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*Project title: NMMU Racing DibaE Electric Race Car Project*

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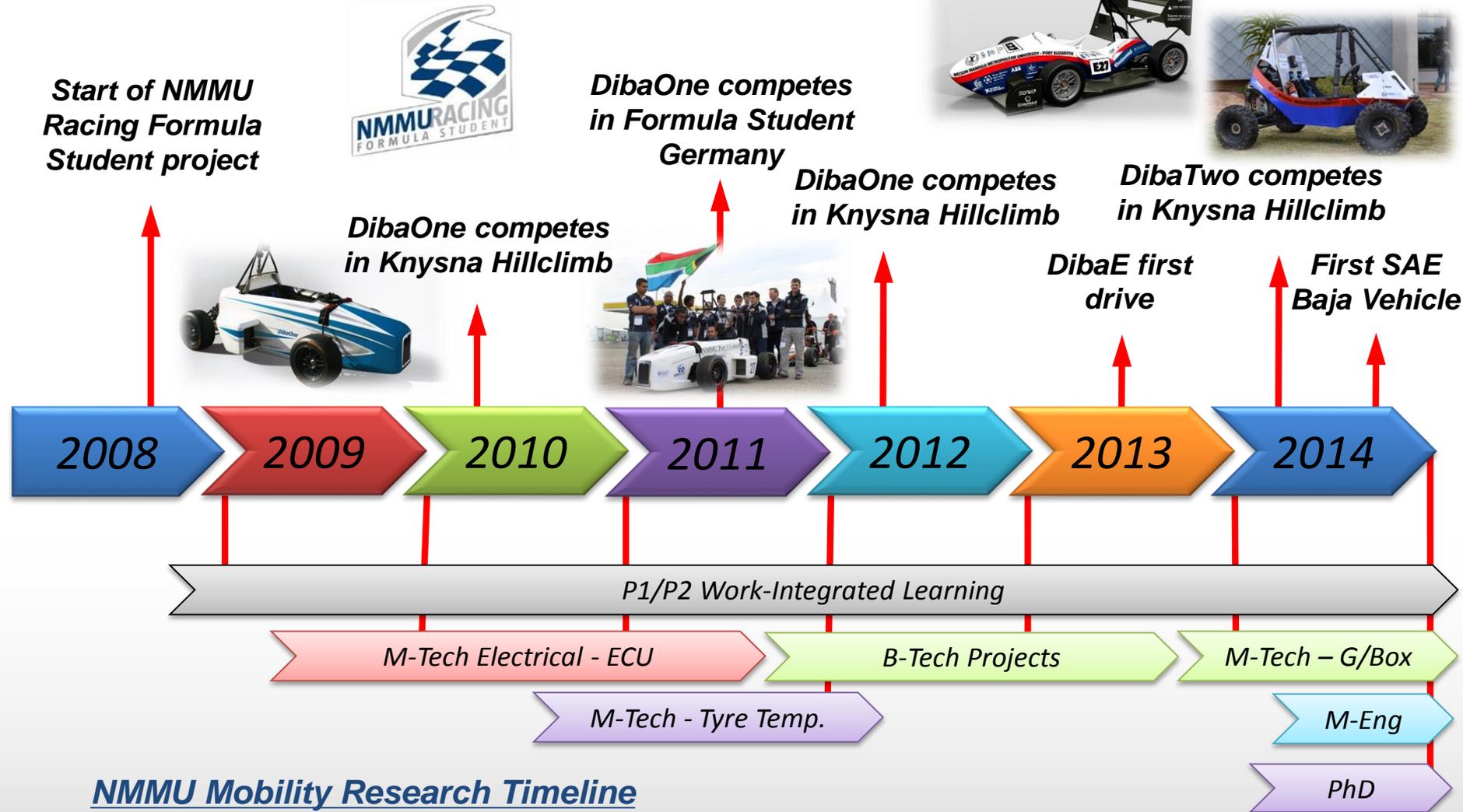


