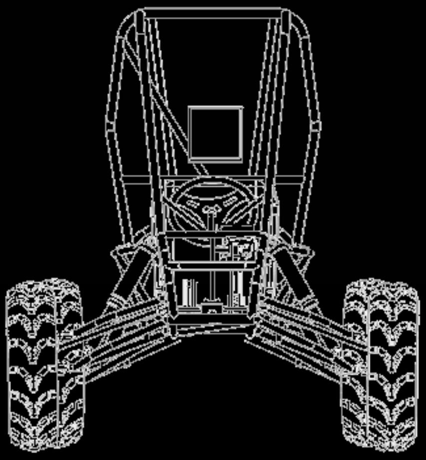
SAE INTERNATIONAL

Venezuela

Universidad de Carabobo

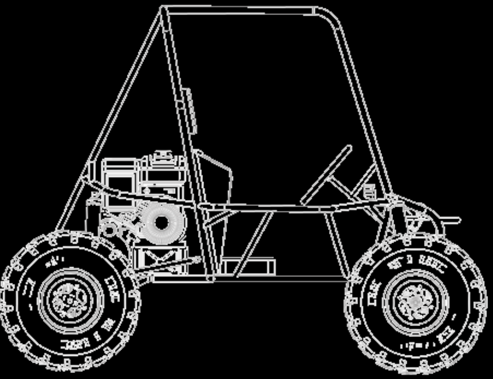
Prototype BAJA SAE UC 2015
Design presentation

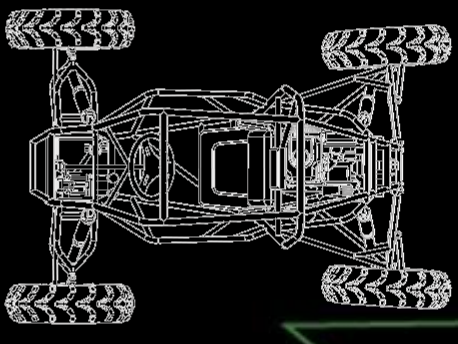
Stronger



Agility

Innovation





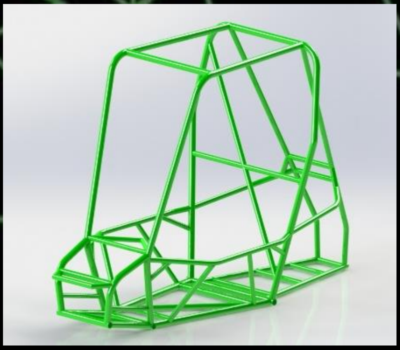
Faster

BAJA UC

Baja Frame
SAE UC 2015

Frame Design Goals:

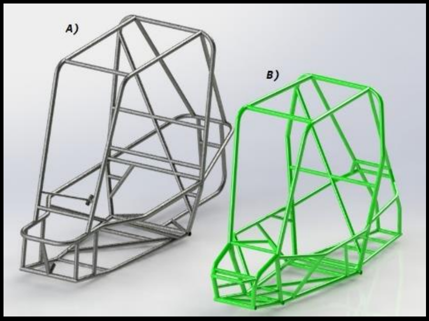
- To improve the chassis geometry and strength in different scenarios by impact analysis per action suspension system, rollover, frontal and side impacts.
- To reduce weight by varying diameter and thickness of the corresponding tubing of side members and reinforcements.

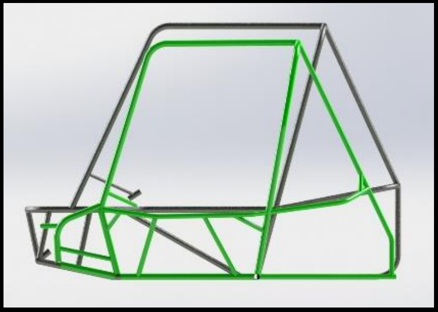


Material Selection:

- Primary Members: AISI 4130, OD 1,25" x 0,065" Wall Tickness.
- Secondary Members: AISI 4130, OD 1,00" x 0,065 and 0,049" Wall Tickness.
- Other Members: AISI 4130, OD 0,875" x 0,035" Wall Tickness.
  AISI 4130, OD 0,75" x 0,049" Wall Tickness.

