

5/1/26

Controlling Temperature of High-Power A.I. Devices

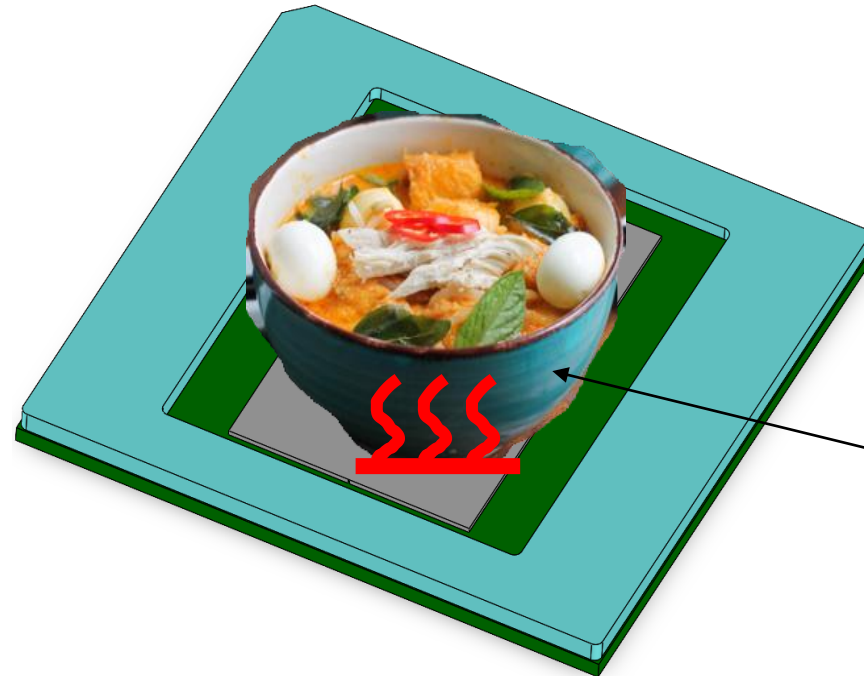
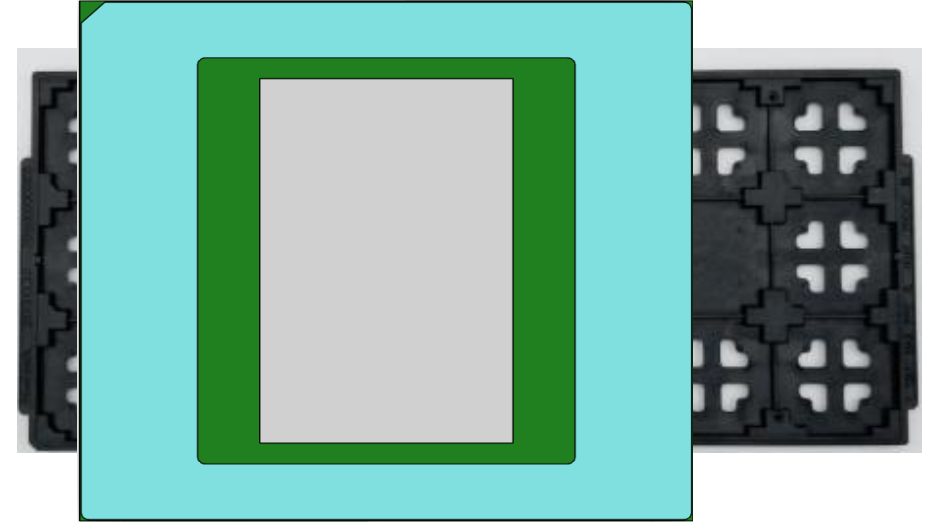
Ernest Blanco

Systems engineer



A.I devices are built different

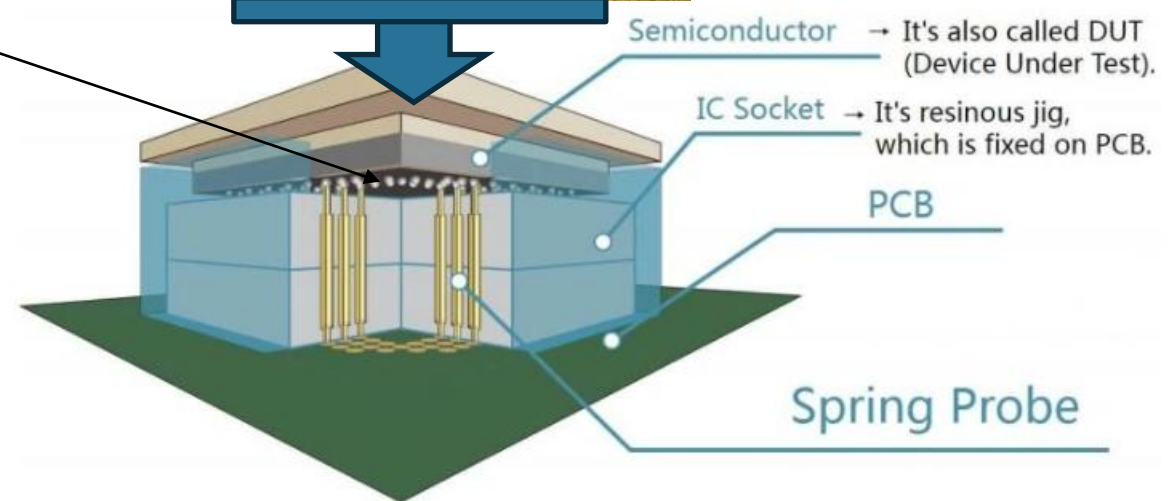
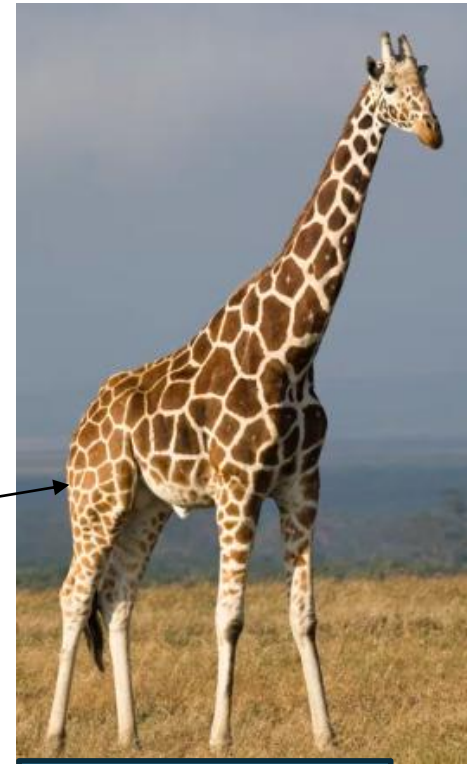
- ❑ Large footprints pushing limits of JEDEC tray size
- ❑ High power during test measured in multiple kW
- ❑ Many new challenges for final test



Sufficient power to cook a Curry Laksa!