# NMMU Racing



# Project History

## NMMU Racing Project Timeline



## NMMU Mobility Research Timeline

## Teaching & Learning

- WIL (Mechanical Eng.)
- Vacation Work (Mechatronics)
- B-Tech Design Projects
- B-Eng Final Year Projects

## Research

- Master's Degrees (Mechanical/Electrical/Mechatronic Engineering)
- PhD (Mechanical Engineering)
- Publications (Vehicle Dynamics)

## Target Groups

- Diploma Engineering Students
- B-Tech/B-Eng Engineering Students
- Post-grad students
- Academic staff (research)

## Partners

- Industry (VWSA, VW Racing, Jendamark, Continental SA)
- NMMU (AMTC, eNTSA, UYILO, Mech. Eng., Mechatronics)



## Mechanical & Electrical WIL (P1/P2)

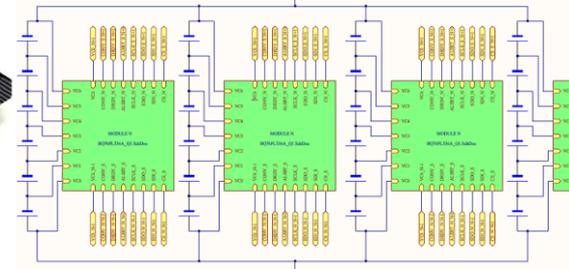
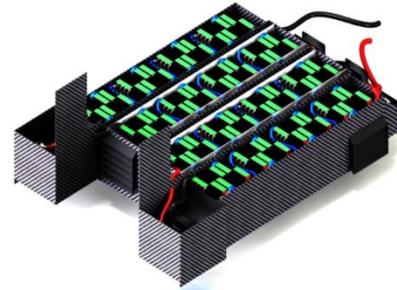
- SAE Baja = 5 students
- Formula Student = 2 students

## Mechatronics Vacation Work

- Formula Student = 10 students p/a

## Mechatronics Final Year Projects

- 2013 = 1 Active aerodynamic wing control system
- 2014 = 1 Active pneumatic suspension control
- 2015 = 3 Battery management, Powertrain management, Launch control system



## Masters Research Projects

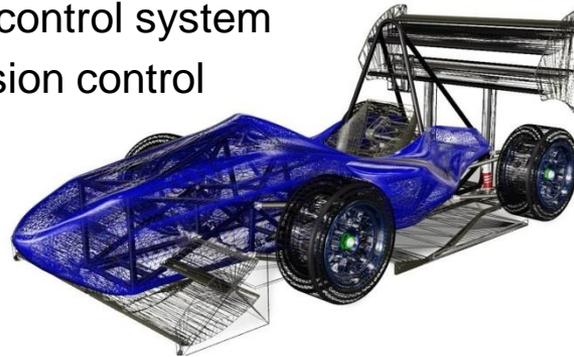
- V. Mohanlal – Characterisation of a fluidic muscle pneumatic suspension system

## PhD Research Projects

- T. Stroud – Fluidic muscle active pneumatic suspension for a light experimental vehicle

## Publications

- SAIMechE R&D Journal - Real-time tyre temperature analysis
- 2015 PRASA-RobMech International Conference - Off-Road Vehicle Active Suspension



