

New measurement examples

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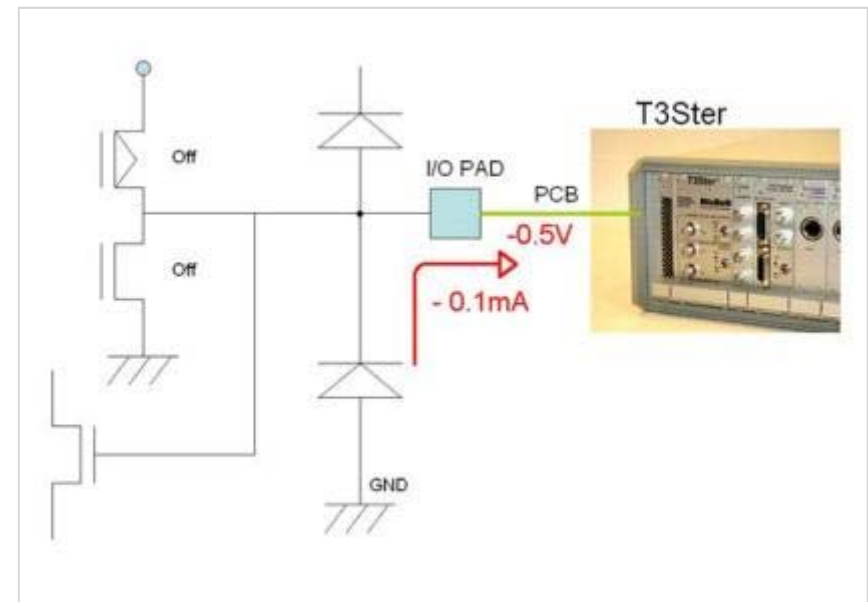
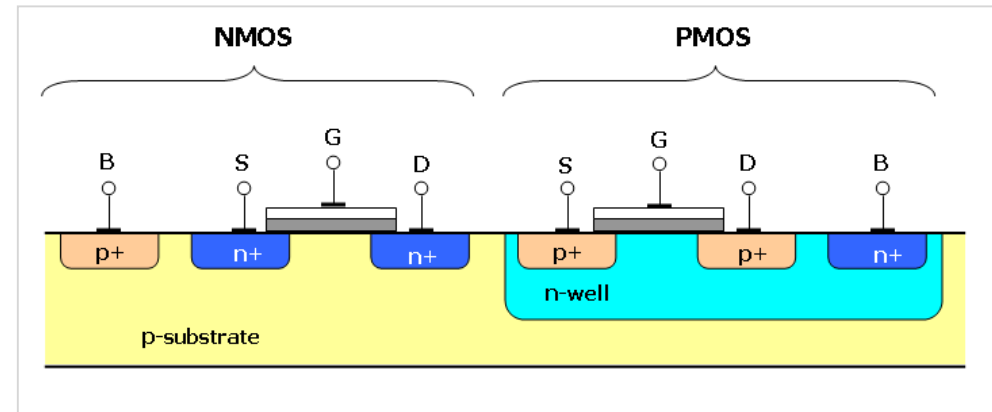
Mechanical Analysis Division

CLM9721 Cortex processor

MEASUREMENT EXAMPLE

How to measure a complex IC?

- Either through the substrate diode of a CMOS circuit by reverse-biasing it between the V_{dd} and the ground pins.
- Or using one of the ESD protection diodes at a non-used I/O pad



Measurement description

- Idea: Identify the main heater IC-s and measure thermal transients on their reverse diodes.



