



Gogoro new smart core platform cooling design

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AGENDA



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Gogoro & powertrain

2

MCU water cooling design

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System thermal design

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Summary

01

Gogoro & Powertrain

About Gogoro

Rethink
Urban Energy

About Gogoro



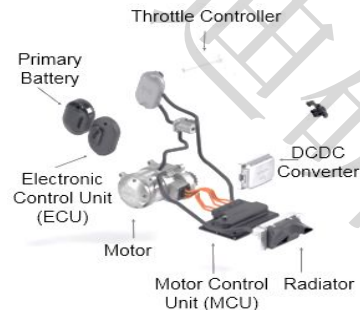
Gogoro powertrain platform

2015 Gogoro 1



- First Heavy-duty Electrical Scooter's Powertrain
- 7.2 KW 29Nm High Torque Density Motor
- Compact Design On Rear Mount

2017 Gogoro 2



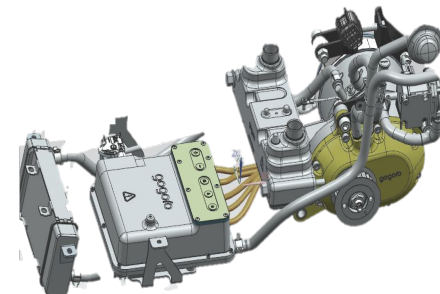
- System module (PBGN)
- 7.6 KW 28Nm
- High Efficiency PMSM 95%
- Cost Efficiency
- Repairable

2019 Gogoro VIVA



- Single Battery
- 3KW 115Nm Hub Motor
- Integration with MCU
- Air Cooling (CFD)