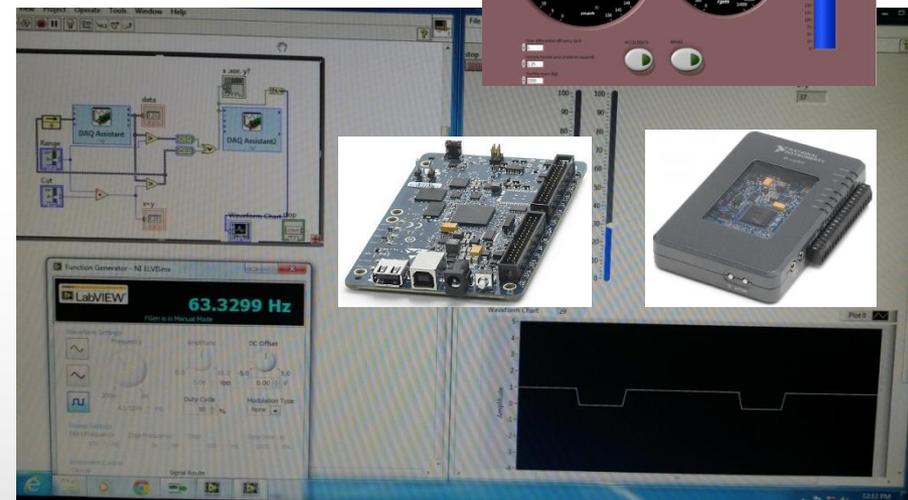
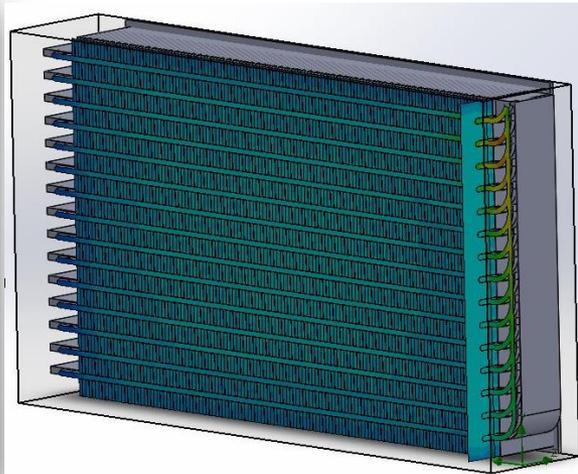
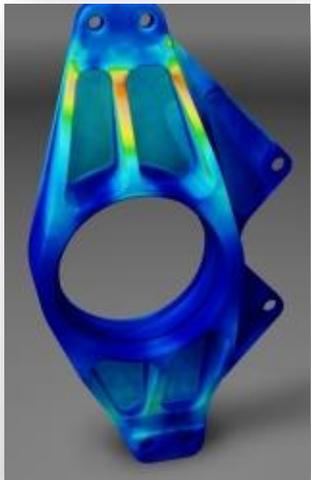
## Mechanical Engineering

- Mechanical design
- CAD modelling & simulation
- Manufacturing processes
- Physical testing
- Project management
- Component & material sourcing
- Staff: T Stroud

Vehicle  
Project

## Mechatronic Engineering

- Electrical system design
- Control systems
- Data acquisition
- Telemetry
- Simulation & testing
- Staff: B Roberts



## DibaE Electric Race Vehicle

- Create new moulds for glass-fibre body panels
- Design and implement Battery Management System (BMS) including electrical aspects and mechanical (mounting/cooling) aspects
- Design and implement cooling system for motor controller and motor
- Interface BMS and motor controller with NI data acquisition & control device (running LabVIEW)
- Provide Human-Machine-Interface (HMI) : Raspberry Pi with screen
- Incorporate various sensors for data acquisition, e.g. wheel suspension linear displacement sensors, accelerometers, GPS
- Complete mechanical aspects e.g. suspension, brakes, pedal box, etc.
- Test vehicle extensively
- Compete in Knysna Hill-Climb event in May 2016
- Race vehicle in Formula-Student competition (Germany, future)

## Benefits

- Practical experience for engineering students
  - Research & Design, Manufacturing & Assembly, Project Management & Procurement, Working in teams under time pressure, hands-on engineering experience
- Enhanced student employability (e.g. Recruiting partnership with Jendamark)
- Exposure for NMMU and students at Knysna Hill-Climb
- Ultimately, exposure for NMMU and students in international event
- Enhanced collaboration opportunities (e.g. Research with Pretoria Uni.)
- Gateway into post-graduate research
- Race vehicle provides an automotive research platform
- Final year projects produce high-level well-documented engineering designs

## Challenges & Lessons

- Recruitment and retention of students (bursaries for M-Eng?)
- Securing funding (vehicle build, tools & equipment)
- Balancing student work on vehicle with academic commitments
- Balancing staff academic responsibilities with project management
- Funding and nurturing post-graduate students

