

SUSPENSION TEAM

Client: Nimrod Meller

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Abstract

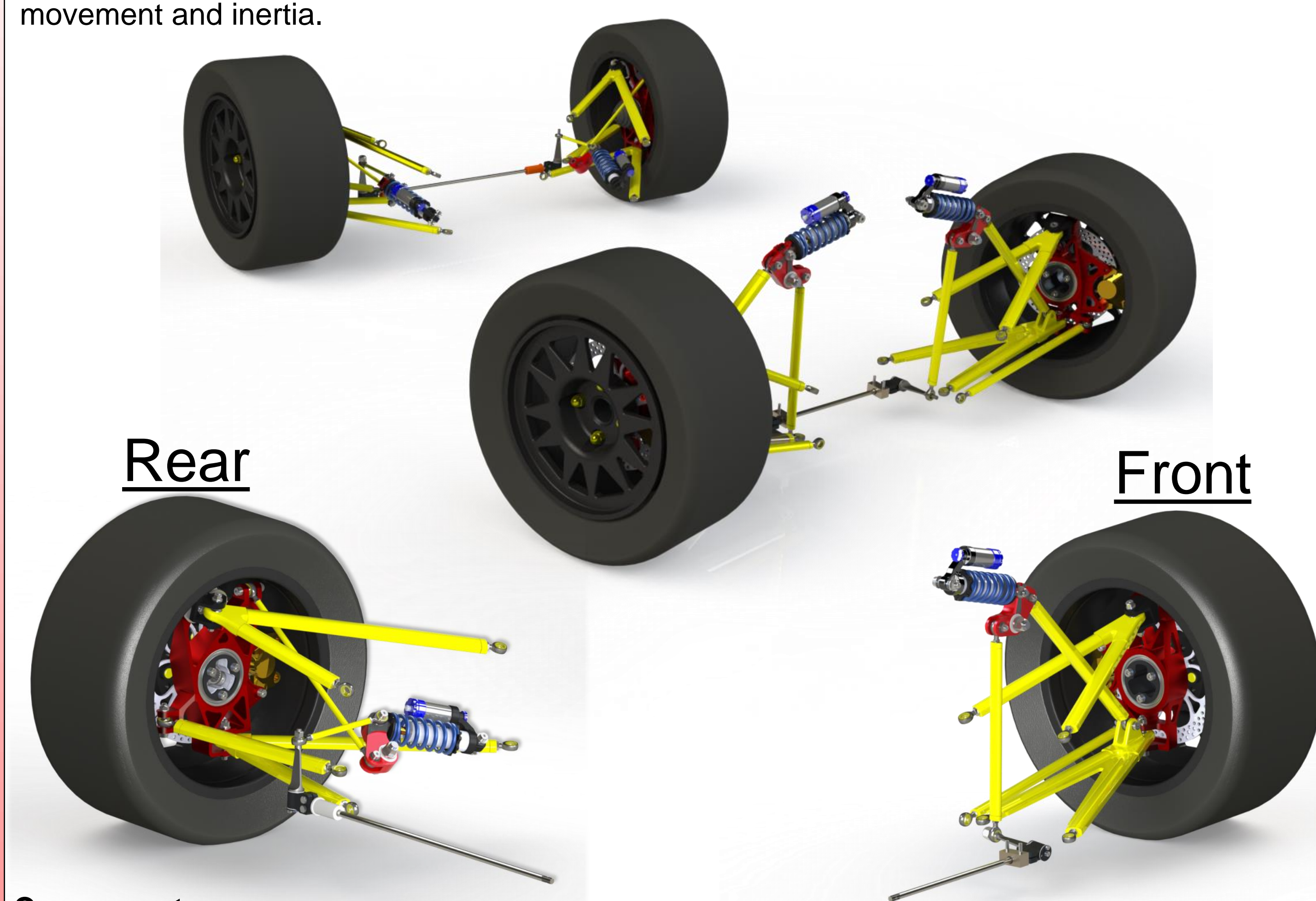
Suspension Team had to enable the production of an effective, adjustable, robust and reliable suspension system. The suspension system is composed of a double wish bone A-arms, push and pull rod damping mechanism and an adjustable blade type anti-roll bar. Most of the suspension component made of a light magnesium alloy.