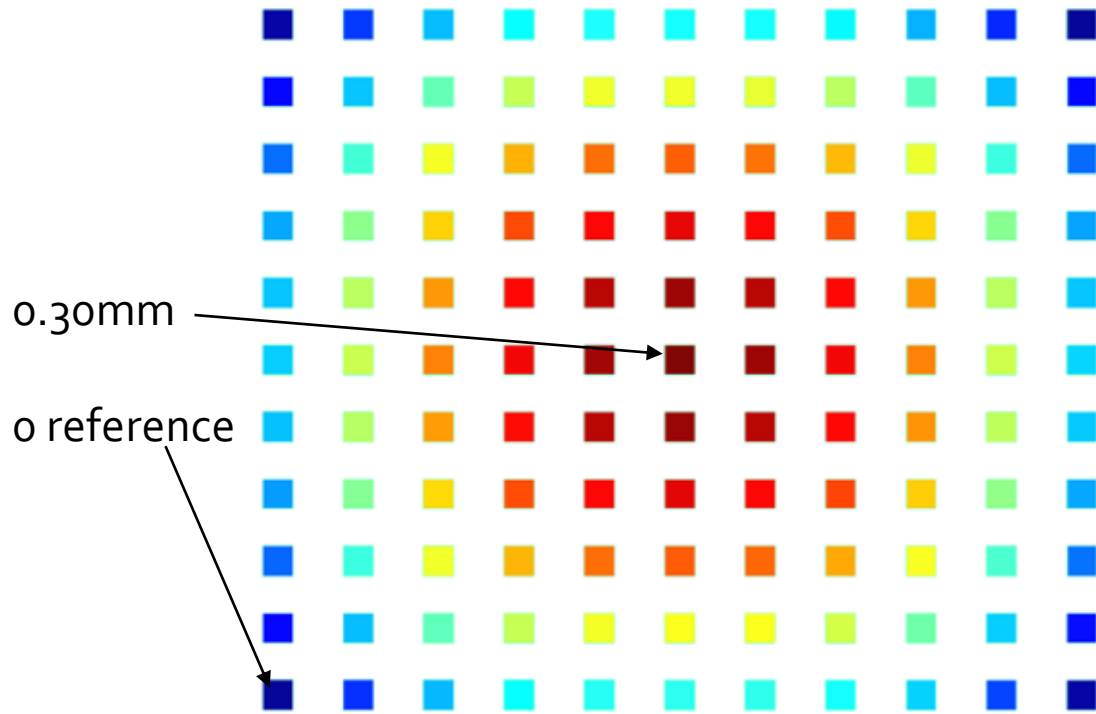
Socketing force

- ❑ High socketing forces
- ❑ > 10,000 balls / device today
 - >300 [kg] socket force
- ❑ Redesign TU for higher loads
- ❑ Roadmap 1 metric ton

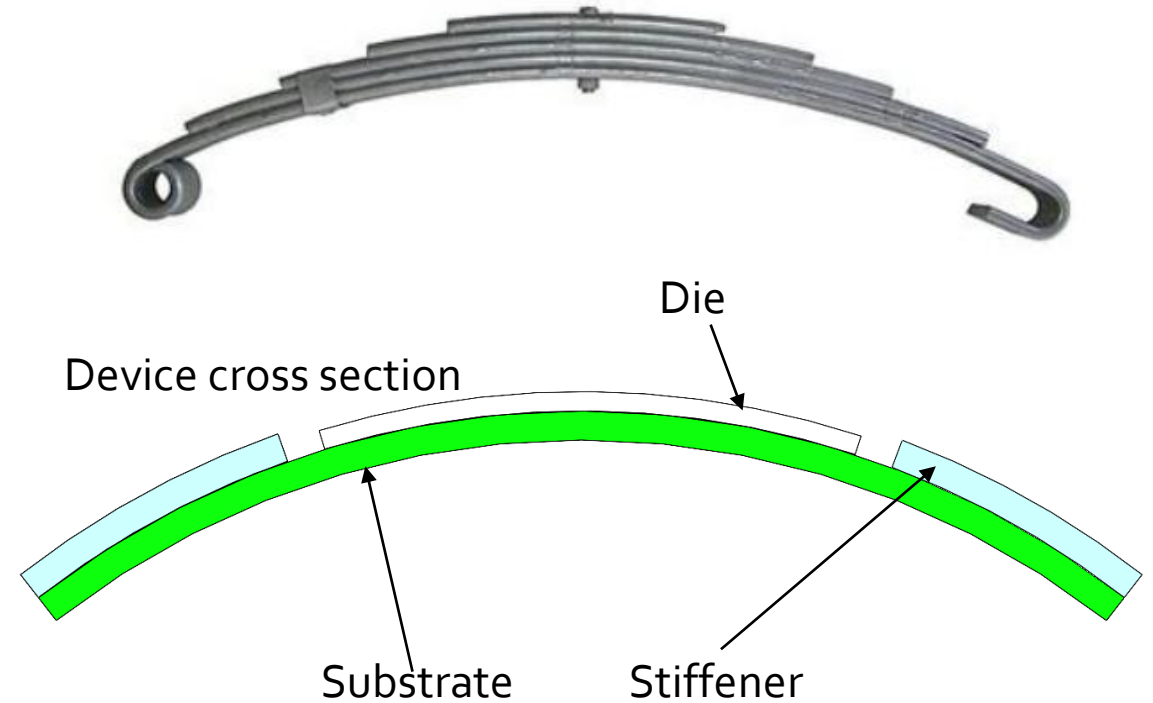


Convex devices

- ❑ Devices are convex, not flat
- ❑ Heat can flatten devices
- ❑ Some tests are at ambient & colder temps

