



An introduction to Electric Vehicle Thermal Management System

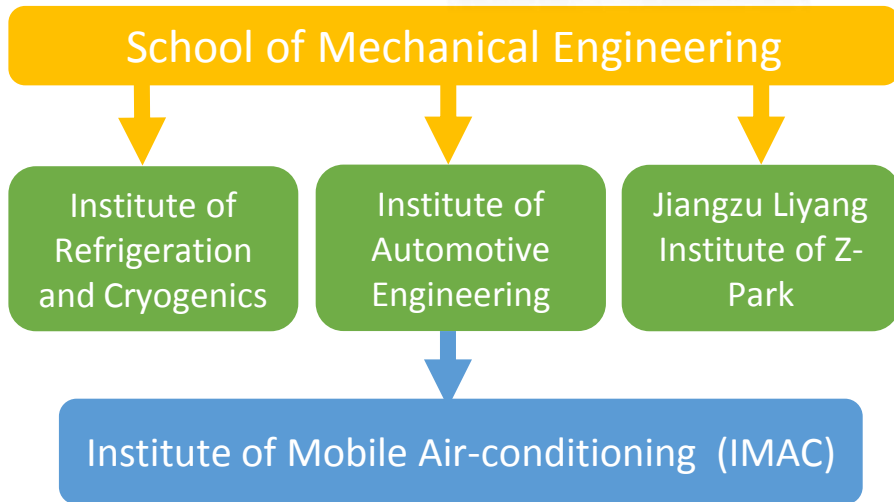
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13661983031

Introduction to IMAC



Team members: RA: Junye Shi ;
8 Phd candidates; 11 master candidates;
5 CFD engineers; 12 lab engineerings

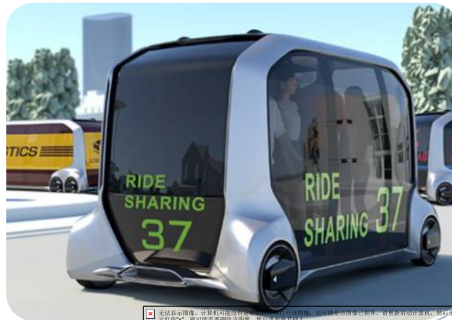
■ Mobile Air Conditioning

- High-efficient MAC System
- Mobile **HP system** for EVs
- Natural Refrigerant (R290, CO2)
- Controller, Ejector, **Compressor**, etc.

■ Vehicle Thermal Management

- Thermal Comfort & Cabin Load
- **Battery Cooling** & Chiller
- Frontal module & Radiator, Oil Cooler

Mobile electrical compressor



Scroll Movement



Orbiting Scroll

- 24V--800V DC
- Scroll type
- AC & HP mode
- Integrated inverter
- Less noise, weight



