Wheel Packages

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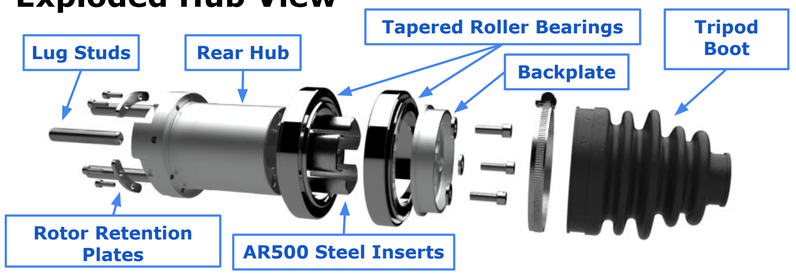
MIT MOTORSPORTS

Design Overview

- AL7075 **monolithic uprights** with **custom in-hub tripod housings**
- Maximizes tractive performance with controlled camber stiffness (<0.5deg at maximum loading), adjustable camber
- Tab mounted 4130 steel **floating** brake rotor
- Interface with optimal suspension points
- High strength to weight and stiffness to strength materials (Ashby)

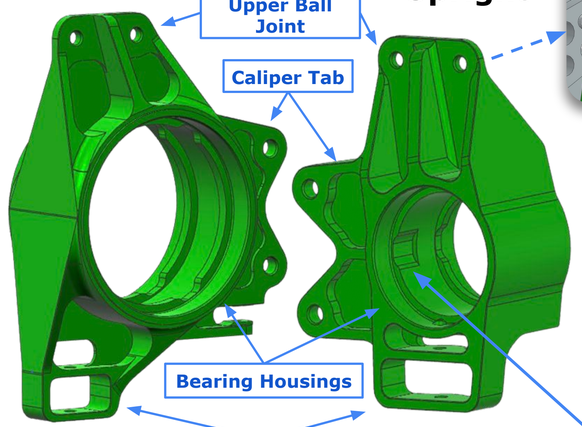
Exploded Hub View



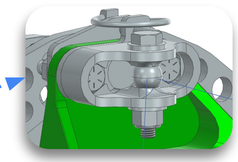
Hardened **AR500** Steel insert sleeves react point load (Hertzian contact)

Tab mounted interface for brake rotors minimizes required custom high-tolerance parts

Rear Upright



Front Upright



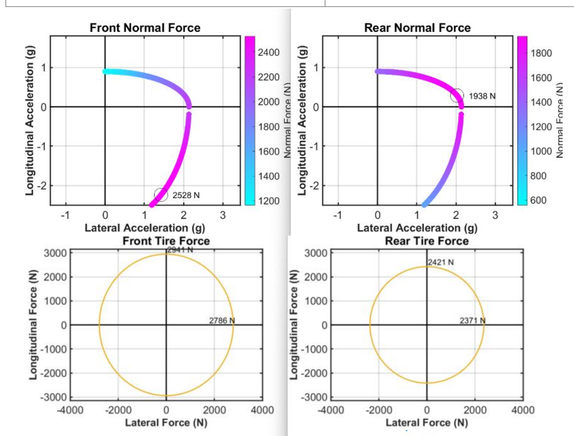
Camber Adjust Assembly

Slotted shim design with 2 degrees of high resolution adjustability
Pin for retention

Analysis

Key Design Requirements

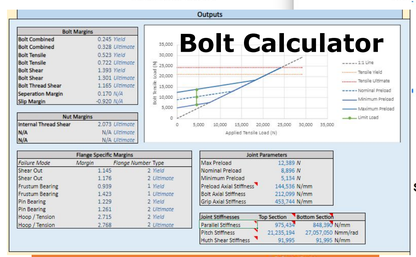
Requirement	Metric	Result
React Contact Patch Loads	Does not yield under combined cornering, braking, and bump load conditions	No yielding observed in 250mi/400km of testing
Clearances	No interferences at wheel packages motion extrema	All > 0.070in
Mass	Stay below 33.5kg	Actual mass of 34.172 kg 2% Over budget
Camber Stiffness	Wheel Package cambers <0.50 degrees under max performance loads	Front Wheel Packages: 0.53° Rear Wheel Packages: 0.47°



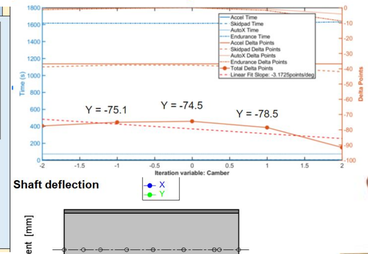
Simulation-Driven Contact Patch Loads

X = Long Y = Lat Z = Norm	Front	Rear
X +	0.0 kN	2.6 kN
X -	3.2 kN	2.6 kN
Y +	3.0 kN	2.5 kN
Y -	3.0 kN	2.5 kN
Z +	2.5 kN	1.9 kN
Z -	0.5 kN	0.9 kN