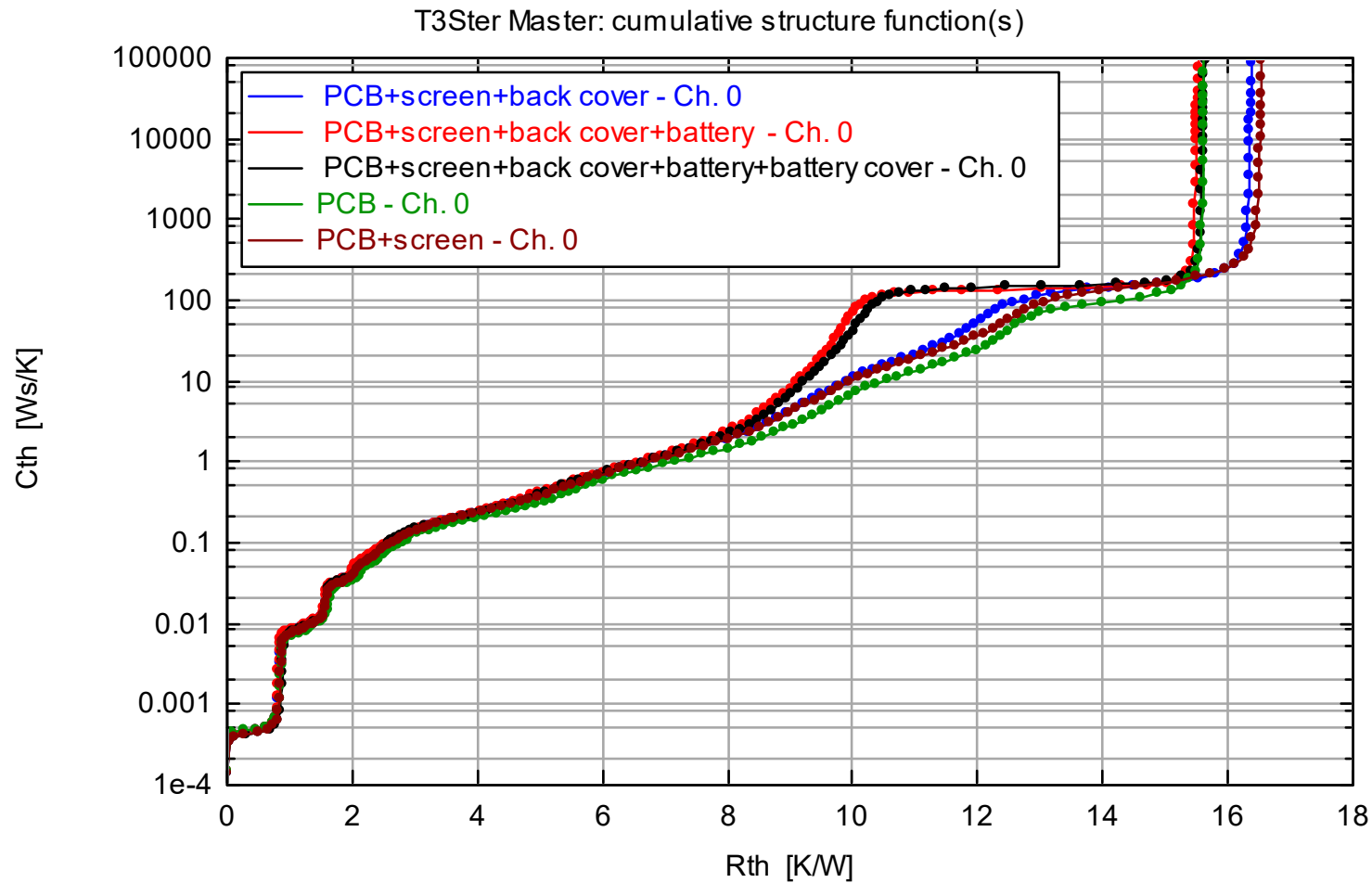
Measurement description

1. Carefully disassemble the phone and turn it on.
2. Identify all the supply voltages on the board by measuring the voltage on the filter capacitors.
3. Assume that the voltage measured on a filter capacitor which is near the target IC is used by that IC only.
4. Turn off the phone and solder wires to the leads of the capacitor.
5. Connect it reversely as we want to power the reverse diode of the IC.
6. Apply heating current and check that only the target is getting hot.
7. If yes smile cause you are ready 😊