Project Objective and Requirements

Suspension Team objective is to design and manufacture optimal suspension, damping and weight-transfer mechanism, deliver maximum tire grip at any conditions, control body movement and integrate with the vehicle components. This year the main goals were to design a lighter mechanism that will enable adjustment of the static camber and the roll stiffness of the car, to fit different drivers and allow fine tuning.

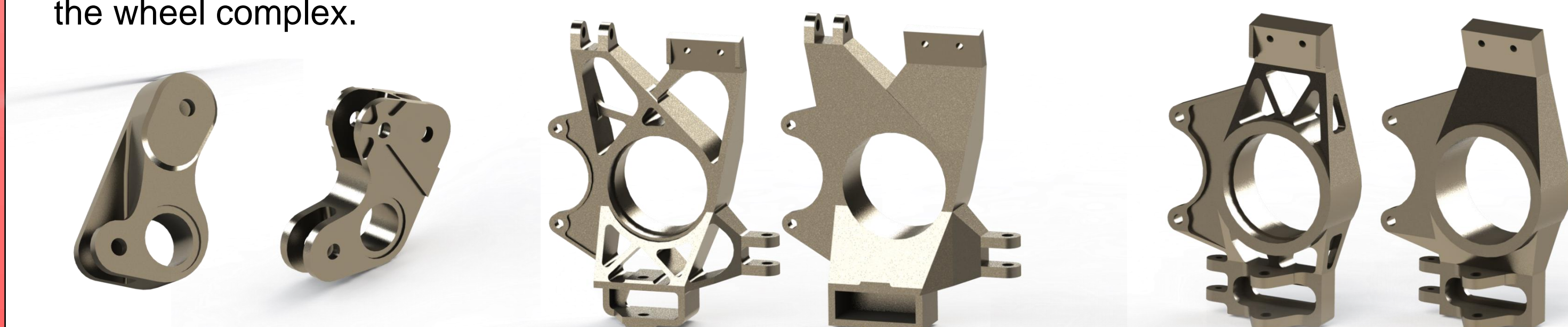
Product Description

Suspension system main task is to link the sprung mass of the car to its tires and control the mass movement and inertia.



Components

- Unparalleled A-arms dictates tire movement and travel range.
- Tie-rods supply steering movement, toe link resist transvers loads from rear tires.
- Load transfer from tires to chassis by push rods in the front & pull rod in the rear.
- Front & rear rockers enable the dampers to operate at the linear range of the shock absorbers & springs, (FOX Racing® DHX 5.0 adjustable coil-over).
- Anti-roll bar mechanism, consist of a torsion bar and adjustable blades, is applied at both axles to reduce body roll & grip loss.
- Special designed upright to connect all of the main components and serve as a base to the wheel complex.



Production & Materials

- Unique ultra-light weight Magnesium (AZ80A-T5) profiles chosen for the A-arms, push-rods, tie-rods, toe-links and drop-links.
- Rod linkage was done by a jig-based TIG-welding with a special made inserts.
- CNC-fabrication of the upright, rockers, A-arms inserts, anti-roll blades and housings.
- Ball joints and rod-ends bearings were used to link to the chassis and wheel complex.
- Steel spacers & bushings were made to eliminate unwanted freedom between part and wear in the system.