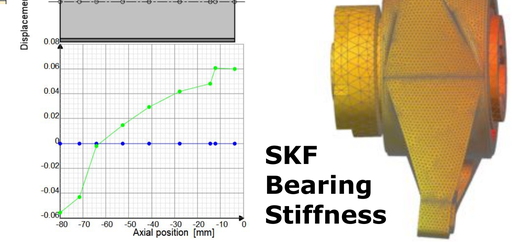
Dynamic Camber Point Simulation



Margins	Failure Mode	Component
2.096	LBJ Bolt Shear Ultimate	Rear Upright
1.140	Lug Bearing Failure	Rear Upright
0.167	Lug Net Tension Failure	Rear Upright
0.573	Lug Shear Out Failure	Rear Upright
42.830	Tab Shear Yield	Rear Upright
0.152	Bolt Combined Yield	Rear Upright
0.277	Bolt Combined Ultimate	Rear Upright
0.213	Bolt Tensile Yield	Rear Upright
0.394	Bolt Ultimate Yield	Rear Upright
7.118	Bolt Shear Yield	Rear Upright
6.806	Bolt Shear Ultimate	Rear Upright
0.132	Bolt Thread Shear Ultimate	Rear Upright
4.509	Separation Margin	Rear Upright

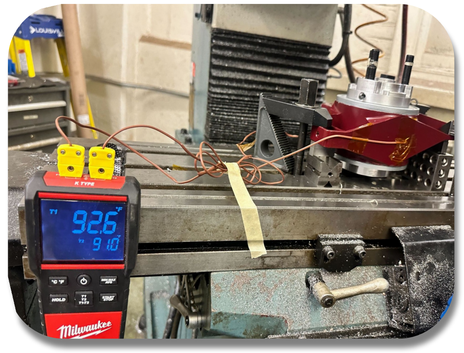


Multibody FEM



SKF Bearing Stiffness

Testing and Validation

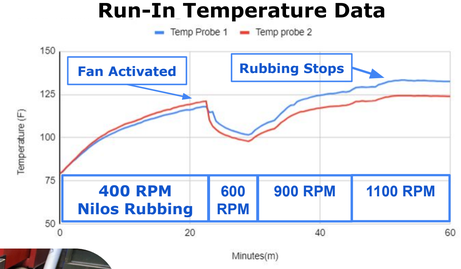


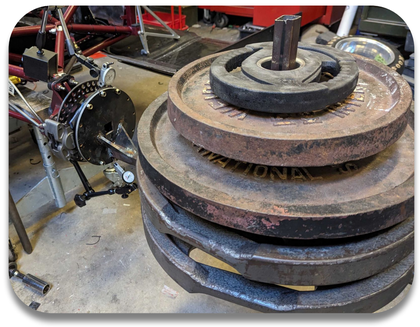
Run In Assembly
Bearings preloaded to axial spec, Nilos rings rubbing causes temperature increase.
Verified that Nilos ring worst-case friction doesn't exceed grease or housing allowables

Fan used to simulate convective cooling while driving

Car max speed: ~1500 RPM (71.4MPH)

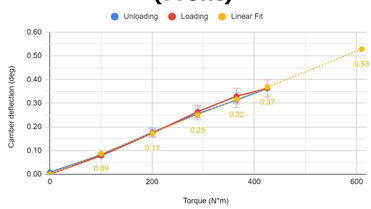
Run-In Temperature Data



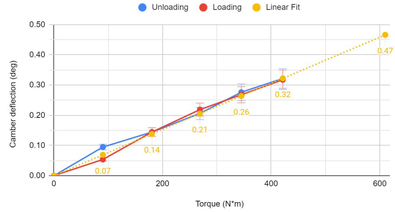


Wheel Package Torsionating
Induced representative contact patch loads into the wheel package to characterize camber stiffnesse

Torsionated Dynamic Camber (Front)



Torsionated Dynamic Camber (Rear)



Design Specification	FEM Predicted	Actual Result
0.5 deg, 3kN at contact patch (609.6 Nm @ 8in radius) Front and Rear: 1,219.2 Nm/deg	Front: 0.43deg at 3kN (1,417 Nm/deg) Rear: 0.44deg at 3kN (1,385 Nm/deg)	Front: 0.53deg at 3kN (1,169 Nm/deg) Rear: 0.47deg at 3kN (1,319 Nm/deg)