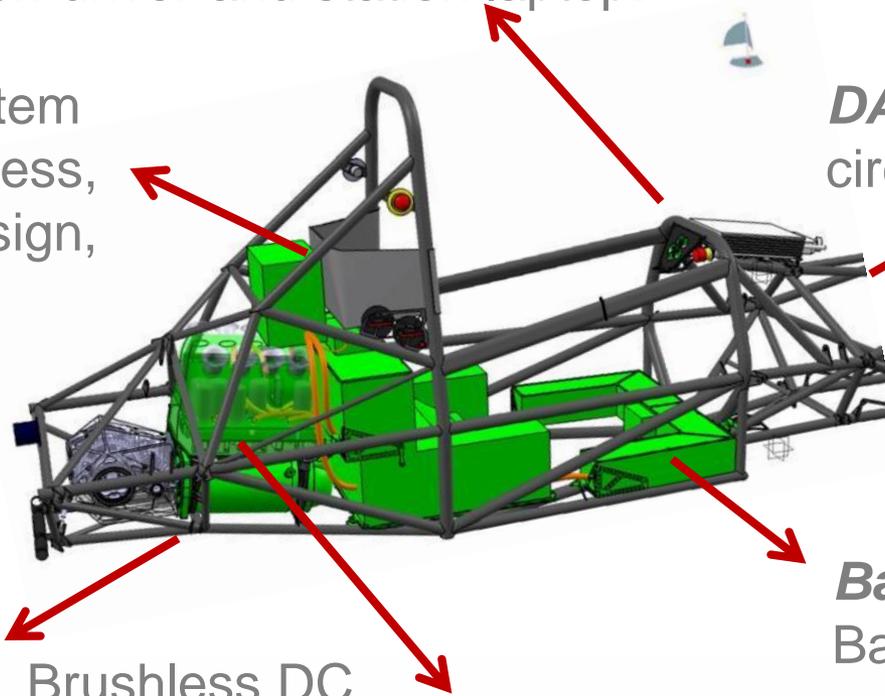


## Electrical Systems

**Telemetry:** 2-way real-time communication and data link between driver and station laptop.

**Electrical:** System wiring and harness, Dash board design, brake lights

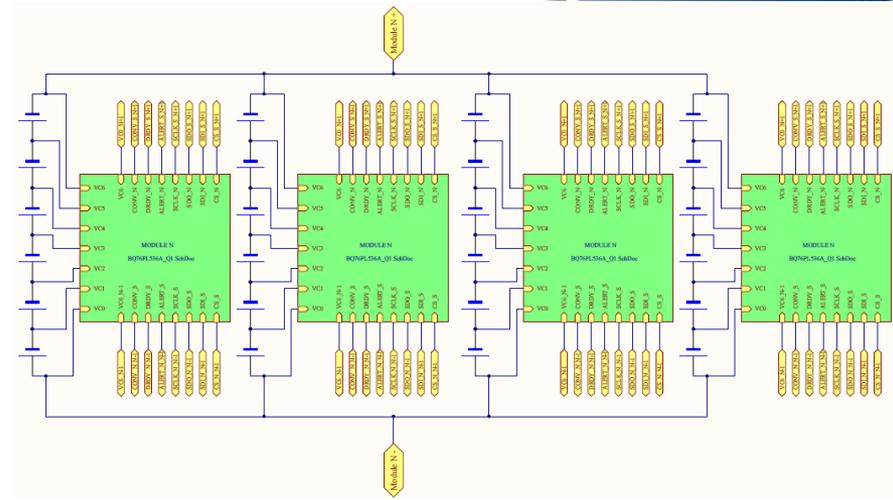
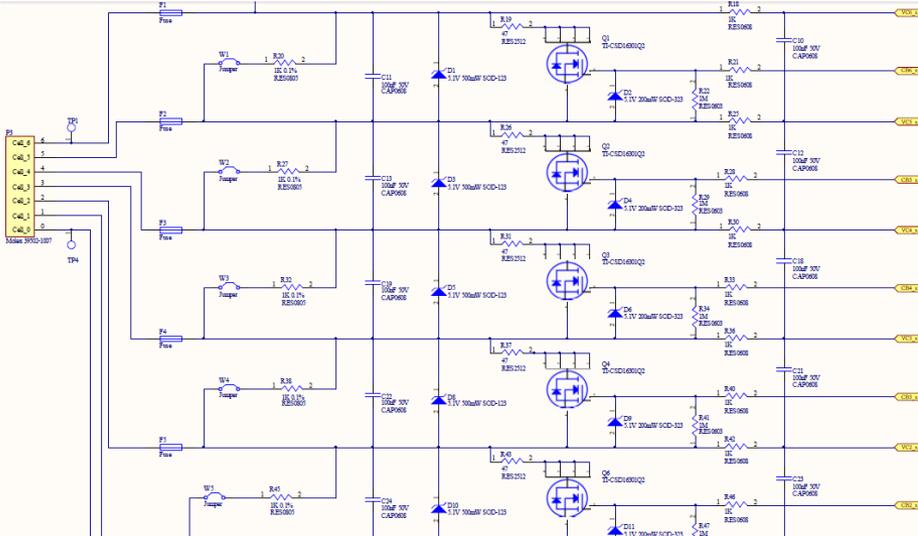
**DAQ:** Sensors, sensor circuit and data acquisition.