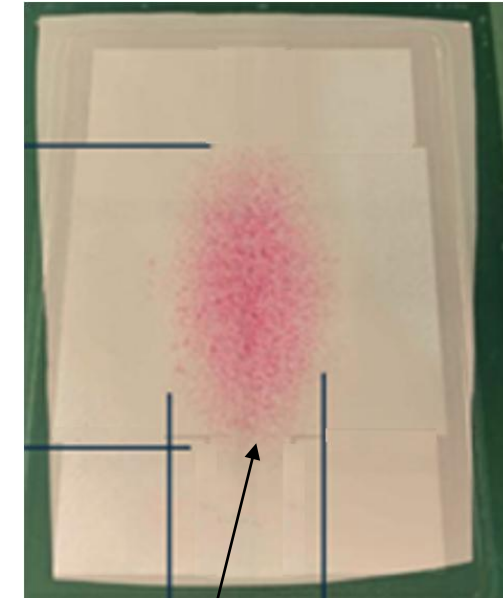
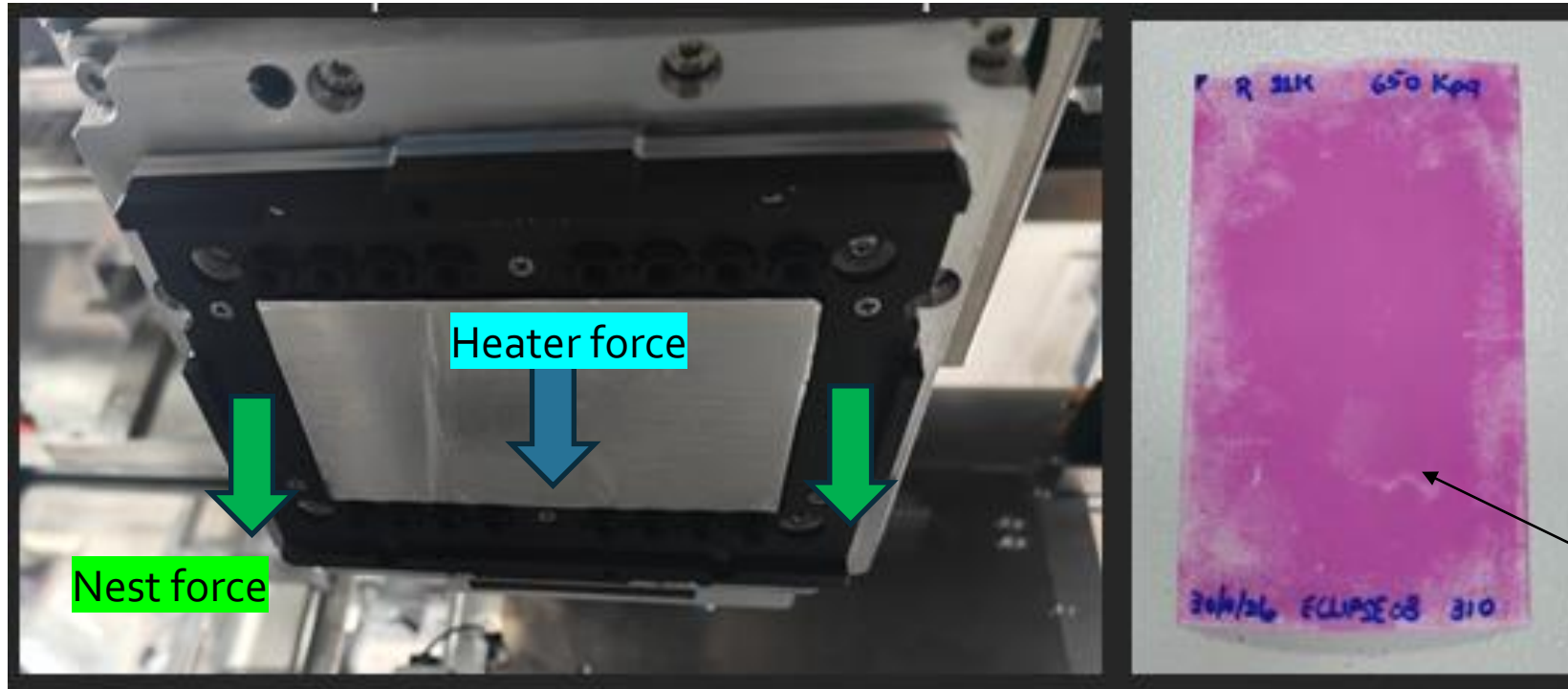


Measured convex device @ room temp



Convex devices cont.

- ❑ Geometry imperfection affects thermal contact area
- ❑ Good contact mandatory to pass tests
- ❑ Higher proportion of force pushing through heater
 - >90% capability vs <20% in older designs

