ARG 26 Accumulator Design

Cornell FSAE, Battery Subteam Lead

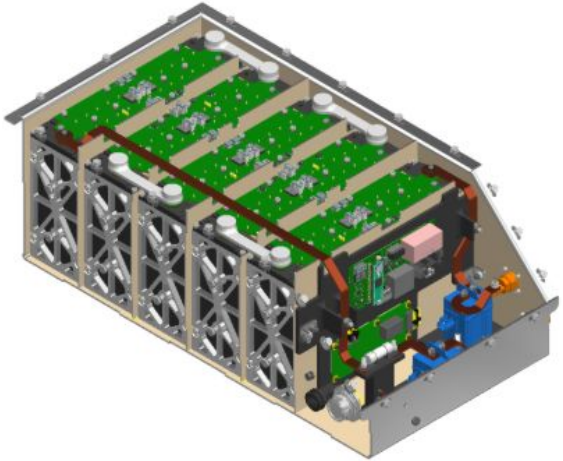
Project I

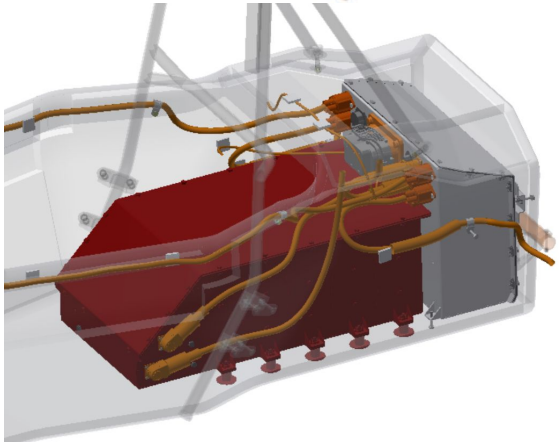
Purpose: Lead team to design, build, and validate pouch cell battery pack for FSAE Electric race car competition in Michigan

Contributions: System design (pack sizing, cell selection, and integration), project management, process design (laser welding and spot welding), part integration

Technical details:

- 125S1P configuration, 543 V, 7.6kWh, 114 kW peak power, 21A regen
- Reduced mass by 11.5 lbs, volume by 15%, and internal resistance by 44%
- **Laser welded cell tabs** (Ni plated Cu) improve reliability and simplicity over bolts
  - Design compatible with **validated spot welding procedure** as well
  - Reduced part count by 200+ through removing bolts and cell spacers
- Integrated **custom BMS** system using **pogo pins** for voltage monitoring
  - High serviceability, validated vibration reliability with on car driving
- Lowered module count from 6 to 5, removing fixed weight and **improving system packaging**
  - Allowed inverters to be mounted in rear, lowering CG & improving weight distribution
- Initial aluminum enclosure replaced with **composite enclosure** saving 7 lbs
- Validated system decisions (pack voltage, energy and thermal performance) with **MATLAB lap simulations** for each event
- Preformed DCIR discharge testing to measure internal resistance of cells





Accumulator (red) packaged in rear of car

ARG 26 Accumulator Design *(Cont.)*

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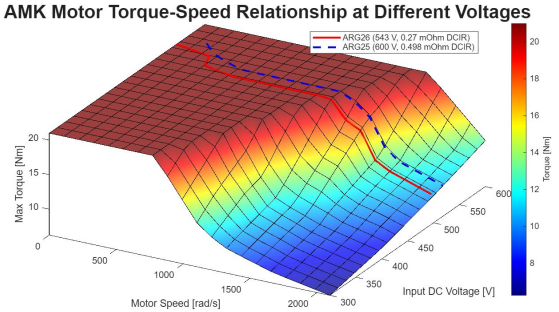
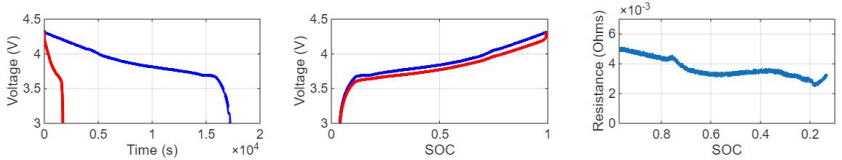
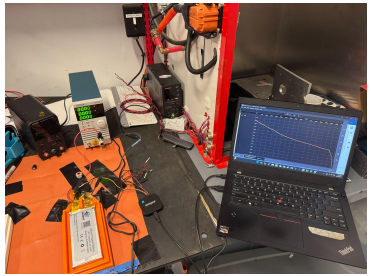


Motor curve analysis justified 543V pack

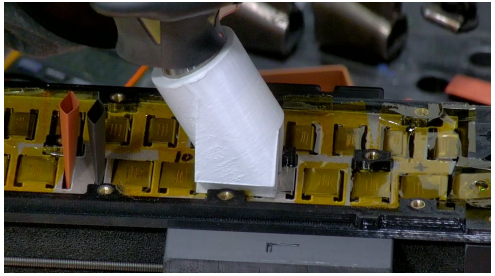


DCIR data from discharge test comparing 0.2C and 2C

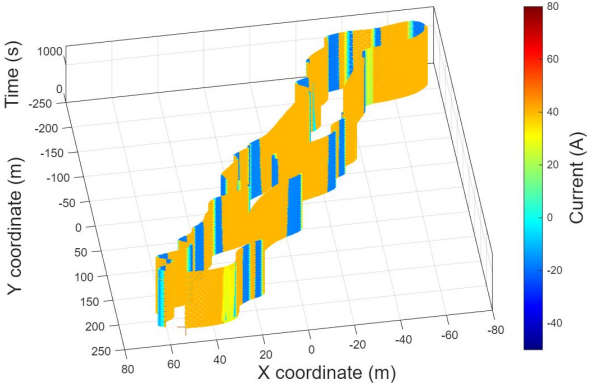


Discharge test setup

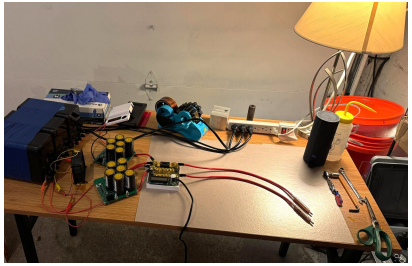
Assembling battery modules

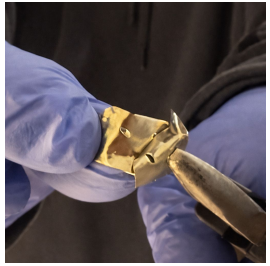


Laser welding battery modules



Current trace throughout lapsim used to validate pack thermal performance





Spot welding setup and peel tested sample

Laser welding training