2022 Gogoro Super Sport

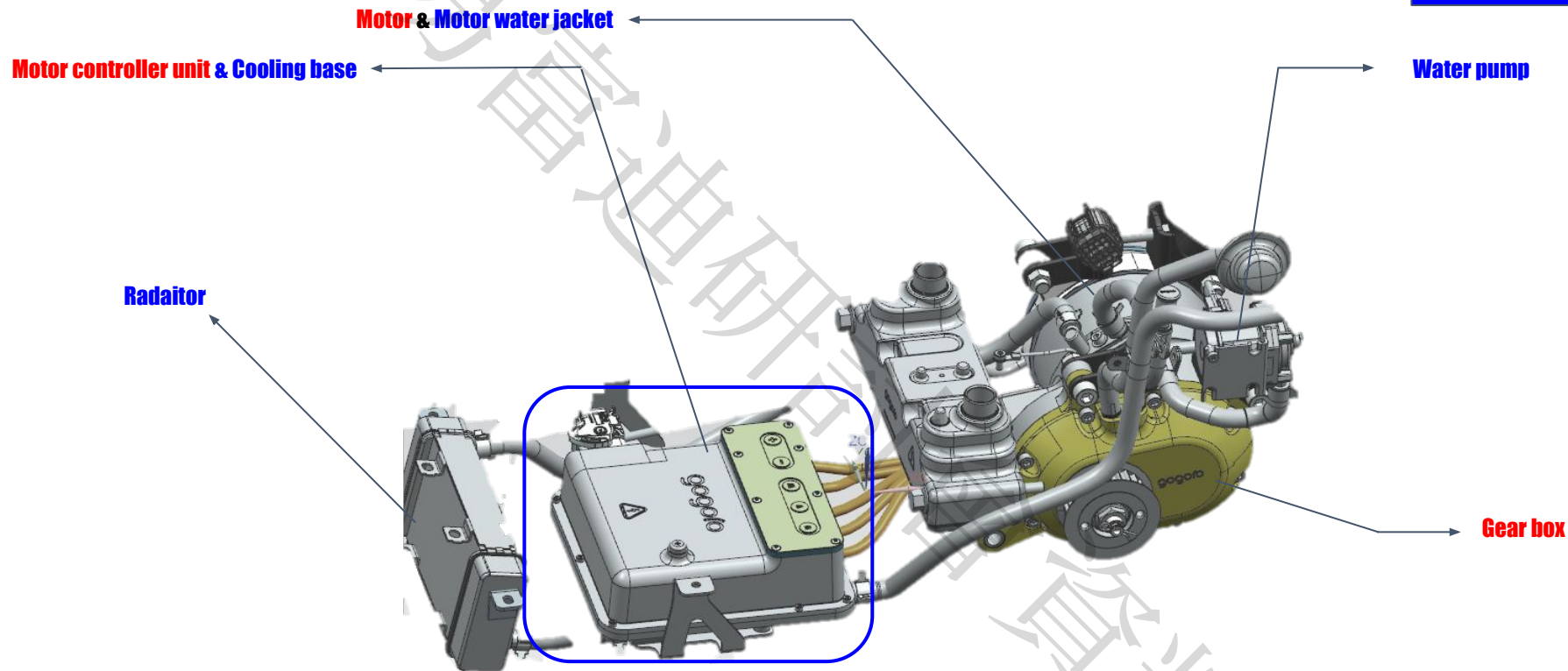


- Noise improve : Belt, Helical Gear
- New Motor Case (Stronger , Reliable)
- New feature :
 - TCS : Traction Control System
 - Cruising control

Powertrain system

Heat source

Cooling part



02

MCU water cooling design

MCU Design Requirement

* Scooter performance requirement

- Climbing : 40kph, 30% / 50kph, 20% / 70kph, 10%
- Acceration : 3.9 sec. 0-50 kph
- Top speed : 96 kph
- Scooter cannot power derating at 45kph~50kph (Urban city, stop and go pattern)
- Scooter cannot power derating at pattern : YMMT (Heavy load)



性能表現

最大功率

7.6 kW @ 3,000 rpm

最大扭矩 (馬達 / 輪上)

28 / 20.6 Nm @ 0-2,500 rpm

爬坡能力 *

30% (17°): 40 km/h

20% (11°): 50 km/h

10% (6°): 70 km/h

傾角

左 : 43° / 右 : 44°

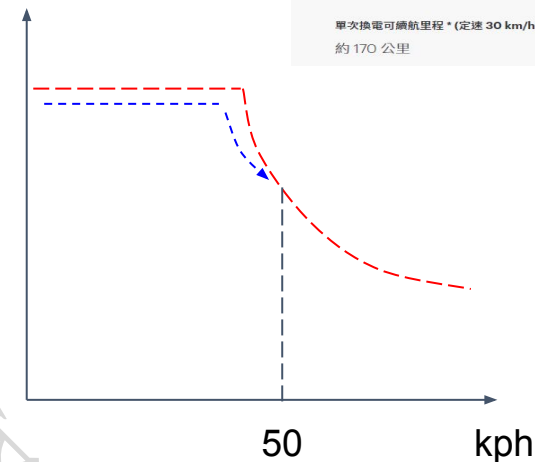
單次換電可續航里程 * (定速 30 km/h)

約 170 公里

* Scooter system thermal design requirement

- Cooling type : Ex. Water cooling
- Steady operate region
- Transient operate time at heavy load
- System heat load, system flow rate, radiator inlet velocity and dissipation, system water temperature, system pressure drop, etc ...

Current
(Heat load)



* MCU thermal performance requirement

- Steady region
- Transient operate time at max. current
- Pressure drop

design flow

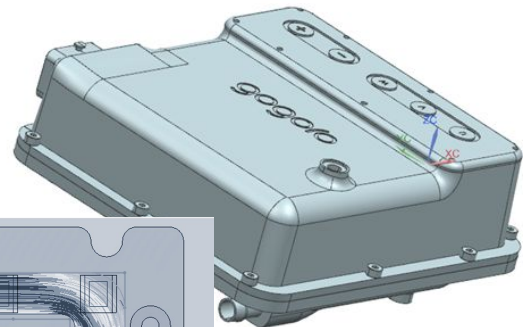
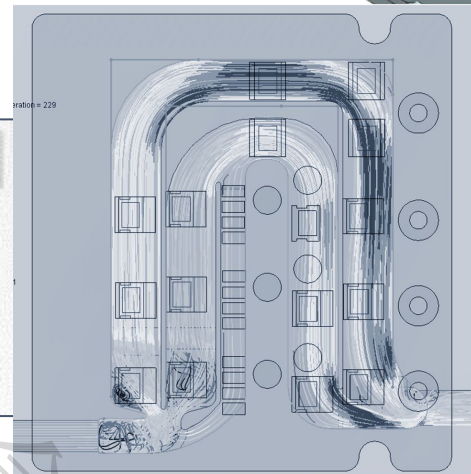
MCU cooling design by FloEFD

* MCU thermal performance requirement

- Steady region
- Transient operate time at max. current
- Pressure drop

Cooling base desing

- Max. component temperature
- R_{th} mos-coolant
- Pressure drop
- Velocity contour
- MOS temperture