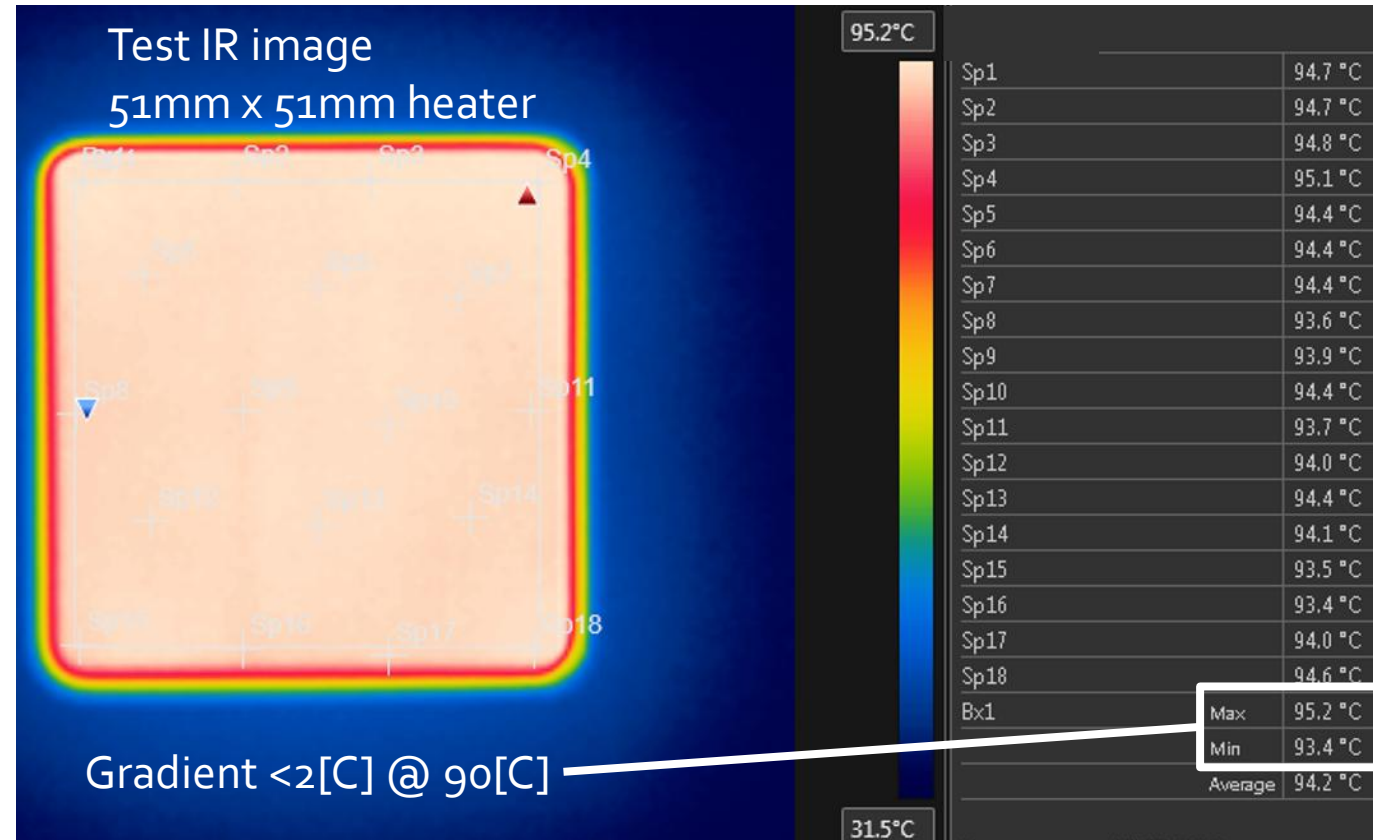
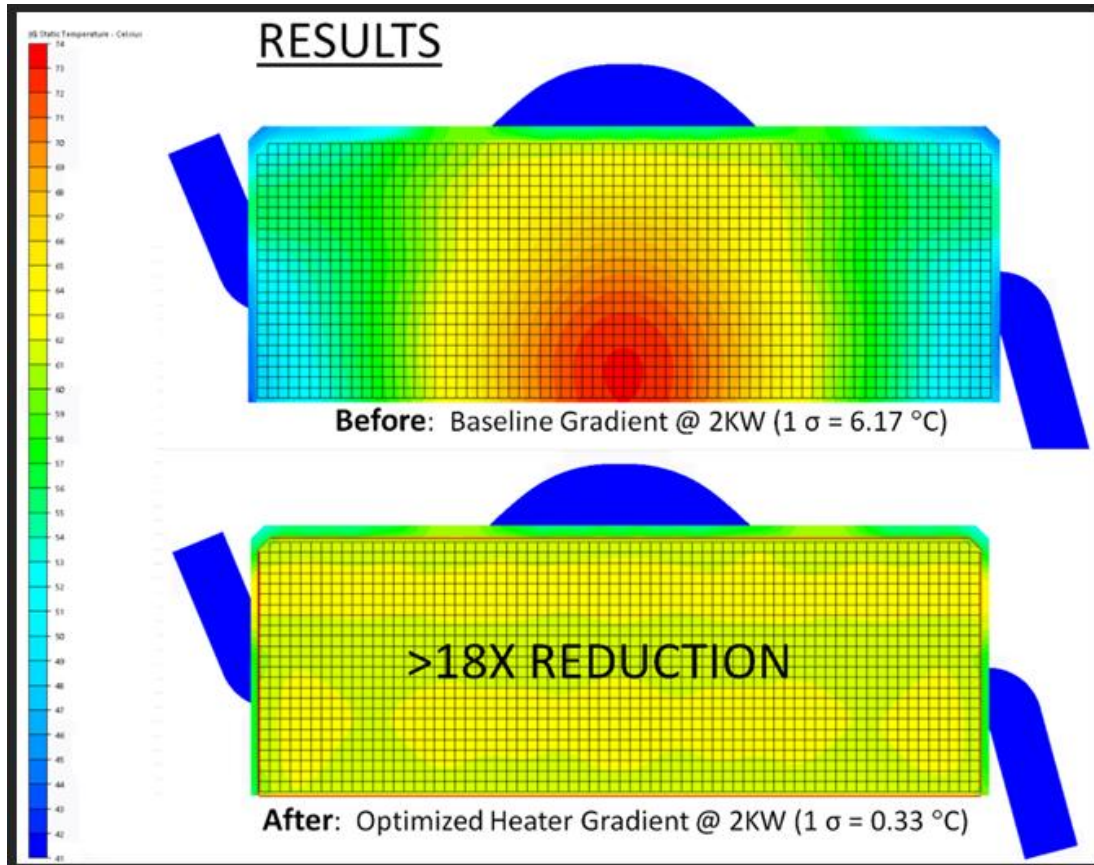