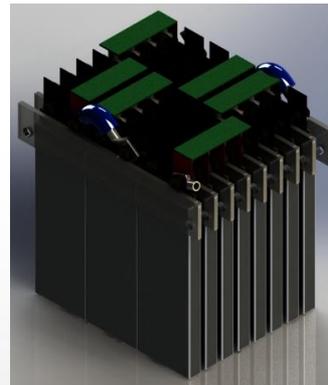
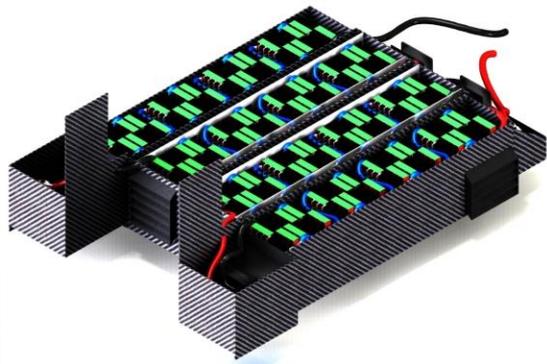
**Motor Driver:** Brushless DC motor driver and controller

**Battery:** LiPo cells, Battery management

**Protection system:** Electrical powertrain protection, a third part independent protection system to monitoring battery, motor driver, motor and HV - LV circuitry.