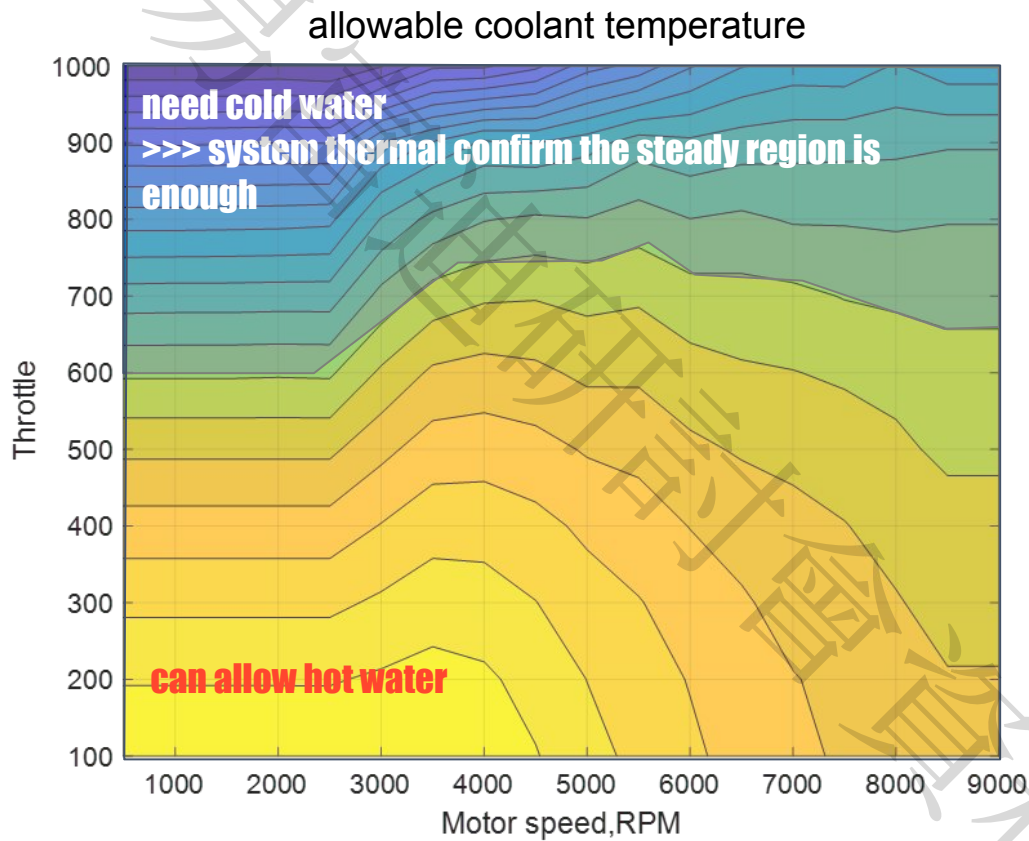


	V00	V01	V02	V03
R_{th} mos-coolant	-	-1.7%	-10.2%	-12.8%
Pressure drop	-	+12%	+6%	-7%