Boundary conditions

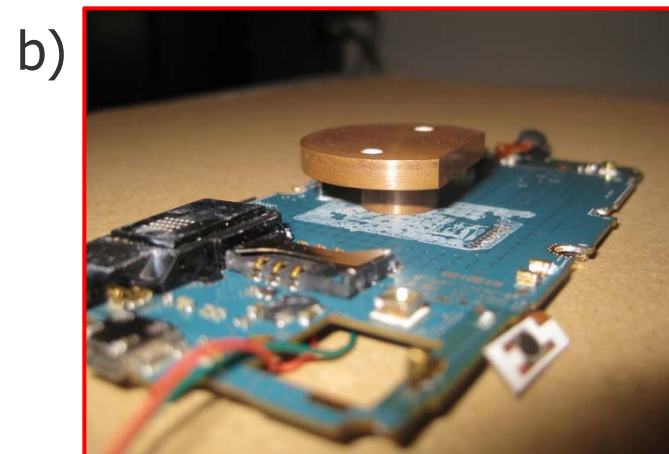
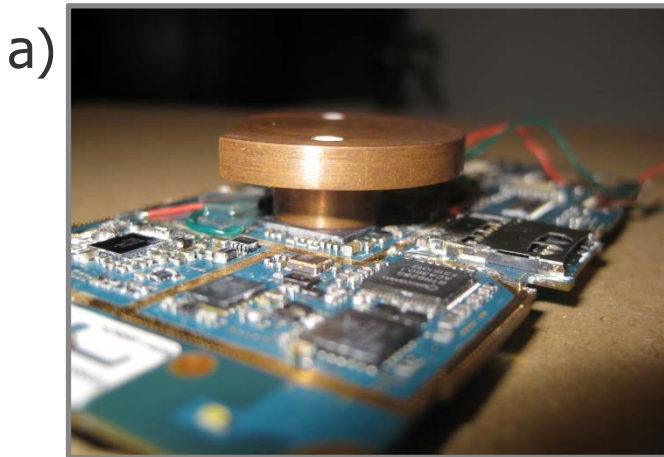
- Measured in still air chamber
- Different assembled stages:
 - PCB
 - PCB + screen
 - PCB + screen + back cover
 - PCB + screen + back cover + battery
 - PCB + screen + back cover + battery + battery cover