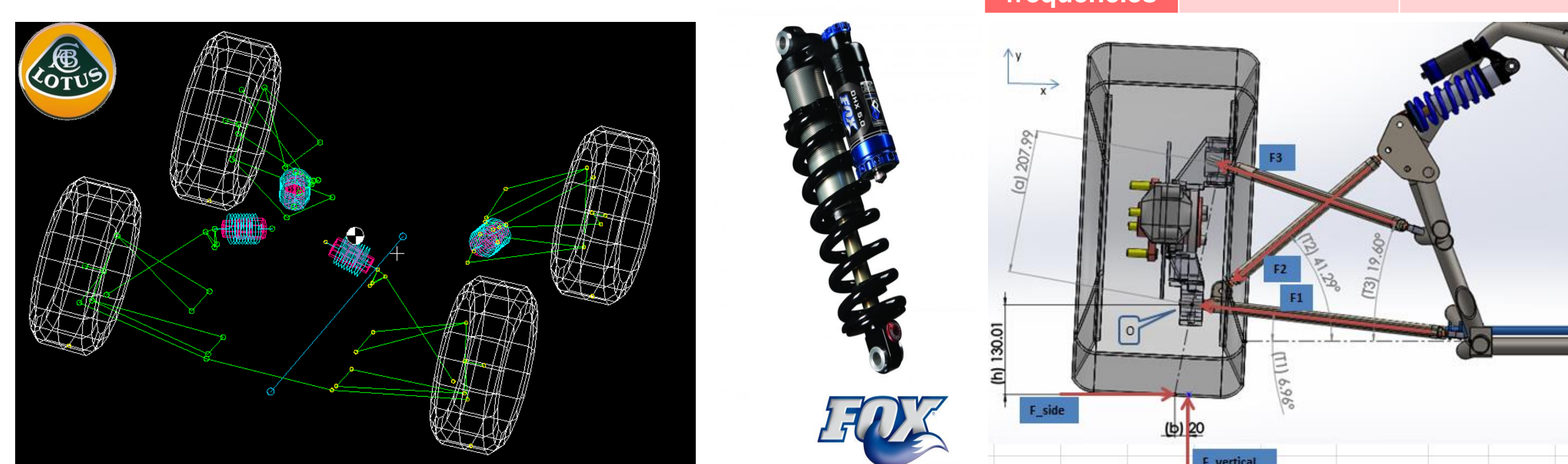


Analysis

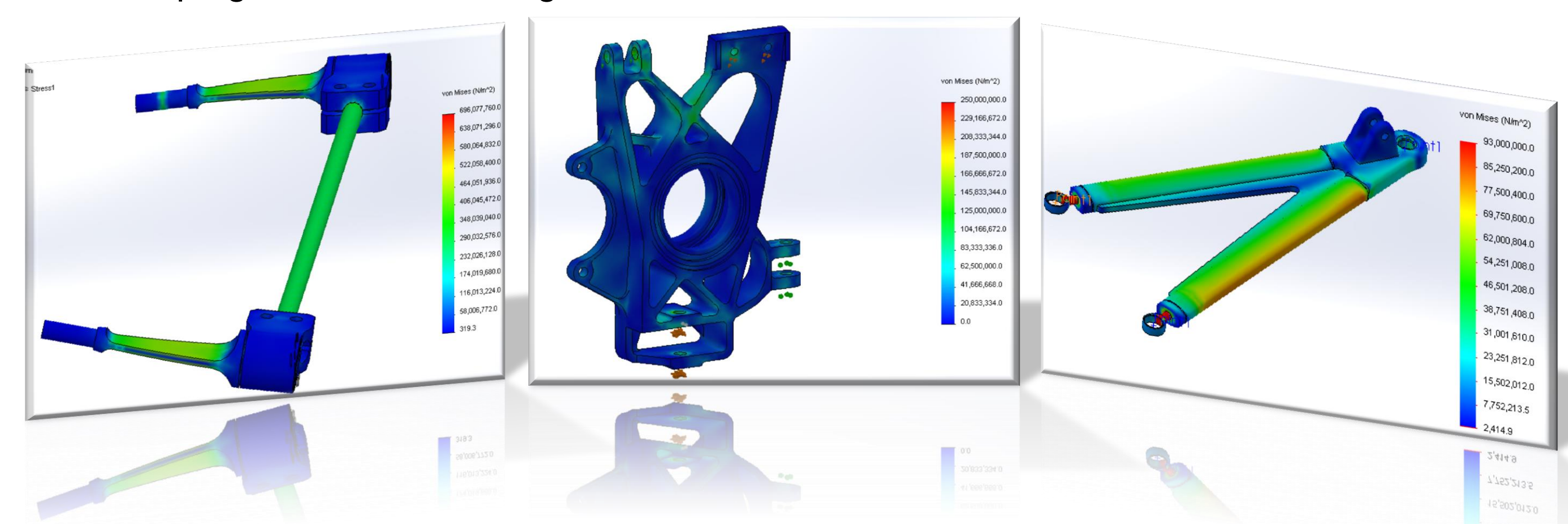
- Suspension geometry design via iterative modeling process by Lotus Suspension Analyzer® software.
- Static & Dynamic calculations were conducted in order to obtain dynamic properties of the suspension system.