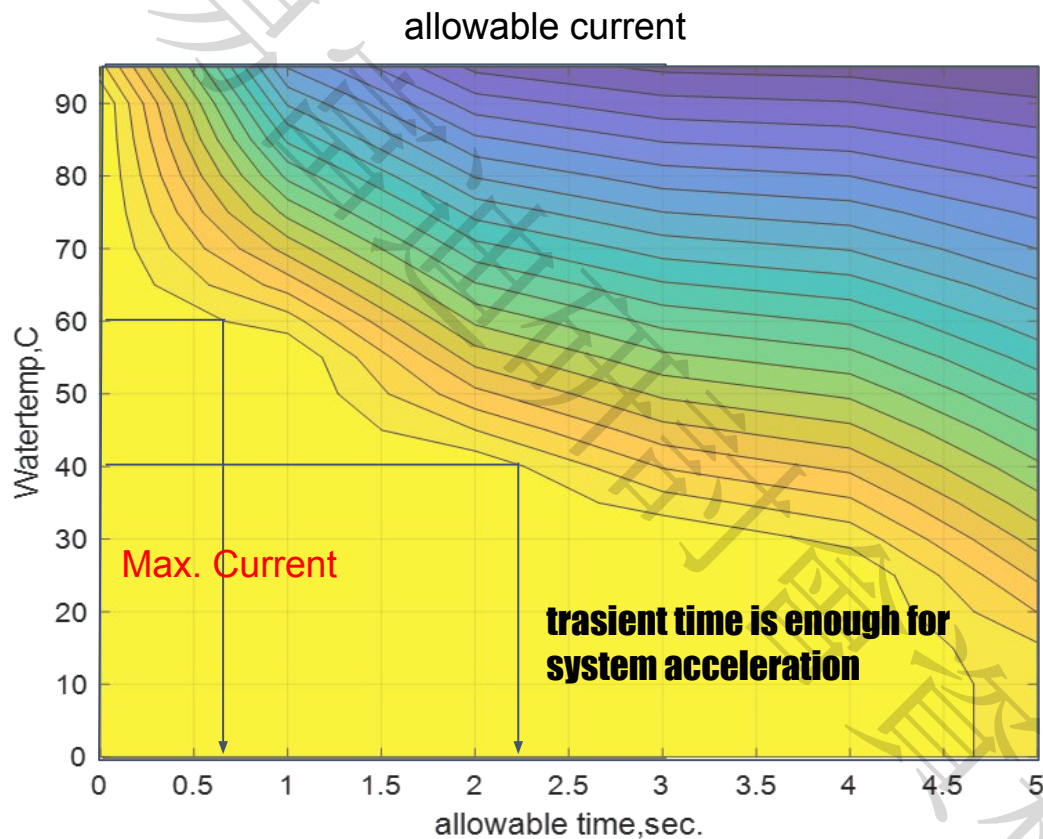


changing tunnel height and width to control the flow velocity

MCU thermal performance - steady



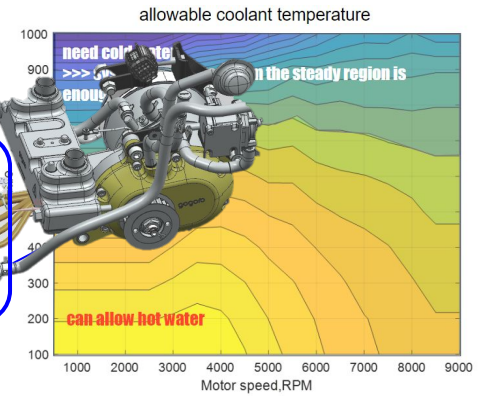
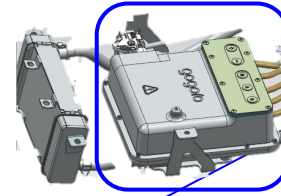
MCU thermal performance - transient



Summray

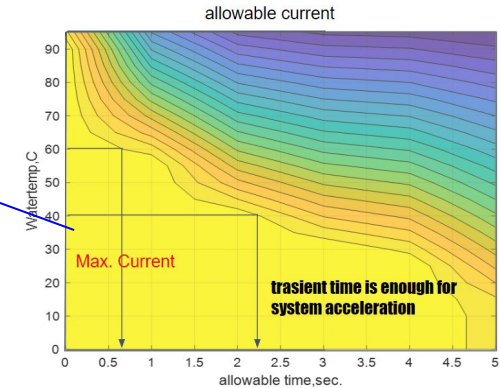
* MCU thermal performance requirement

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- Transient operate time at max. current
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03

System thermal design

Request

✱ Scooter performance requirement

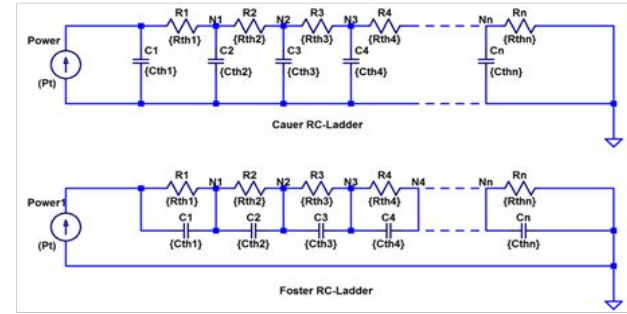
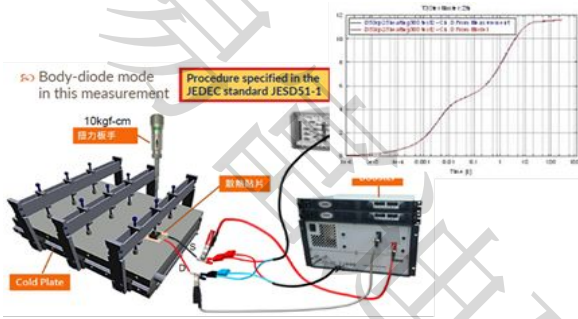
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- Acceration : 3.9 sec. 0-50 kph
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✱ Reality & Complex question

- Can take 200 kg payload ?
- Can climb 10% slope road ?
- Will thermal derating in tropical country ?