Poor contact

Good contact

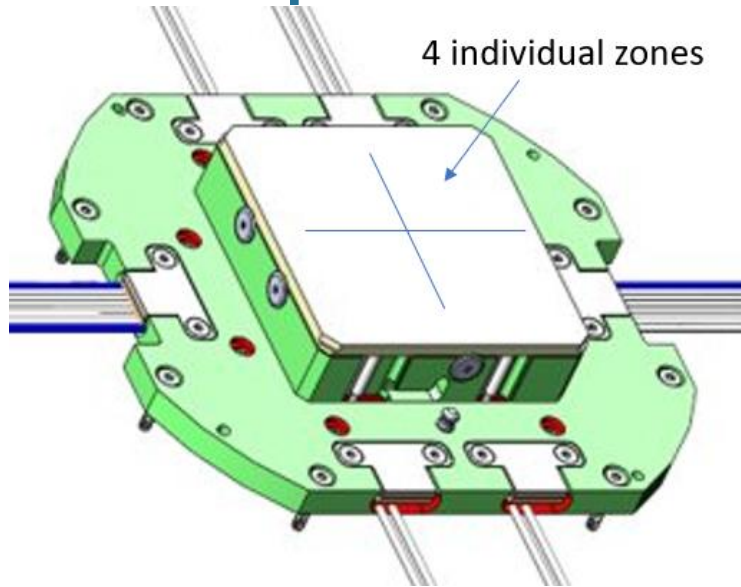
Temperature gradient

- ❑ More sensors in device → tougher gradient specifications
- ❑ Improved design and test methods to optimize heater gradient

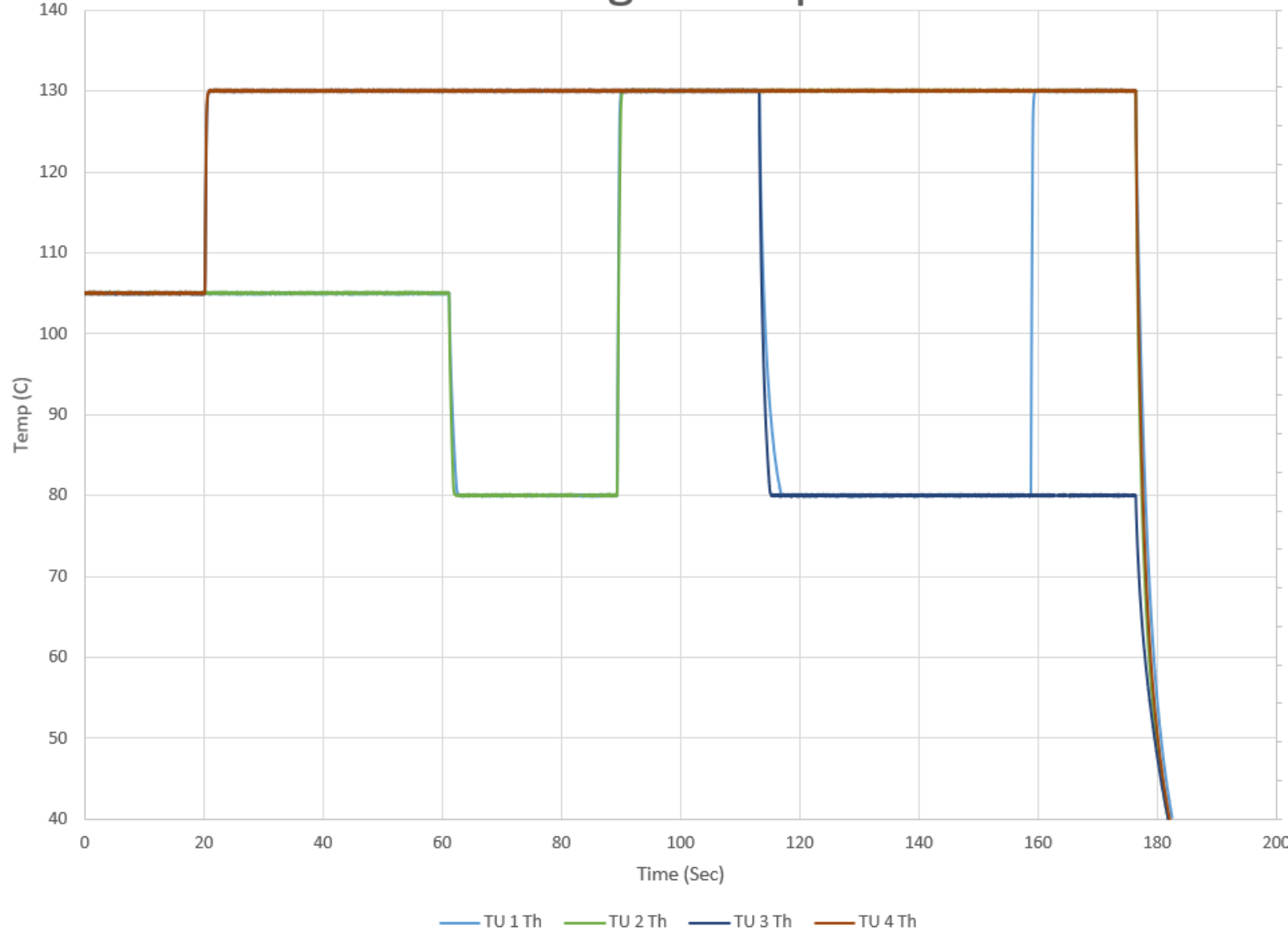


Multizone

- ❑ Large device → good gradient is not enough
- ❑ Die zones have different thermal loads during test
- ❑ Developed multizone TU with independent control