Comparison:





A) Frame: BAJA SAE UC 2014

Weight: 40 kg

B) Frame: BAJA SAE UC 2015

Weight: 28 kg

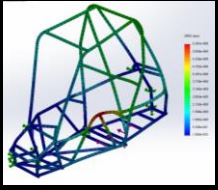
Total Reduction Porcent (%): **15%**

Finite Element Analysis

Side Impact

Charge Applied: 5000 N
Max Strength: 346,8 MPa

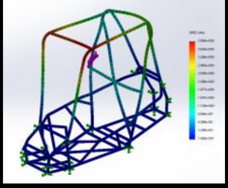
FDS: 1.3



Roll Over

Charge Applied: 5000 N
Max Strength : 187,9 MPa

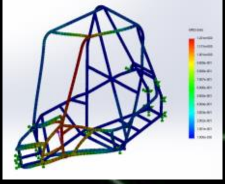
FDS: 2,3



Front Susp Impact

Charge Applied: 5000 N
Max Strength: 184,0 MPa

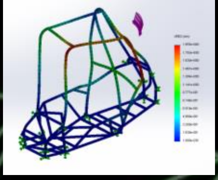
FDS: 2,5



RHO Impact

Charge Applied: 5000 N
Max Strength: 387,4 MPa

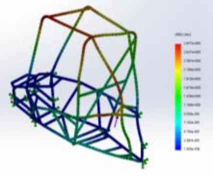
FDS: 1,2



Rear Susp Impact

Charge Applied: 5000 N
Max Strength: 370,0 MPa

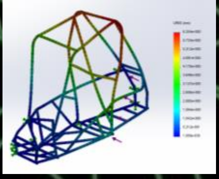
FDS: 1,2



Firewall Impact

Charge Applied: 5000 N
Max Strength: 237,5 MPa

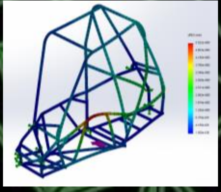
FDS: 1,9



SIM Node Impact

Charge Applied: 5000 N
Max Strength: 372,4 MPa

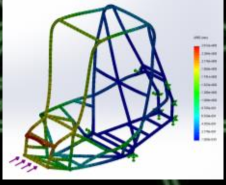
FDS: 1.2



Front Impact

Charge Applied: 5000 N
Max Strength: 162,4 MPa

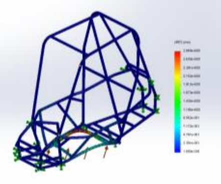
FDS: 2,8



USM Impact

Charge Applied: 5000 N
Max Strength: 206,4 MPa

FDS: 2,2

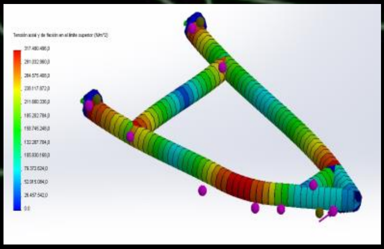


Suspension

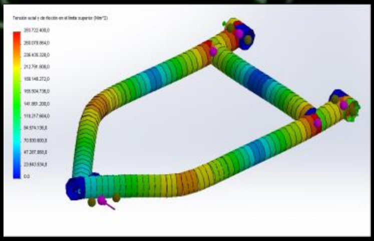
Suspension Design Goals:

- To design a variable suspension system, static and dynamic, that will allow an efficient vehicle configuration to improve its performance.
- To implement a rear suspension system of the unequal A-Arm type that will allow the variation of the static and dynamic toe in order to improve the maneuverability of the vehicle in close curves.