Simplified math model

* **T3SER**



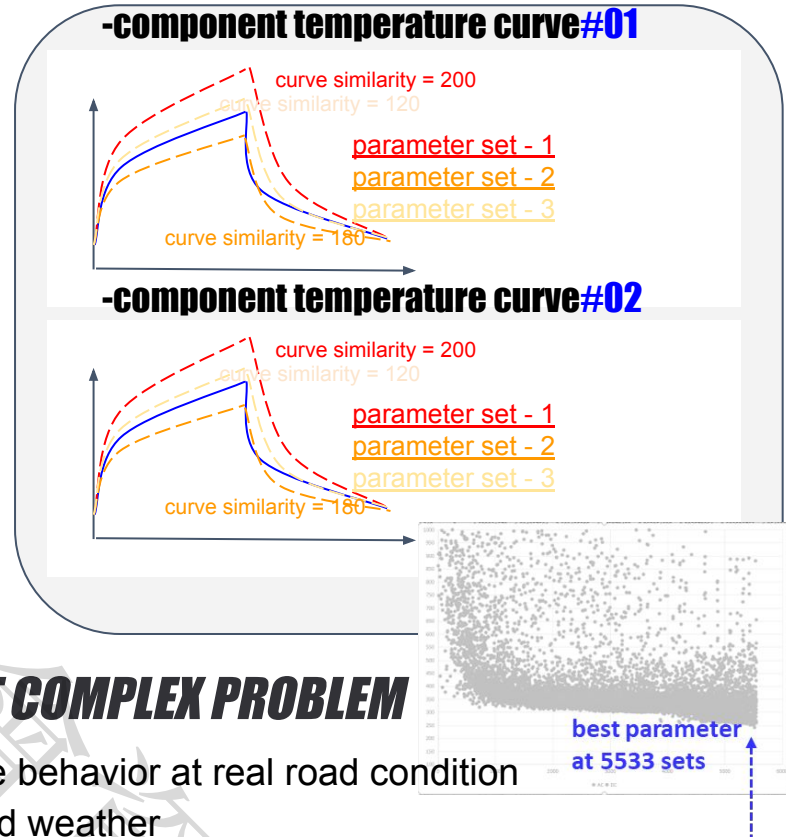
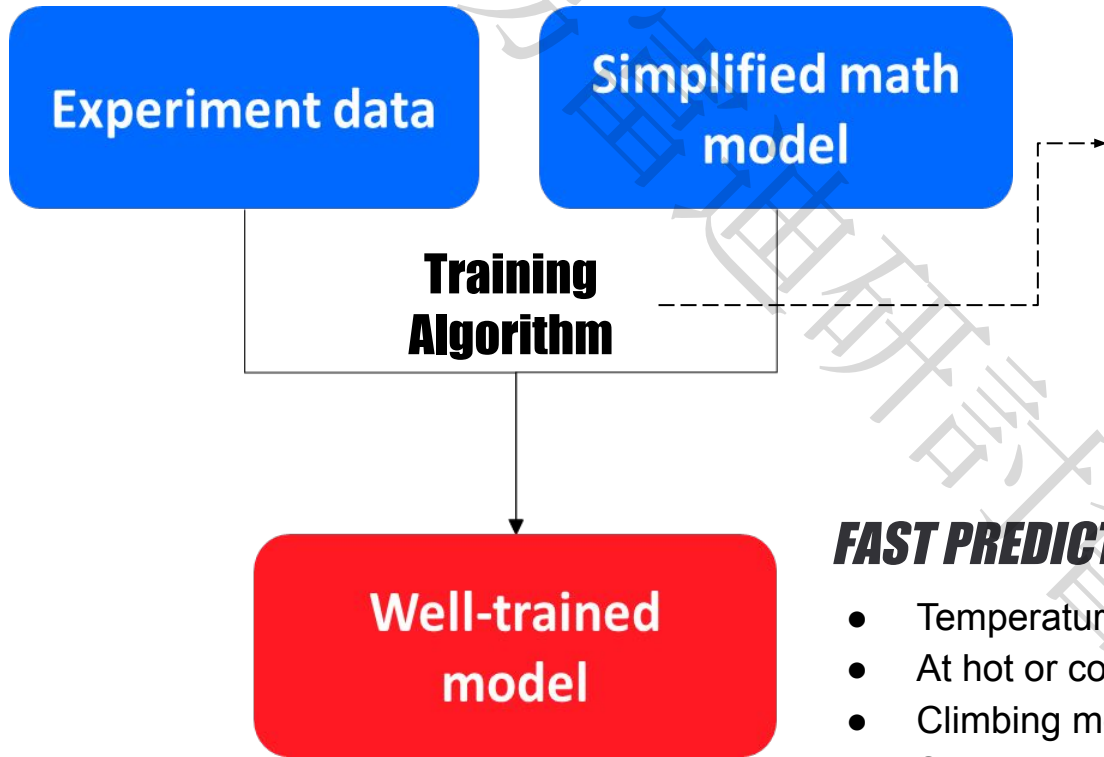
* **Simulation tool FloEFD**