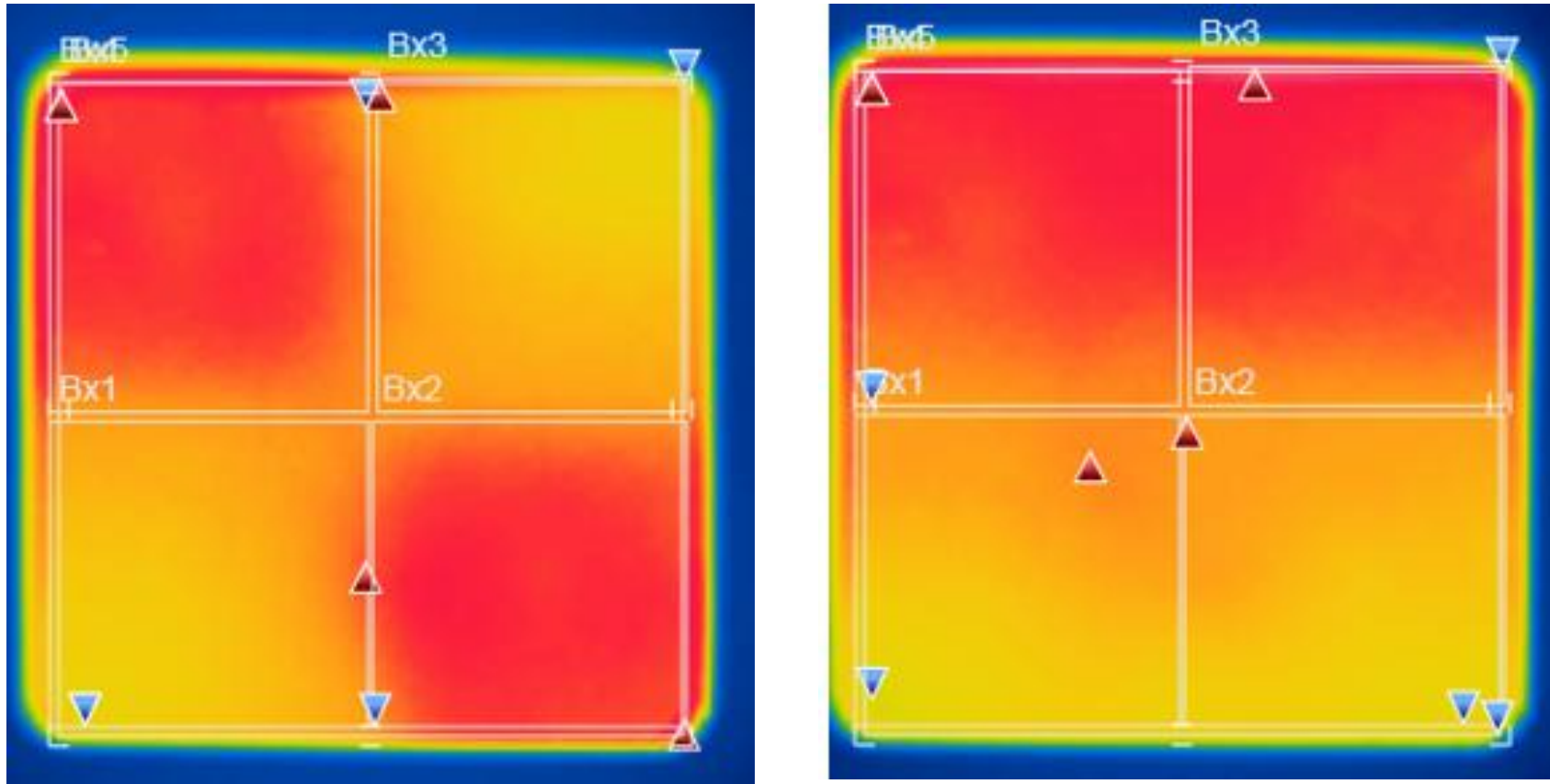


Heater controlling 4 independent zones



Multizone cont.

- ❑ Customizable TU zones to match die zone dimensions
- ❑ Enables better overall control of die temp
- ❑ Testing IR images, 130C and 145C zones



TIM

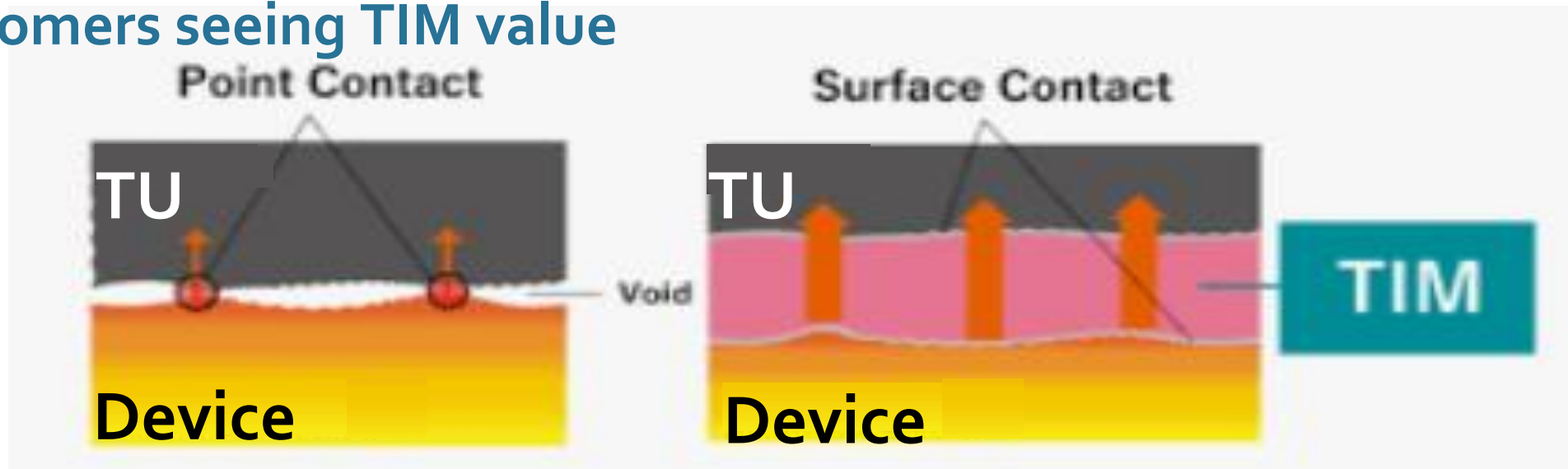
- ❑ Final test pushes TIM technology past its intended use
- ❑ Extensive evaluations & testing of next gen TIMs
 - Low thermal resistance, long lasting & serviceable in the field
- ❑ More customers seeing TIM value