Result structure functions

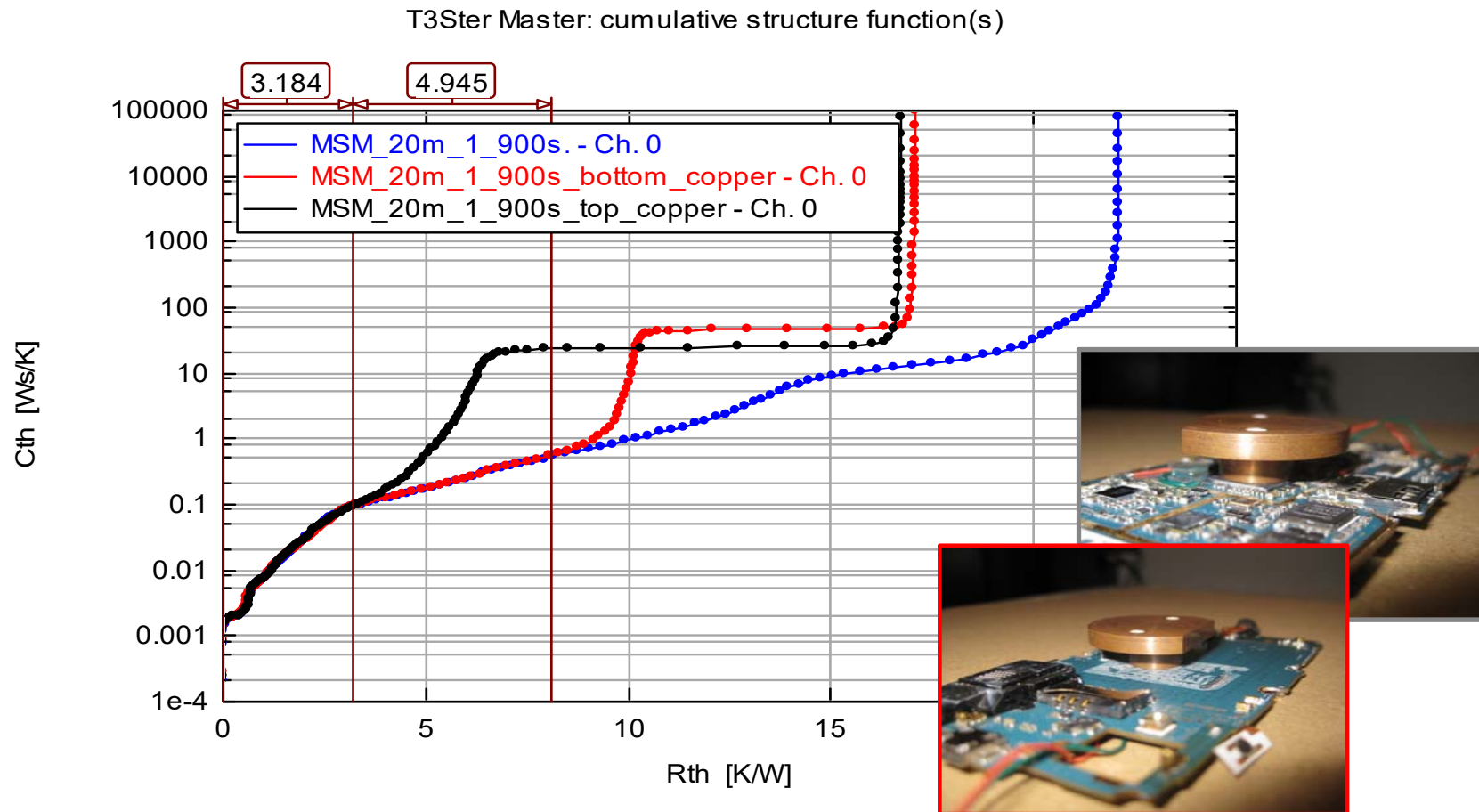


Identify Partial Heatflow path

- A copper block is used to modify boundary conditions to carry out dual interface method
- a) On the target IC -> Junction to case R_{th}
- b) Under the target IC on the opposite side -> Junction to bottom PCB R_{th}

