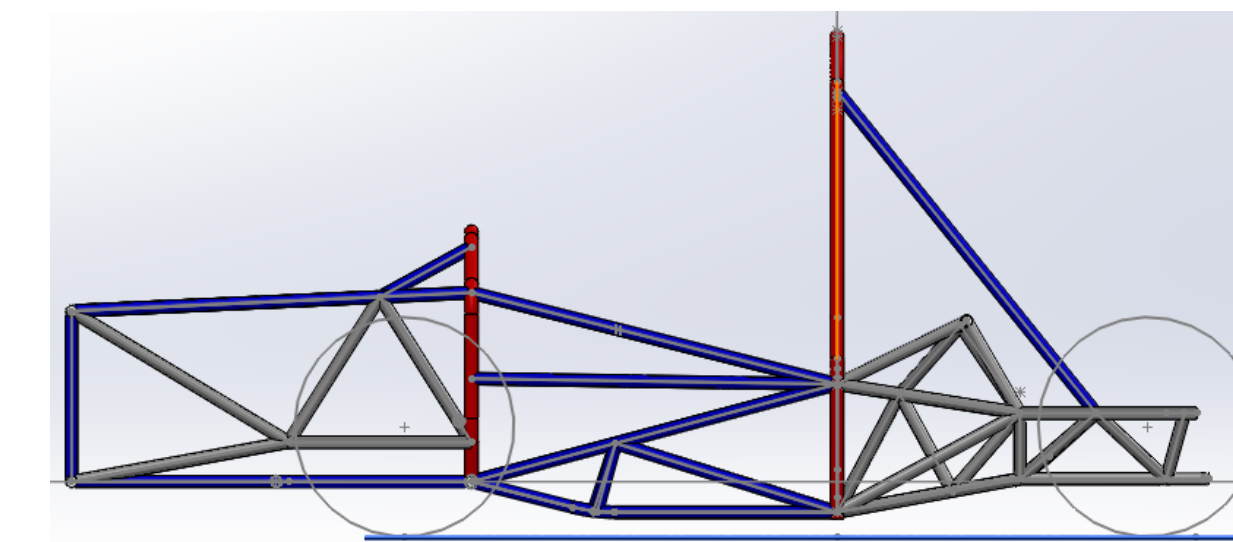
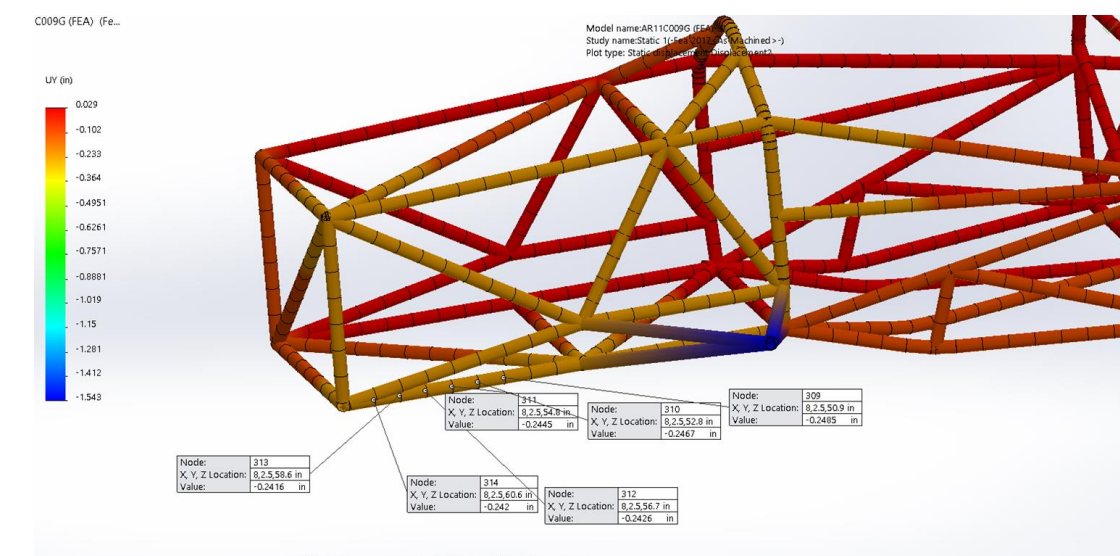
- Rules Compliant
 - Comply to the rules set by FSAE
- Lower Center of gravity
 - Lower center of car but keep nose and rear at original height for optimized suspension.