Good TIM is like good tires



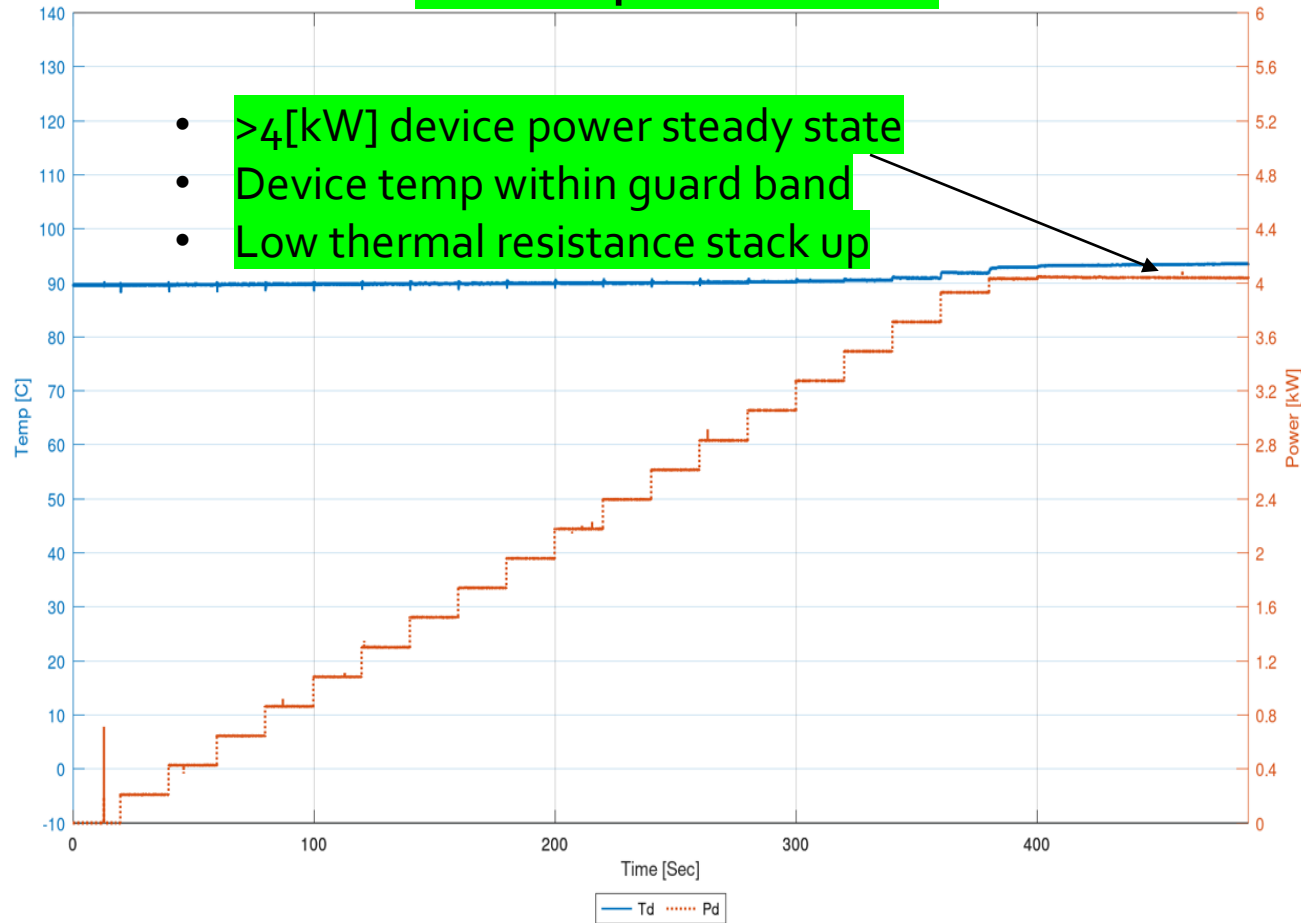
Most capable 4x4 vehicle

Still needs good tires otherwise performance will suffer!