Mechanical Compressor

- Driven by engine belt
- Swash plate, wobble plate
- Only for AC mode

Electrical Compressor

Low AT
Operation

Natural
Refrigerant

Electrical
Compressor

- Scroll manufacture
- Inverter integration
- Motor control

- 20°C cold climate
- Back pressure
- Oil Circulation
- 120°C Discharge T

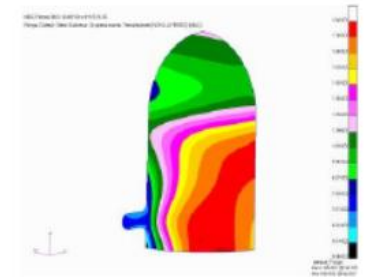
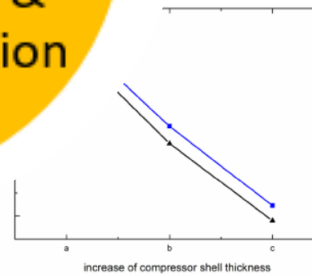
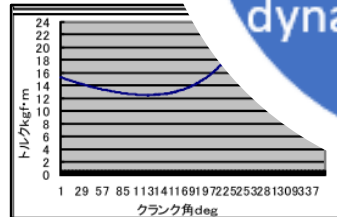
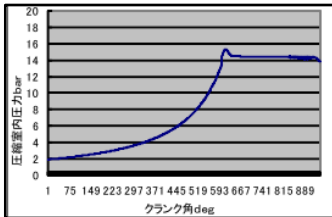
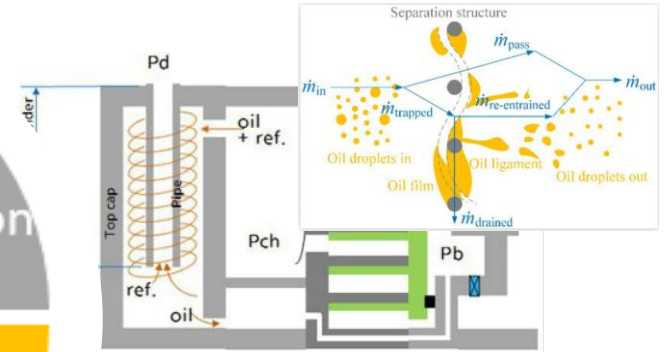
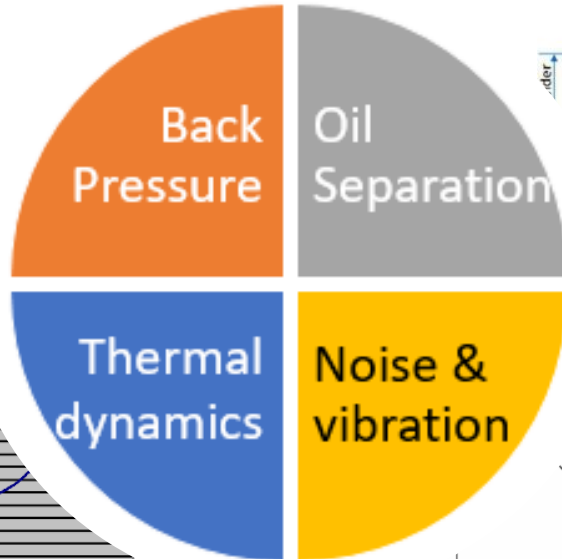
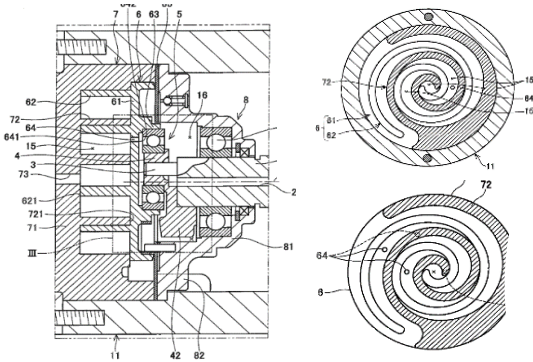
- CO₂ Refrigerant
- 12.5MPa Discharge P
- 150°C Discharge T
- POE Oil Properties
- Scroll material

Mobile electrical compressor



Back pressure match the condition variation
Positive valve & Passive Two Balancing Hole

High efficient cyclone oil separator
Oil & Gas ref & Liquid ref flow analysis



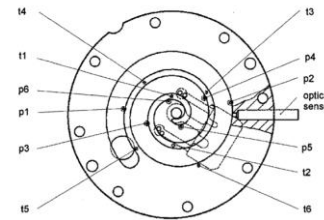
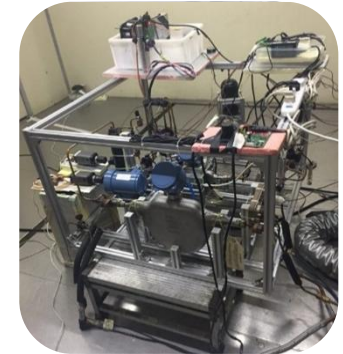
Scroll compression process thermal dynamic
Accurate prediction of T, P and Force
Novel application: EVI; CO2; R290

Analyzing the source of the noise
Dynamic balancing design
Scroll manufacture and measurement