- Improved driver ergonomics
 - Reclined seat
 - Triangular shaped front roll hoop to give greater visibility
 - longer nose to accommodate reclined driver position
- Reduce weight
 - Smaller main roll hoop
- Strength
 - Torsional Rigidity minimum of 2000 lb/deg

This Year's Chassis:

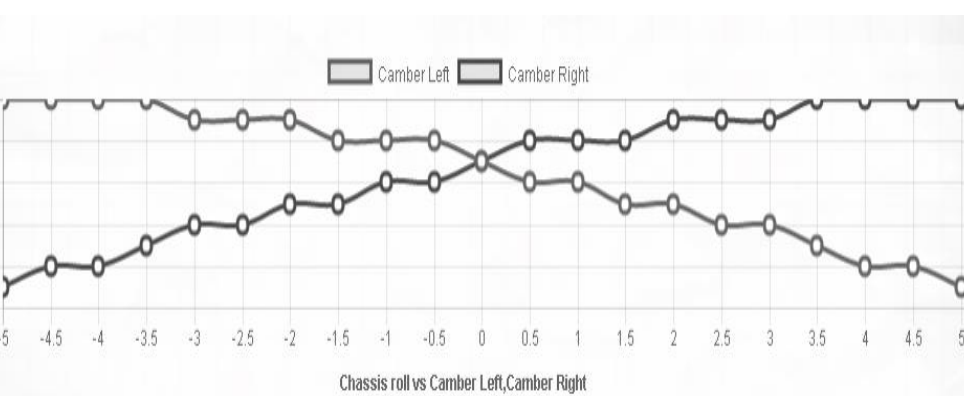