Get the hard to measure data

- convection properties
- Thermal resistance properties
- Heat Flux
- Etc...

Model training



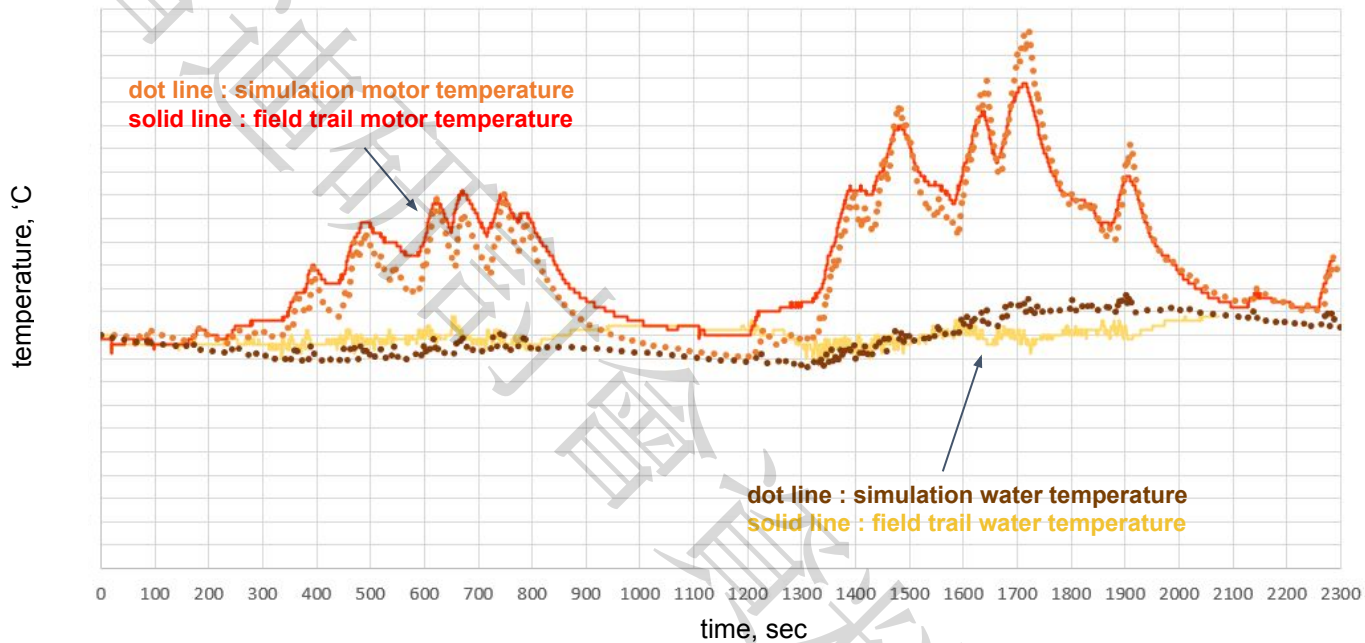
FAST PREDICT COMPLEX PROBLEM

- Temperature behavior at real road condition
- At hot or cold weather
- Climbing mountain
- System derating performance
- etc ...

Simulation

Field trail data log

- Throttle
- Scooter speed
- temperature
 - Coolant
 - Winding



04 Summary

gogoro

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Any Questions?