Mobile electrical compressor



Compressor test facility



Collaboration Partners

GMCC 美芝

HIGHLY 海立

OBRIST

SONGZ

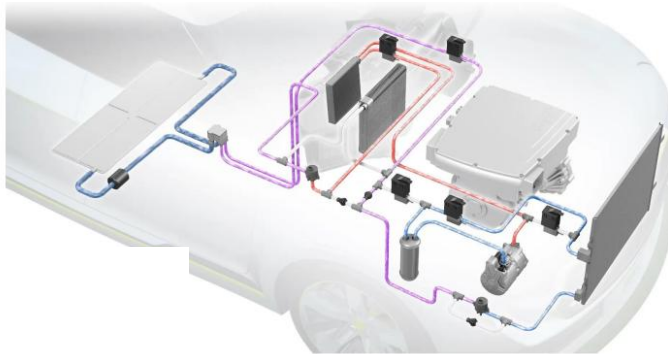
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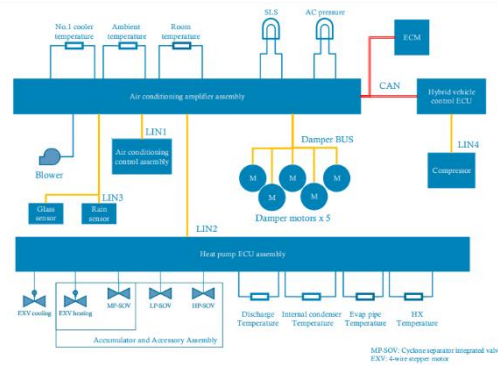
Thermal management for NEV



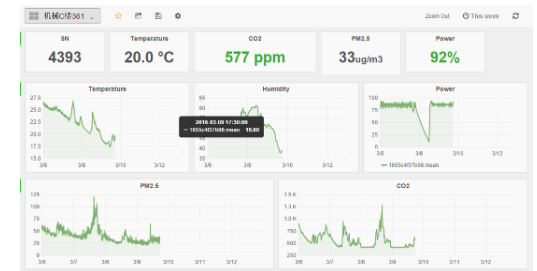
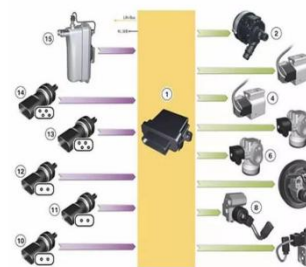
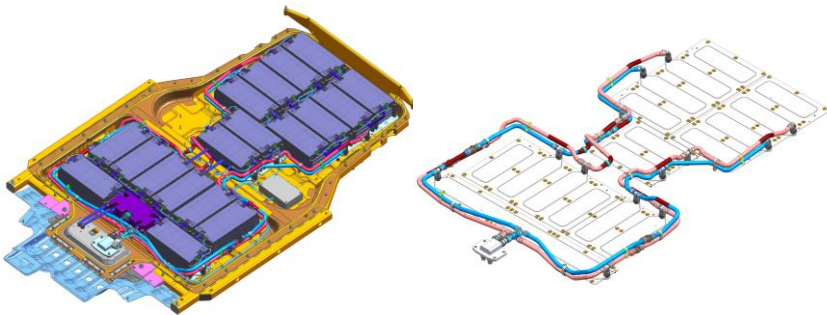
Cabin heating: Heat pump



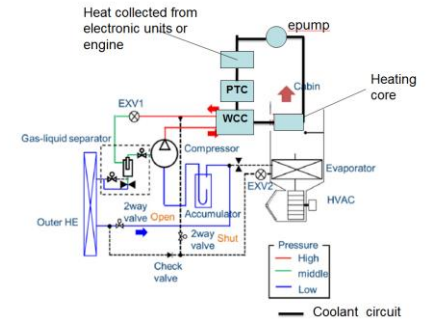
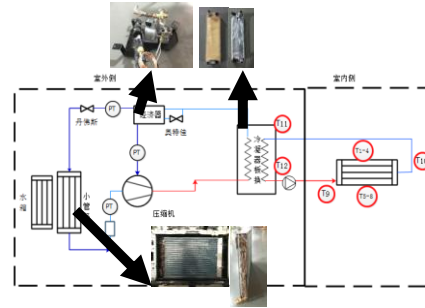
Smart controller