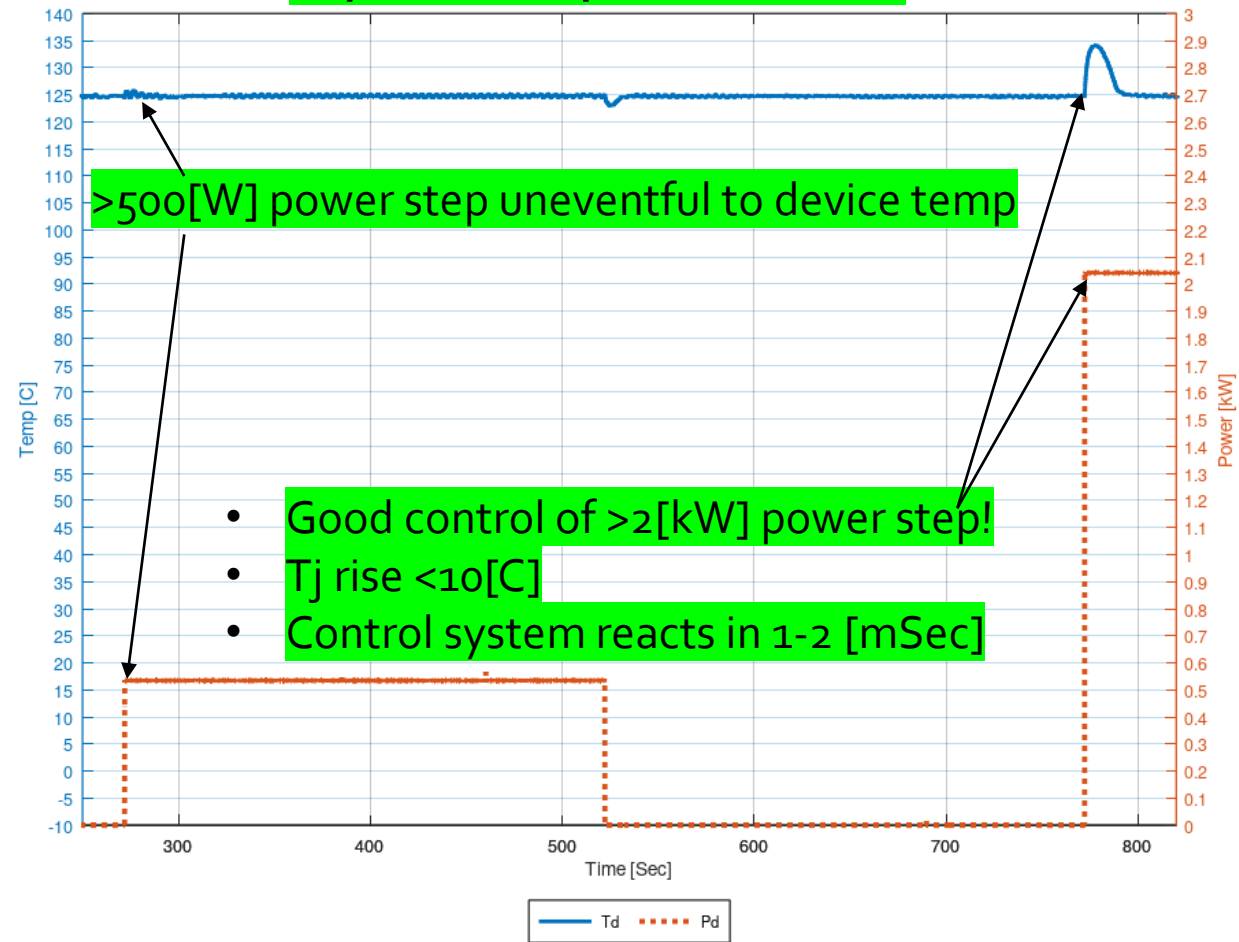


Static & dynamic optimization

Static power test



Dynamic power test



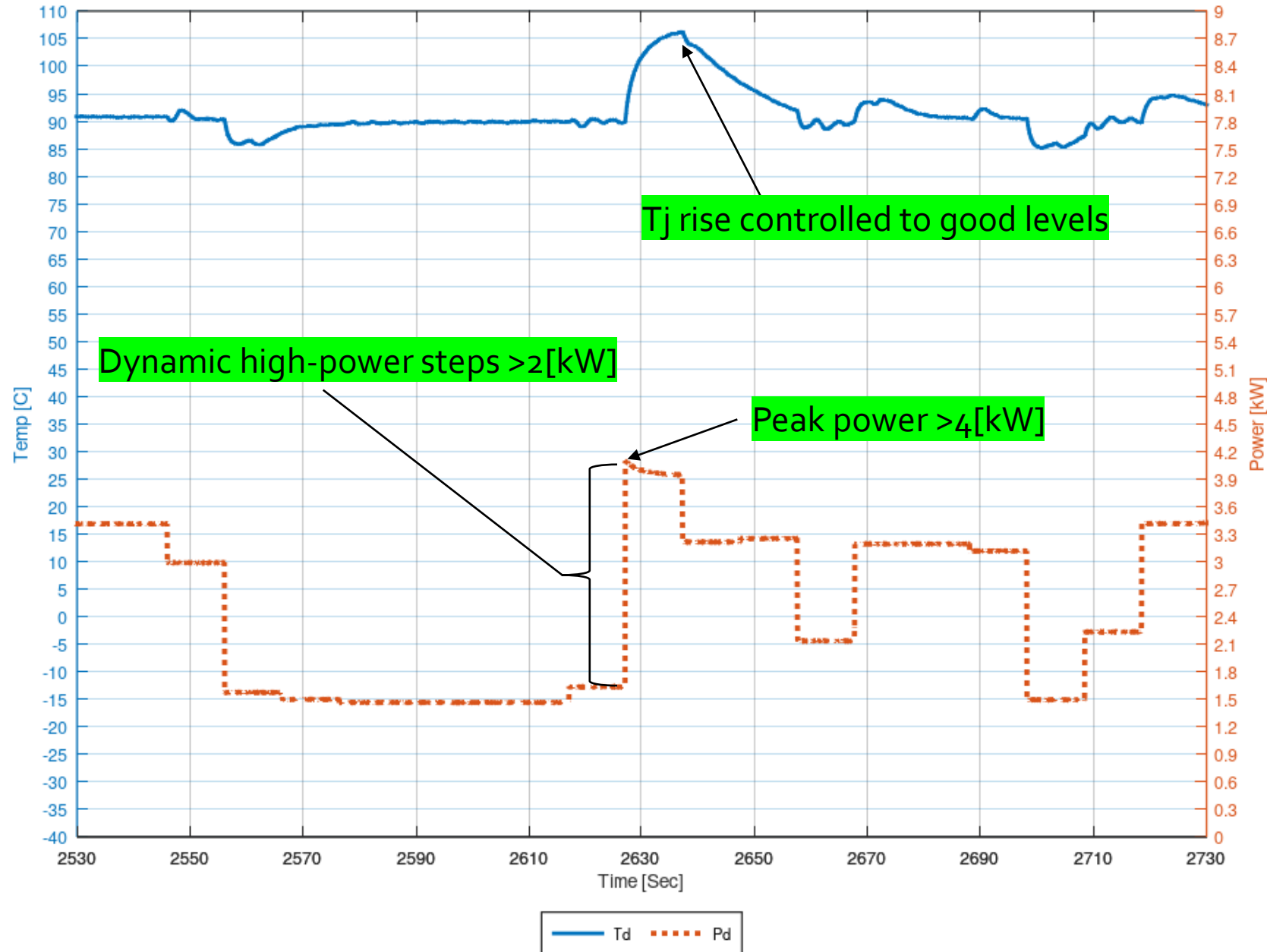
The customer

- ❑ Some customers provide limited info on new applications
- ❑ Best results are with close cooperation with customer
 - Detailed test & device specs
 - Roadmap & design reviews
- ❑ Aviation analogy
 - 787 → Design based on latest feedback & cooperation
 - A380 → Design based on old ideas
 - 787 commercial success, A380...not



Results

- ❑ When all challenges are solved effectively:
 - Beautiful performance graphs
 - Products passing final test
- ❑ Enable the A.I revolution to continue to scale



Grazzi OBRIGADO PALDIES SHUKRIYA SHUKRAN
KIITOS SPASIBO ASANTE EFHARISTO
SALAMAT XIEXIE DEKUJI DANKE Hsieh hsieh
Cảm ơn

NA GODE
DO JEH
GRATIAS TIBI

THANK YOU
Blagodarya

DANKE JE
Gamsahabnida
Dhanyavaad
Khub-kun
NGIYABONGA

MERCI
GRACIAS
Tusen takk
Köszönöm
DANK U
FALEMINDERIT

HVALA MAHALO
TERIMA KASIH
GRAZIE
DZIEKUJE
Doumo Arigatou