dynamics characteristics

	Front	rear
Roll center	16.5 [mm]	82 [mm]
Center of gravity	Height - 312 [mm] Longitudinal dis - 49/51 % (f/r)	
Motion ratio	0.7	0.63
Spring rate	300 [Lb/ft]	250 [Lb/ft]
Natural frequencies	2.9 [Hz]	1.9 [Hz]



- Finite elements analysis was performed using Solidworks® simulation tools to achieve the desirable factor of safety. A design study has been conducted in order to decrease weight while keeping the desired strength.

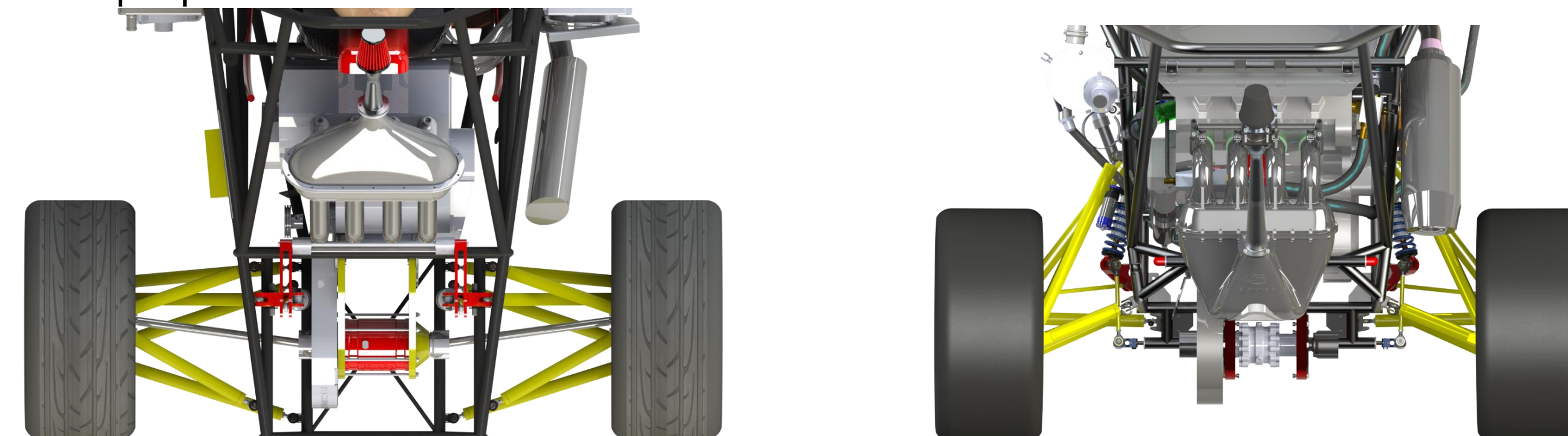


Innovations & Challenges

- Design & manufacture a 35% lighter uprights with static camber adjusting capability. all done by using multiple finite elements analysis to get the desirable factor of safety after great material removal
- Design & manufacture unique adjustable anti roll bar mechanism to prevent extensive body roll. The mechanism includes two blades and based on torsion and bending torque principles.



- The Chassis is shorter than last years car what limits the optional anchoring points at the rear. An optimal design has been achieved to anchor all the suspension parts to the designed chassis
- A unique pull rod mechanism at the rear rocker environment.



2013

2014

Acknowledgements

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