Battery Temperature control



High efficient HP system



I-generation
Four-way valve

II-generation
Three HX

III generation
Vapor Injection System

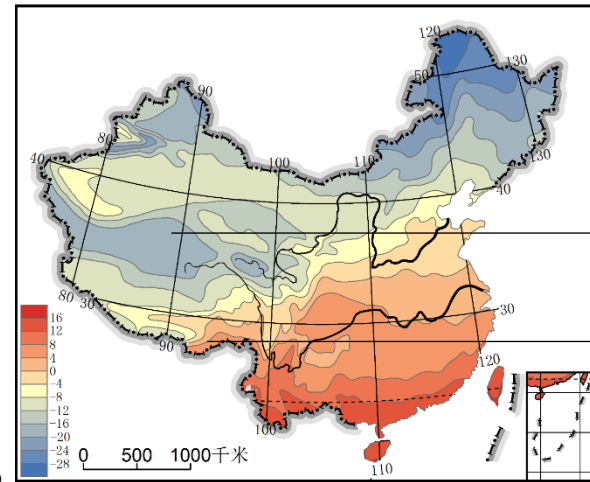
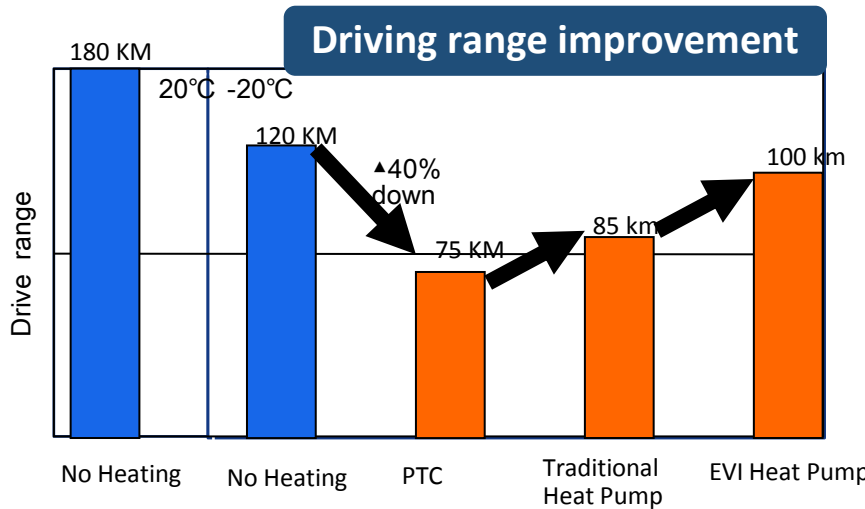
IV generation
EVI + Battery