- Theoretical weight
 - 76 lbs (no welds)
- Torsional Rigidity
 - $\Delta y = -0.2443$
 - $\Theta = 0.875^\circ$
 - 2286 lb/deg

Last Year's Chassis:

- Theoretical weight
 - 75 lbs (no welds)
- Torsional Rigidity
 - $\Delta y = -0.282$
 - $\Theta = 1.009^\circ$
 - 1982 lb/deg

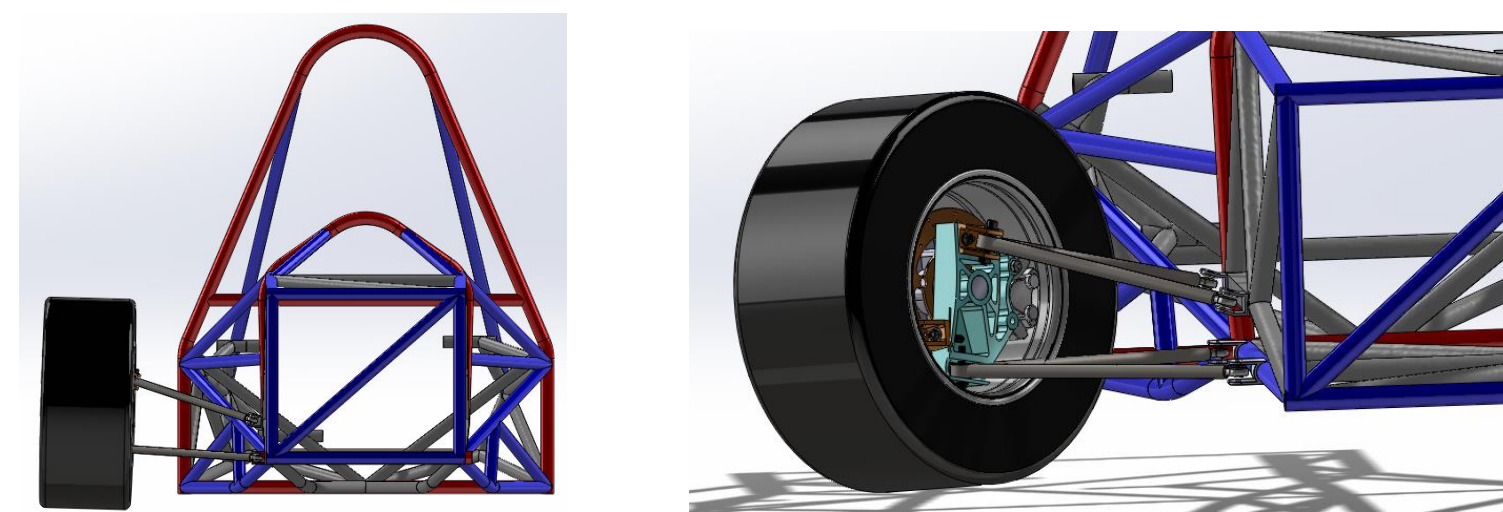


New Camber Angle VS. Body Roll