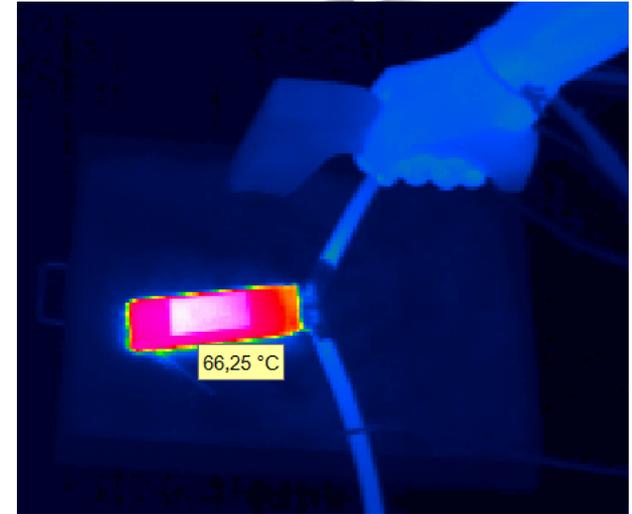
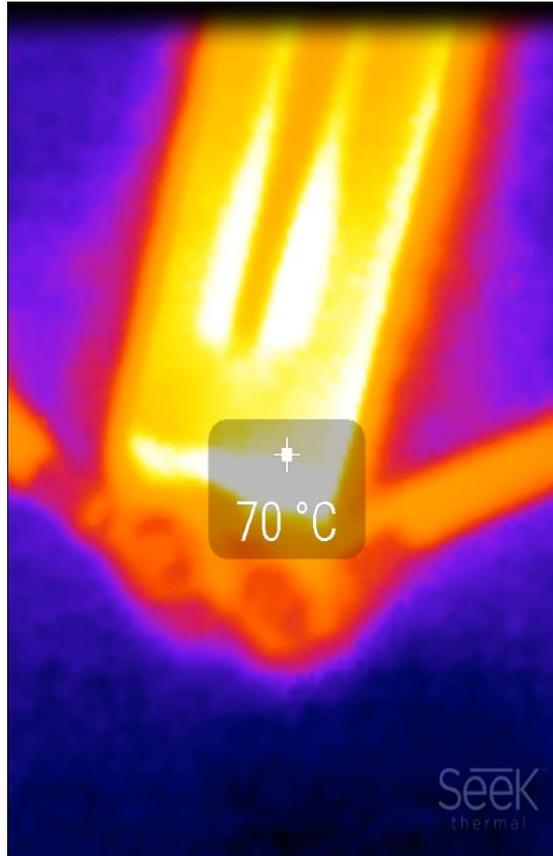
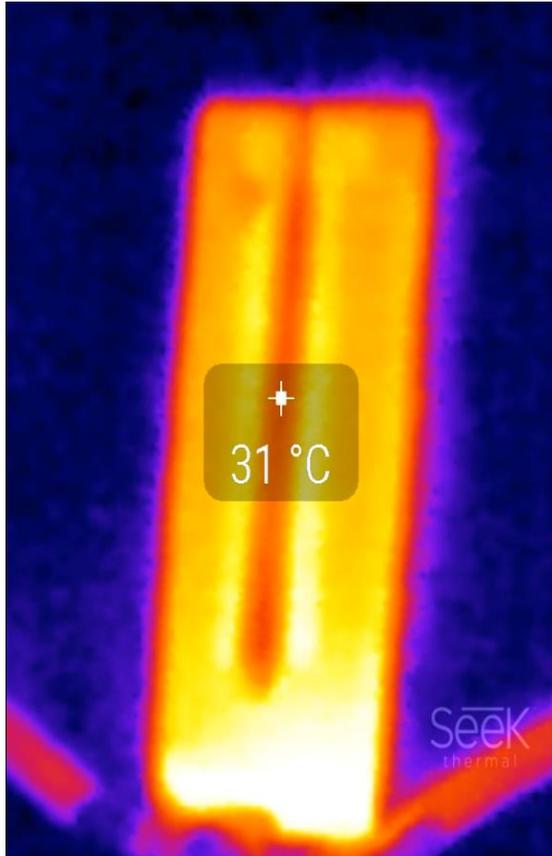


## Battery Management System

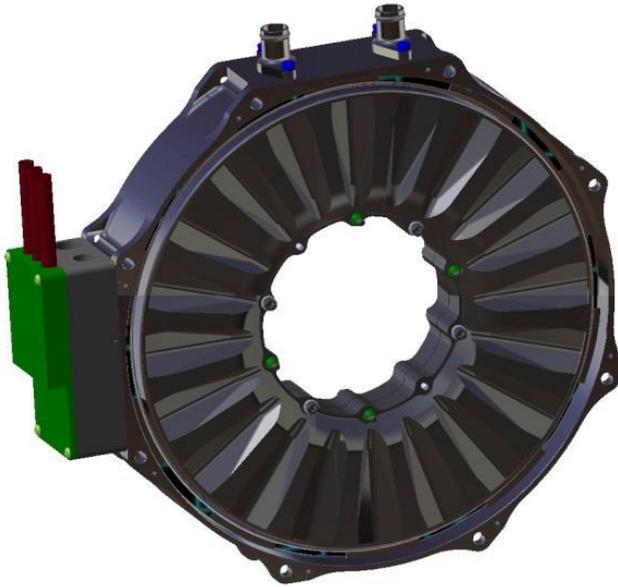


## Battery Pack





Battery Thermal Testing



YASA Electric Motor



Motor Controller



Data Acquisition & Control



- Race Track Testing of Diba2