2003

2007

2010

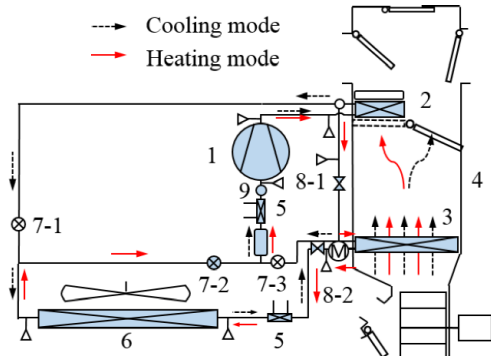
2015



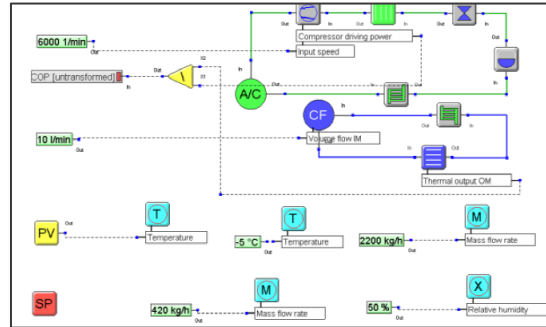
V Generation: CO2

- IV Generation
- III-generation
- II-generation
- I-generation

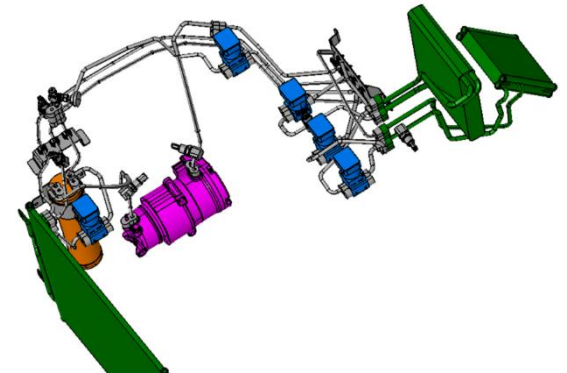
CO2 HP system



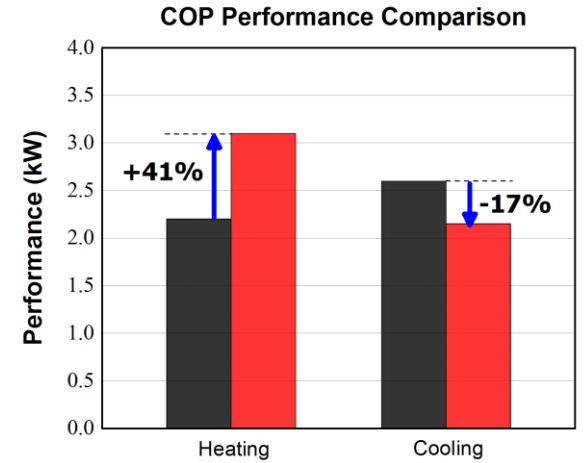
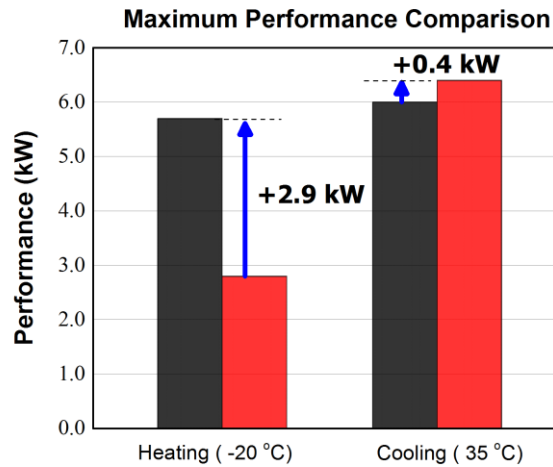
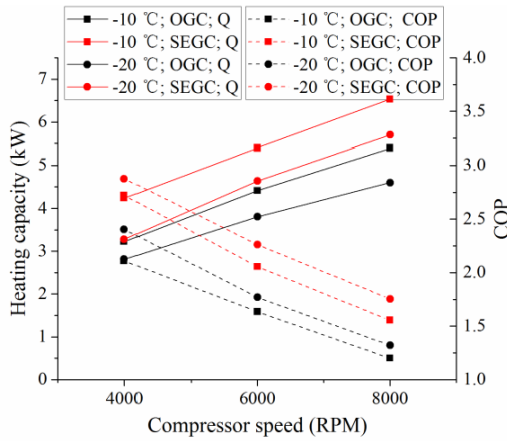
Novel SGC Design