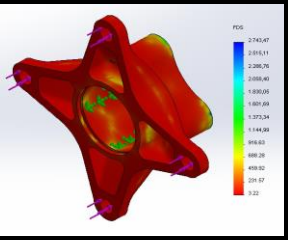
Finite Element Analysis



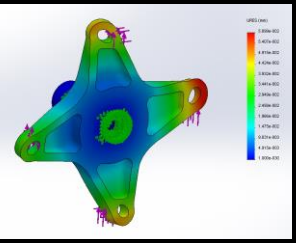
Front Lower A Arm



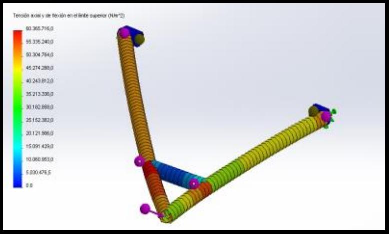
Front Upper A Arm



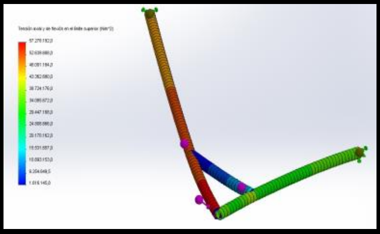
Front Hub FDS



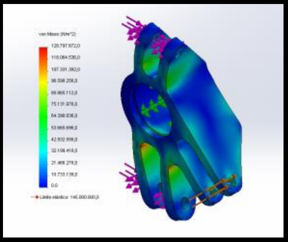
Rear Hub Displacement



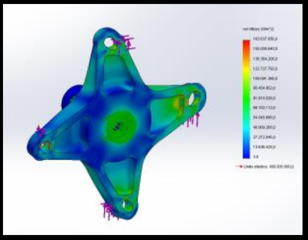
Rear Lower A Arm



Rear Upper A Arm



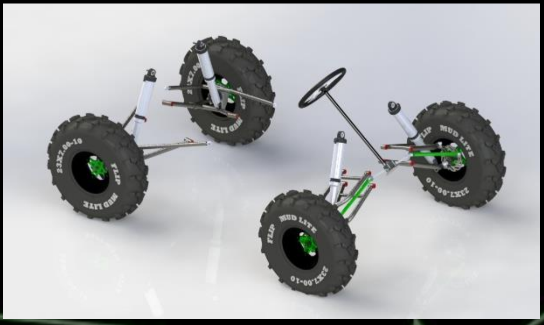
Rear Upright



Rear Hub Max Strength

Components Assembly

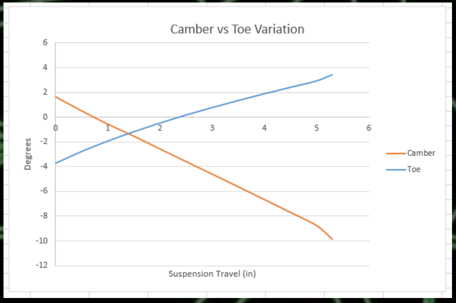
Suspension Assembly



Rear Suspension Components

Front Suspension Components

Suspension Graphs

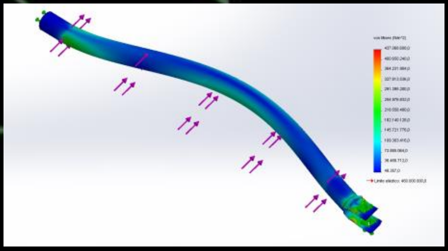


Steering

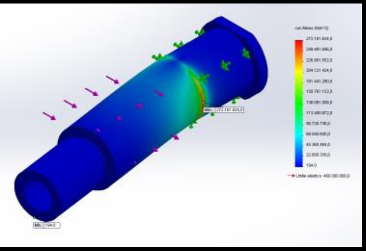
Steering Design Goals

- Lowering turn radius based on Ackerman Criteria.
- To improve prototype's maneuverability by reducing steering wheel's angle, manufacturing a new steering box.