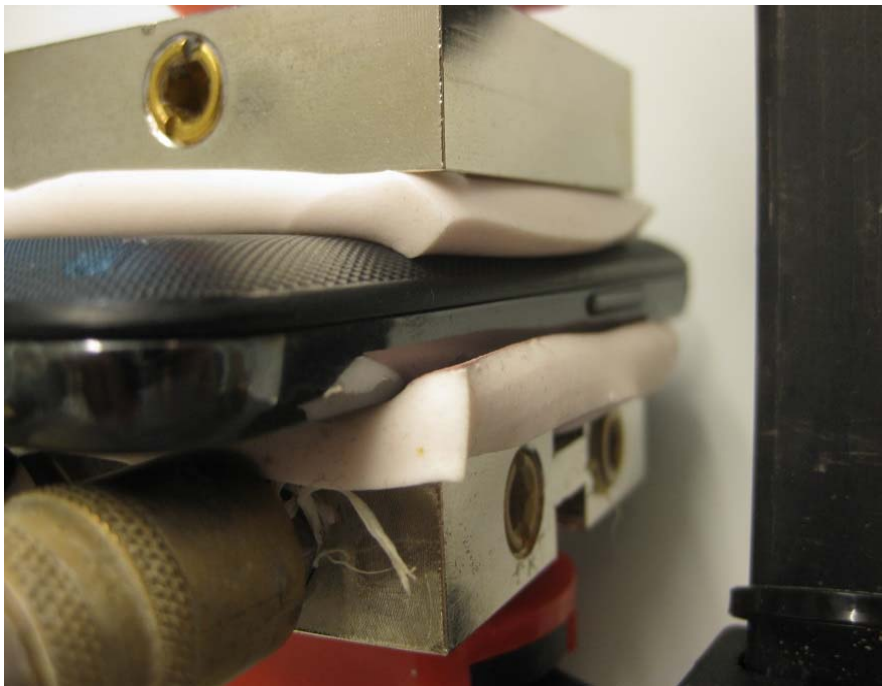


Structure functions of Partial Path

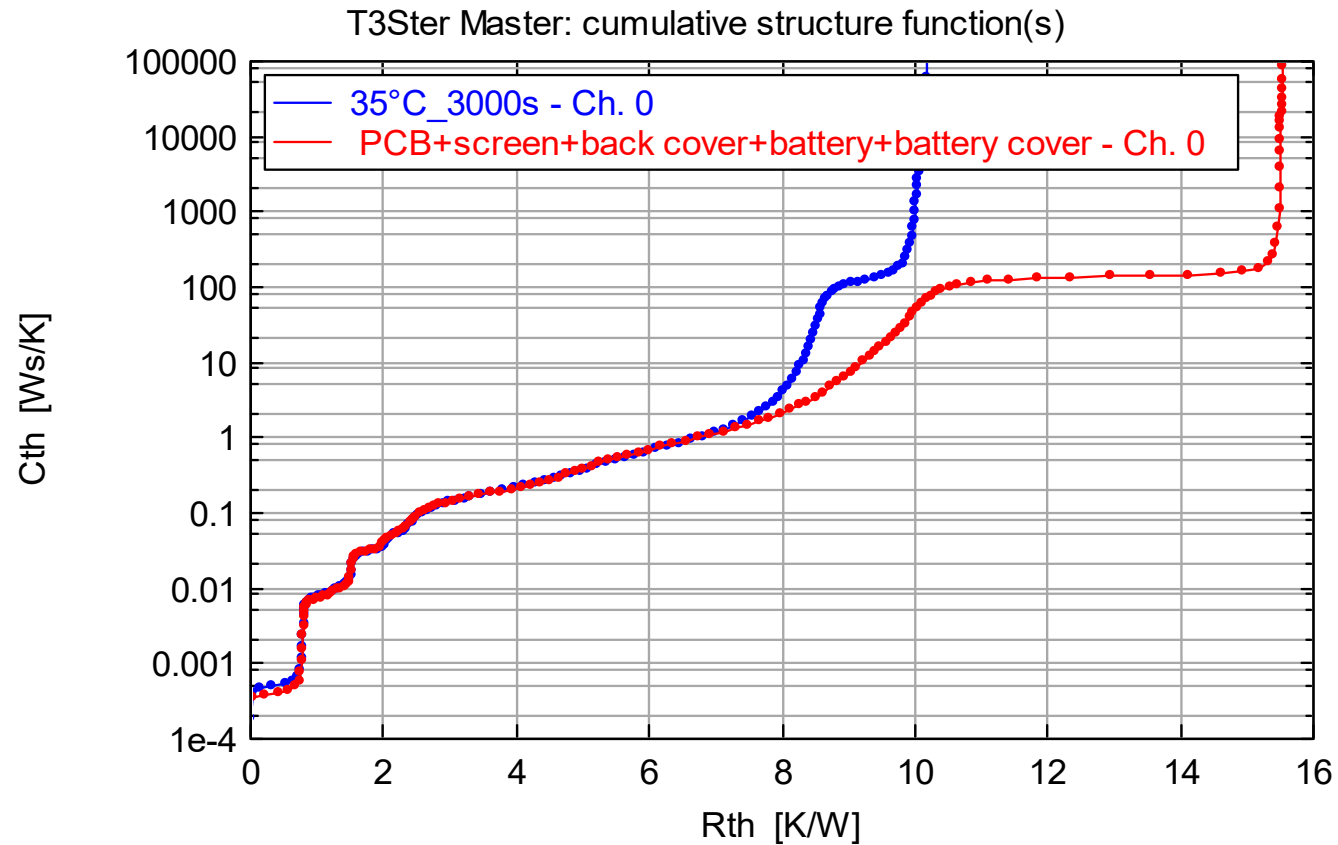


“Grab Hold of It”