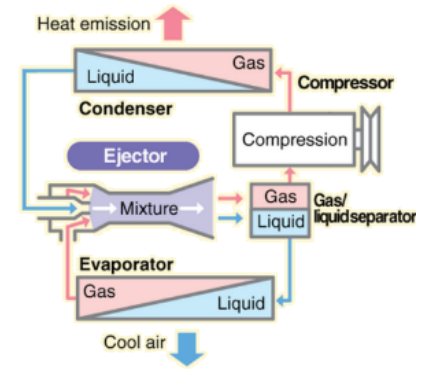
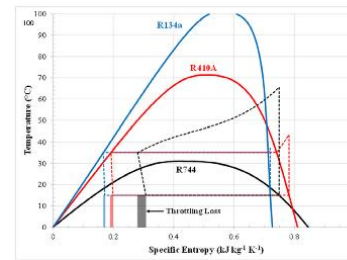
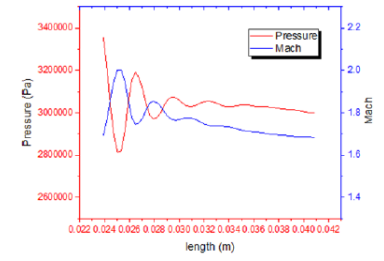
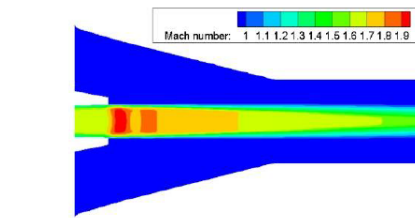
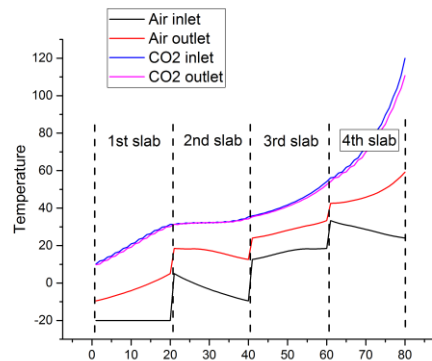
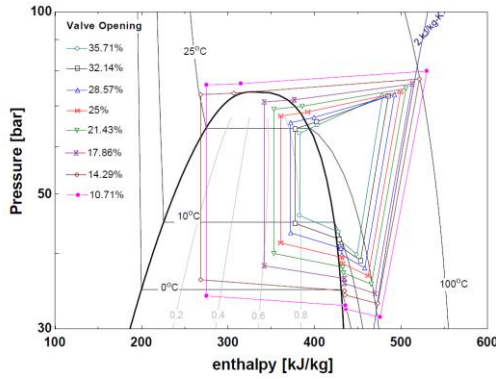
Prediction & Optimization



Prototype & Field Test



CO2 HP system & Ejector



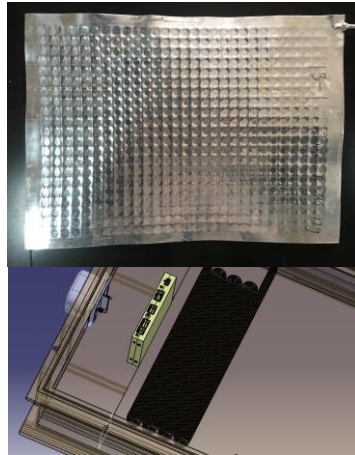
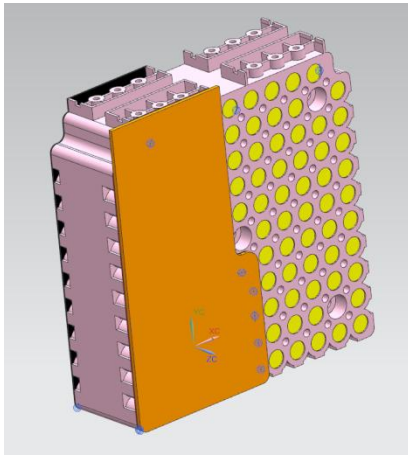
CO2 Microchannel HXs