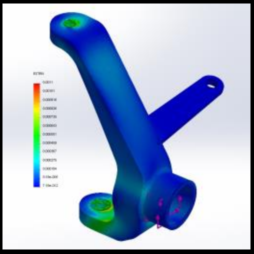
Finite Element Analysis



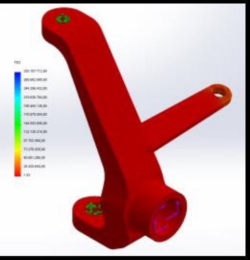
Steering Arm - flexion



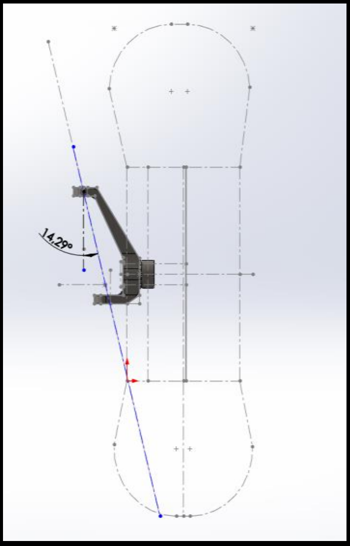
Spindle Max Strength



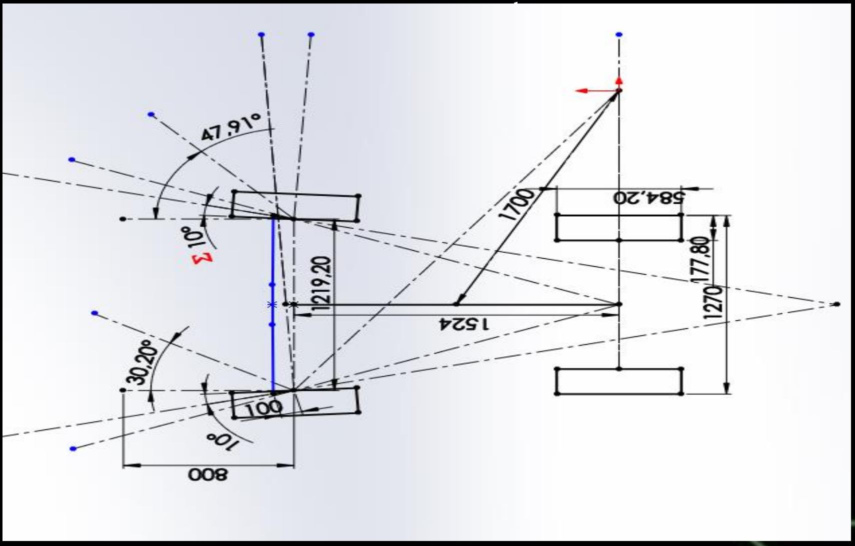
Knuckle Displace



Knuckle FDS



Knuckle Design & Kingpin angle



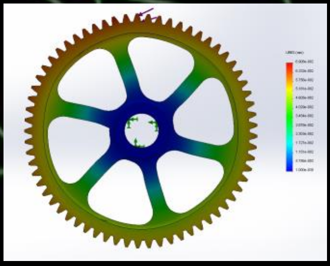
Ackerman Criteria

Suspension & Steering Parts Assembly

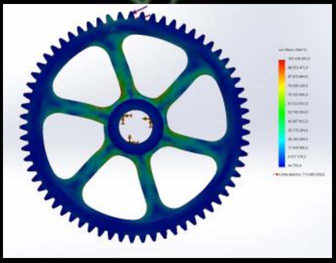
Transmission and Brakes

Transmission design goals:

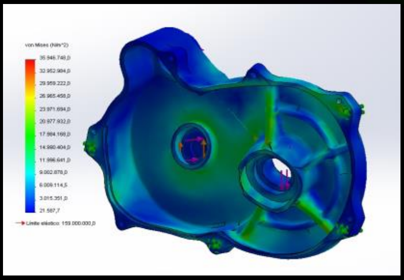
- To optimize the transmission system as compared to previous prototypes, a gear transmission was designed.
- To establish a transmission ratio that would allow the maximum engine torque and to increase acceleration capabilities.