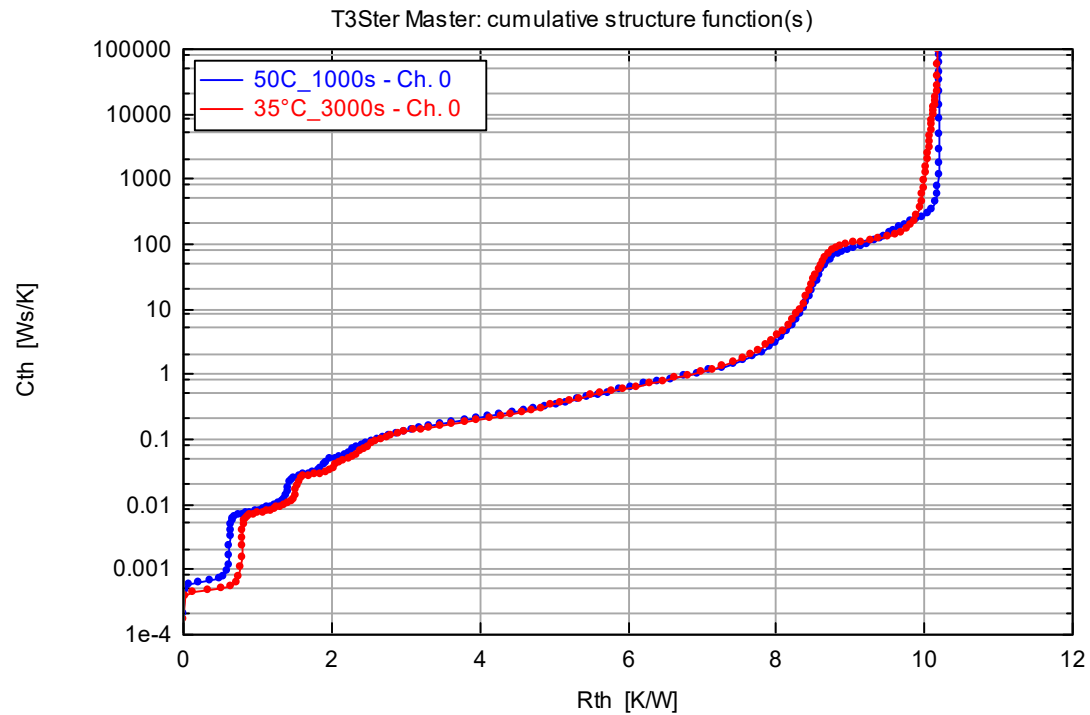
- Simulation of phones kept in hand.
- The phone contacted double side to a 35C thermostat through a gap filter



“Grab Hold of It”



“Grab Hold of It” @ 50C



What can we do?

- A. Measurement on a real board with heater and several additional components.
 - (R&D lab, in-line, on-line)
- B. Measurement on a real board with most other components removed.
 - (R&D lab only)
- C. Measurement on a board modified for simple powering.
 - (R&D lab only)
- D. Measurement on a dummy holder board.
 - (R&D lab only)

What can we measure?

- a) Real component on a real board (e.g. processor).
 - Changes in real operation may cause a power step

- b) Real component on a modified board.
 - GND and VDD lines can be used for powering the substrate diode, enable or disable inputs can be biased for temperature sensing.

- c) Packaged thermal test chip.
 - Separate resistive heater and diode sensors. Not always available for TIM vendors and rarely for end-users.

How to power up?

- i. Low power level.
 - Suitable for heat conduction path analysis.
- ii. Normal power level.
 - Suitable for reliability analysis.
- iii. Higher than normal power level.
 - Suitable for accelerated reliability analysis.

At planning the measurement we can compose any combination of the above.

Conclusion

- High level systems can be measured easily
- Effect of main heaters can be analysed
- Easy to set different boundary conditions
- Effect of changing boundary conditions is measurable
- Cool application 😊



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