R410A & CO2 Ejector

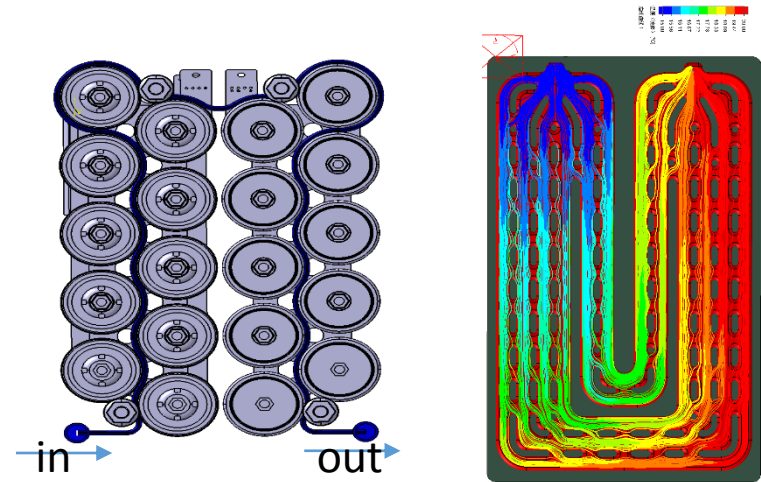
Battery cooling



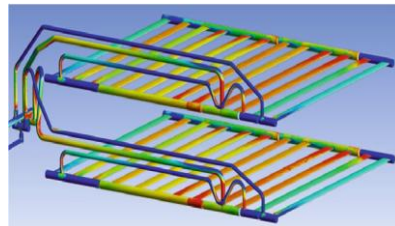
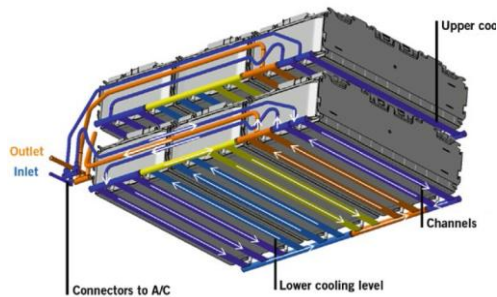
Novel solution: Heat pipe technology



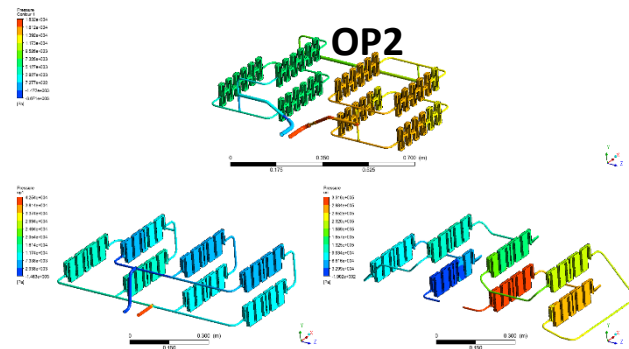
Cooling plate development



Battery package: Passenger vehicle



Battery package: Truck

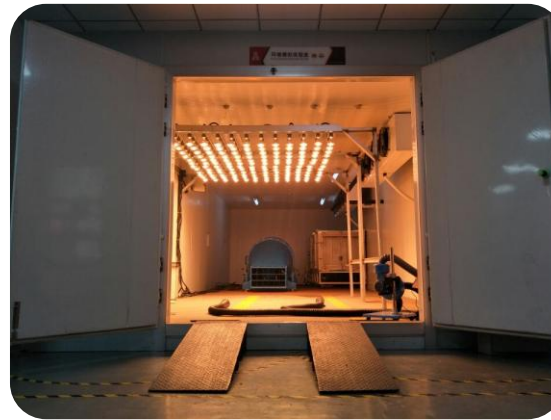


Thermal management for NEV

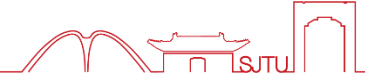


Liyang Research Center

- ✓ HP calorimeter facility
- ✓ Battery chiller test facility
- ✓ Environmental simulation lab
- ✓ Electrical compressor test facility
- ✓ Battery charging facility



Thermal management for NEV



上汽集团
SAIC MOTOR



北汽集团
BAIC Group



长安汽车



上汽大众
SAIC VOLKSWAGEN



吉利汽车
GEELY AUTO



江淮汽车



Dun An



银轮股份
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