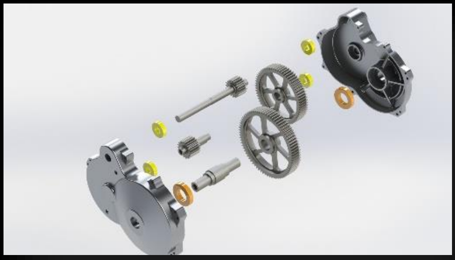
65th Gear



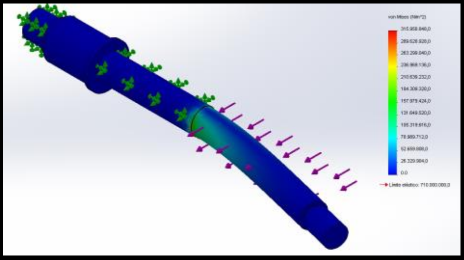
65th Gear
Max Strength



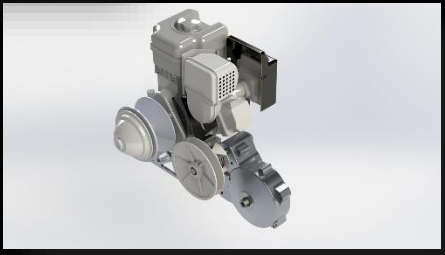
Transmision Case – Max Strength



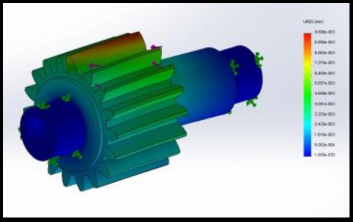
Gearbox parts



In Shaft - Deformation



Transmission Assembly



Shaft – pinion displacement

Brakes design goals:

- To increase the braking pressure, still using the same pumps and calipers as the previous prototype.
- To design disks adjusted to the required measures and with a geometry according to an efficient thermal distribution.

Brake Disc

Pedal Assembly W/ Components

Ergonomys, Safety & Controls

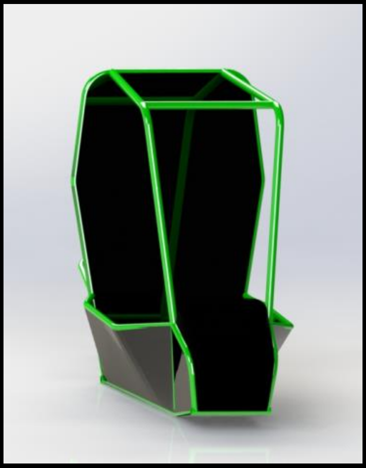
Ergonomics and safety design goals:

- To design a seat focused on improving –on track- driver's comfort.
- Improving vehicle's Aerodynamics focused on body work.

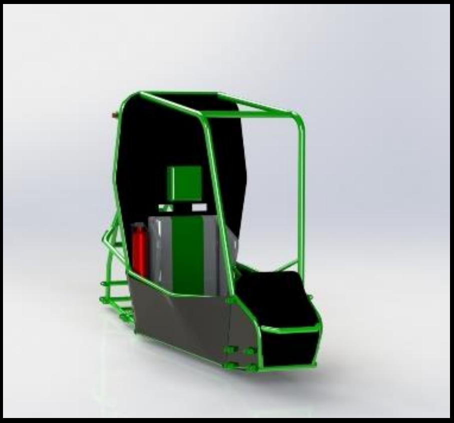
Controls

- To obtain remote information and in real time of the parameters of the prototype (RPM, speed, fuel level and acceleration) to determine the dynamic status of the prototype performance. This information can be saved for reference. An ECU, an OBD communication and an integrated ELM327 model will be used in order to visualize the program parameters already existing and commercially available.

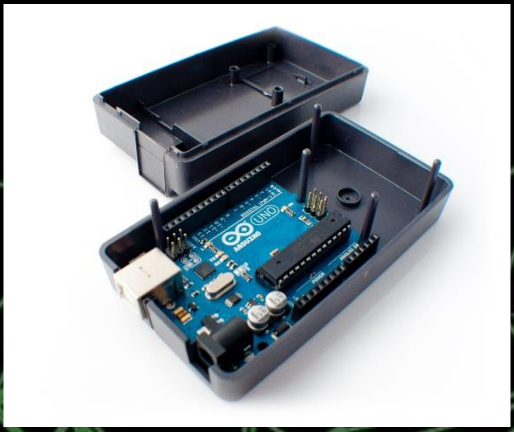
Baja SAE UC Seat



Body Guards



Body guards & Chassis Assembly



Arduino / Baja SAE UC data Transm sys

Rino 71 Assembly