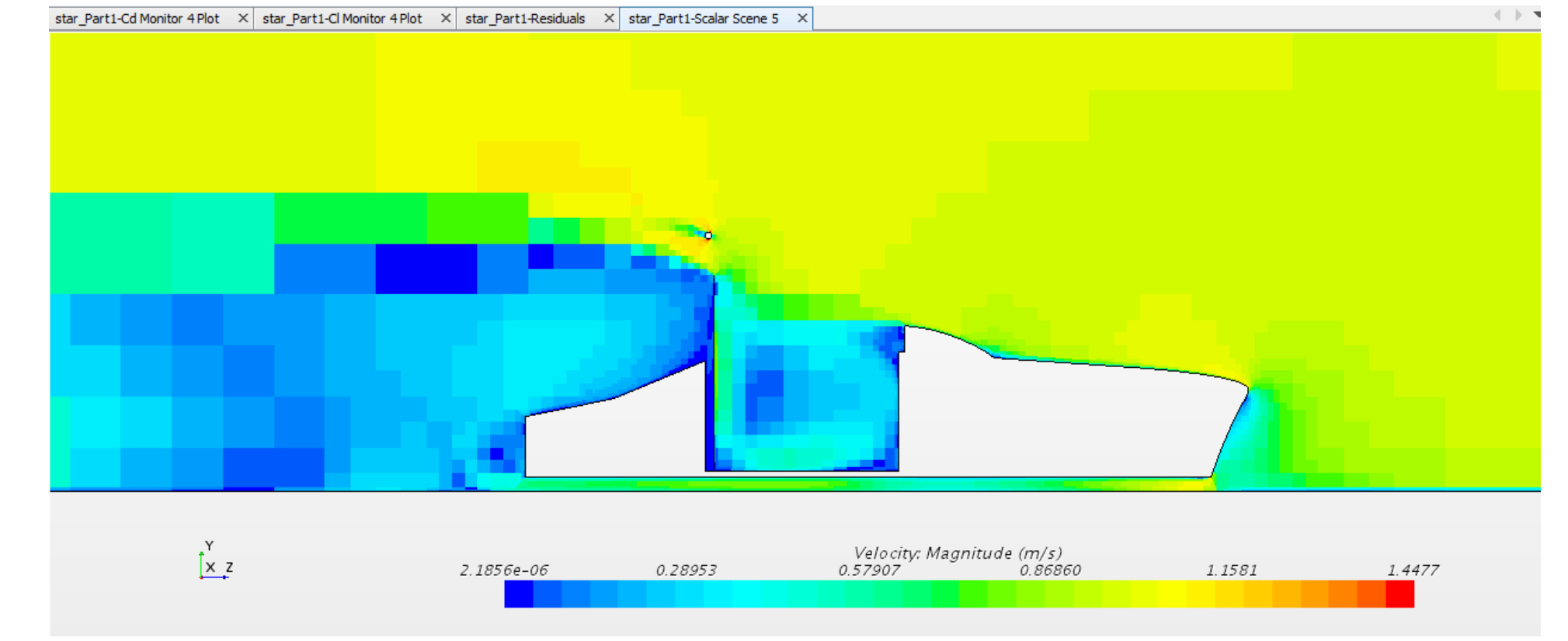
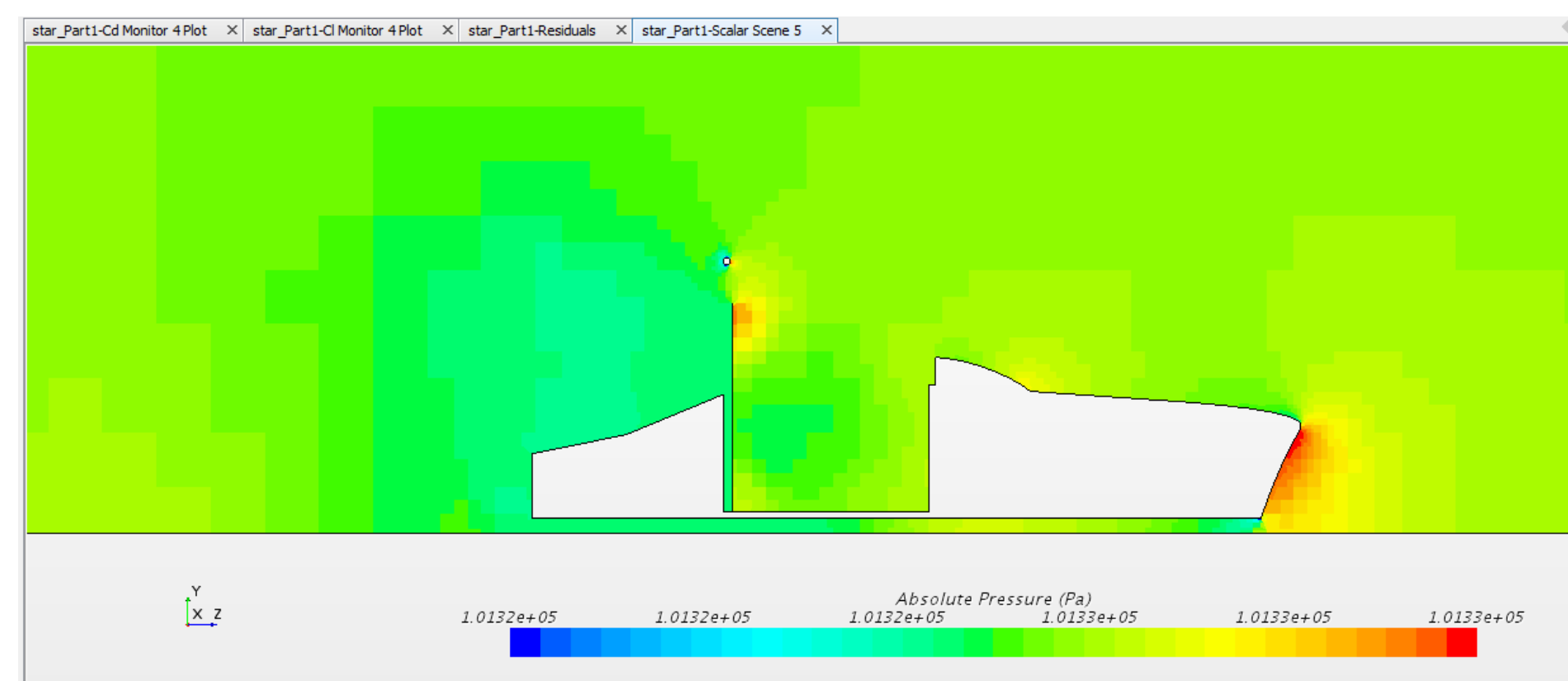
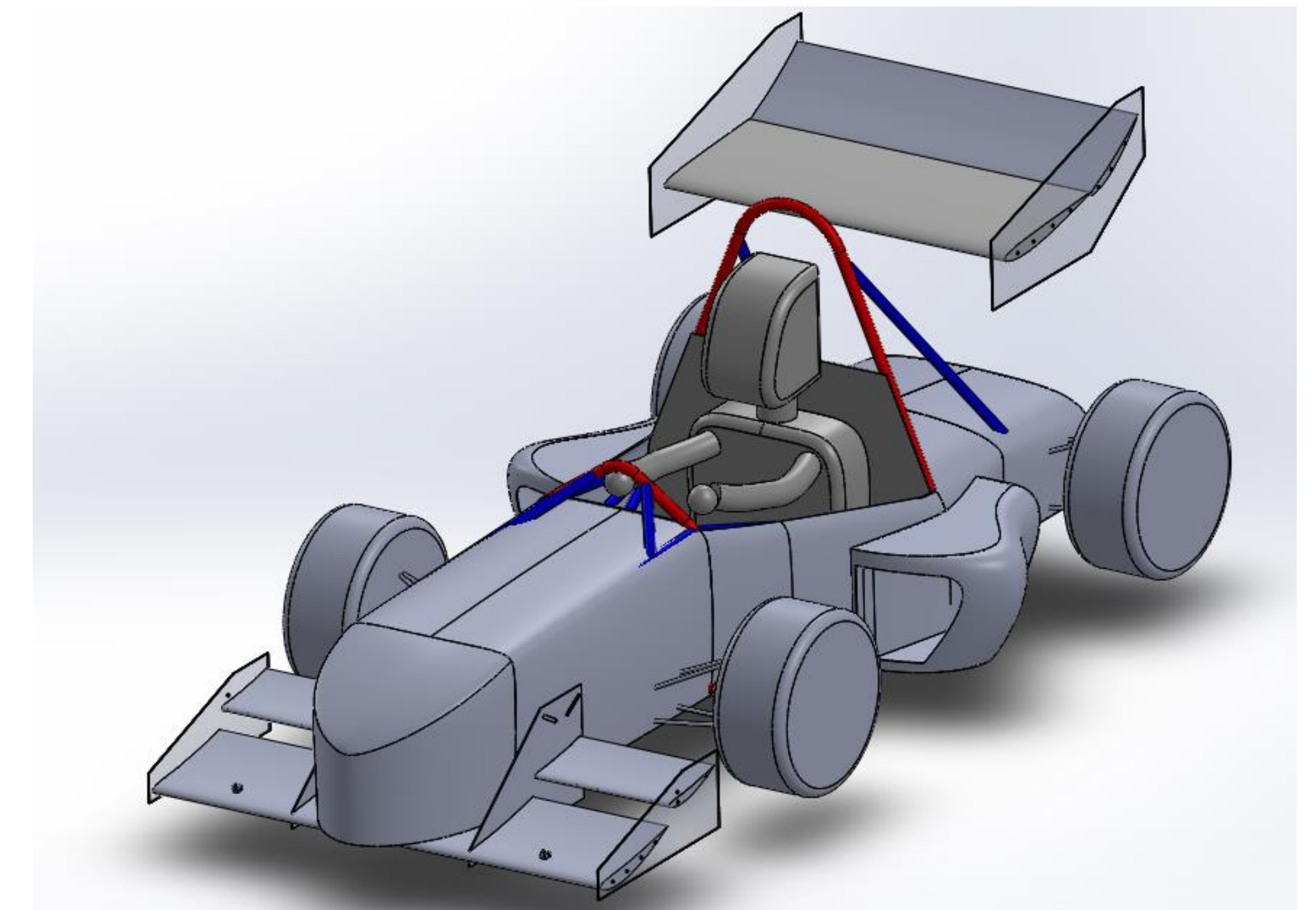
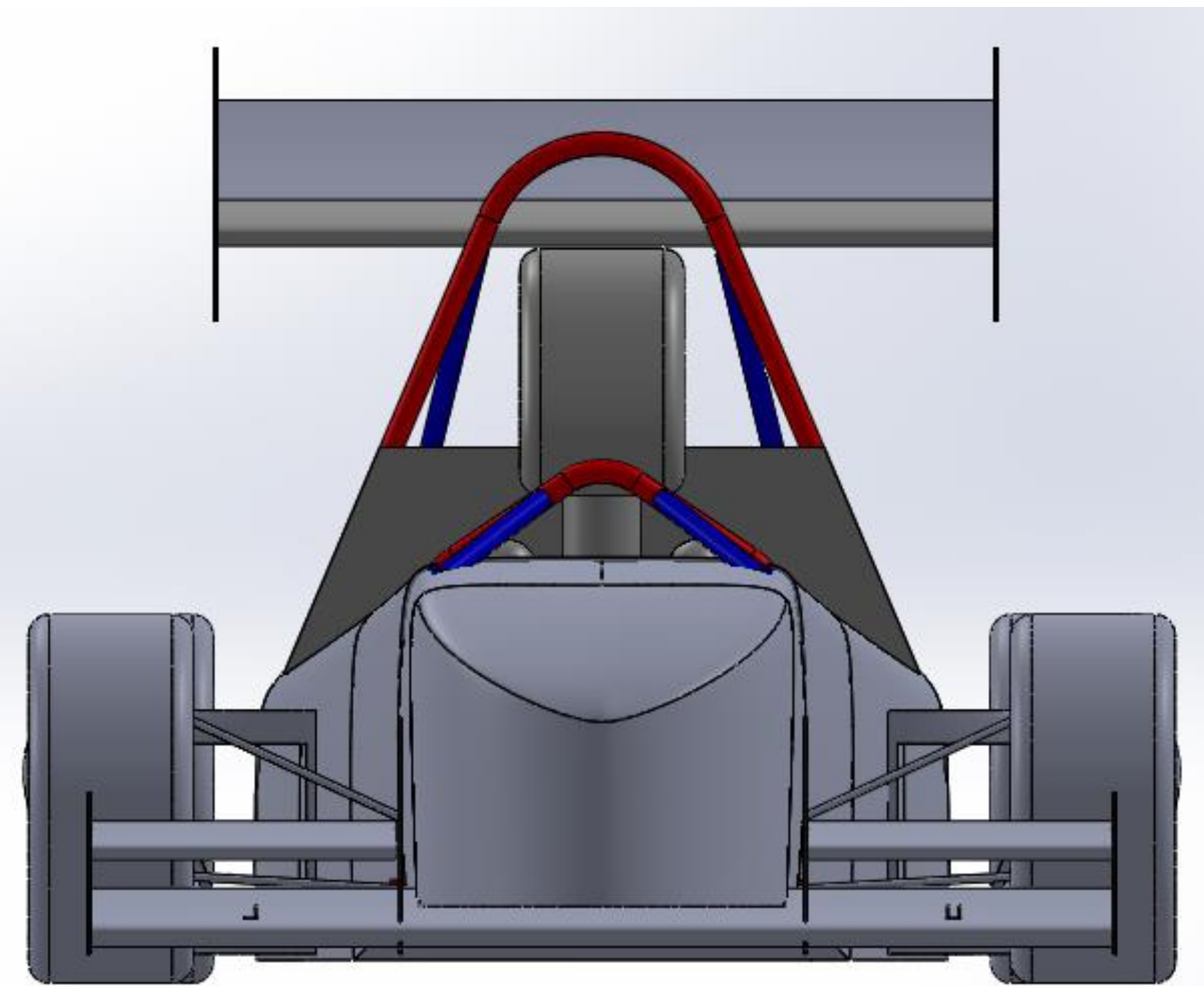
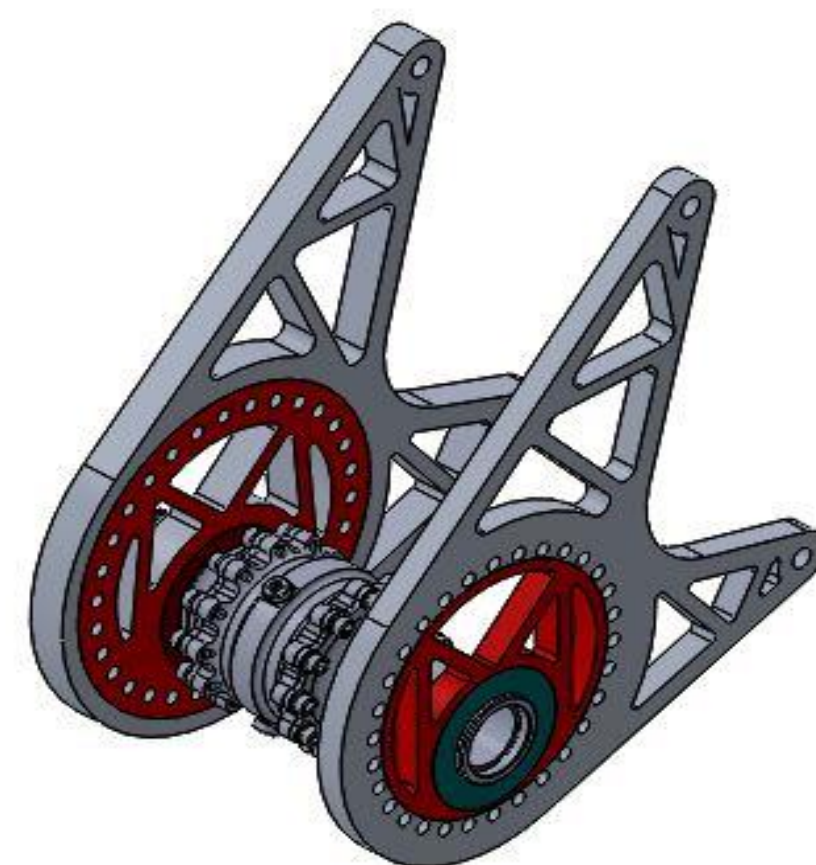
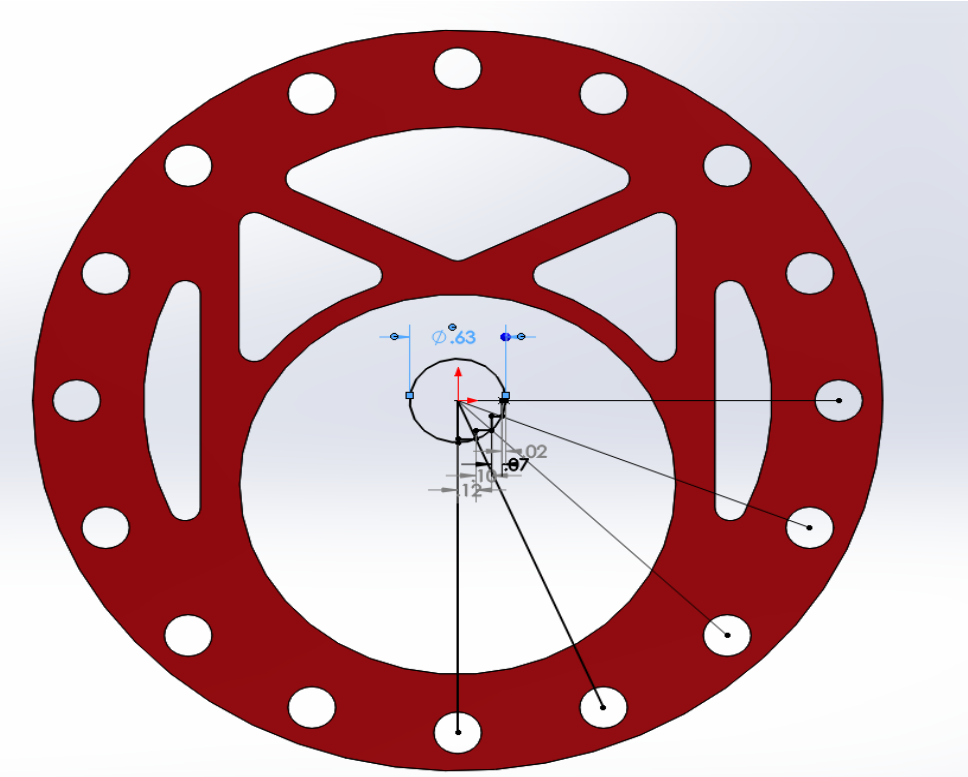
Optimization of Dynamic Camber- Wheel camber of 0 degrees at all times is desirable

AR-12 Front a-arm and wheel assemblies mated to the chassis



Powertrain:

- Our main objective this year for Powertrain design on AR-12 is to optimize the packaging of all our components in order to have stronger and lighter parts. As a result we expect to have a better power to weight ratio.
- Our new differential mounting assembly will be shorter in distance between the engine and the differential in respect to last years design
- Vehicle will also have lower engine placement.
- Improvements will lead to great indication of increased structural integrity in order to avoid all yielding as noted from the previous 2015-2016 AR-11 Savage.
- Improvements in design will also contribute to the overall drop of the vertical center of gravity.
- Conformation of these details will be given when our components have been manufactured and integrated onto the 2016-2017 car for verification.



Team Captain: Matt Clark

Team Leads: Tomas Perez, Tim Zaragoza, Daniel Torres, George Bishara, Alex Lupercio