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MOTIVATION

Evaluating the reliability of power semiconductor devices is now more vital than ever. AC power cycling platform has therefore been proposed to stress test the power module to develop a reliability model. In T-type IGBT modules typically used for solar applications, it is challenging to access all of the terminals of each device without interfering with other devices. Furthermore, it is time-consuming to track device degradation, and thus, an integrated and automated method for high-precision static and dynamic characterization of T-type power modules is proposed.

OVERVIEW OF THE PLATFORM

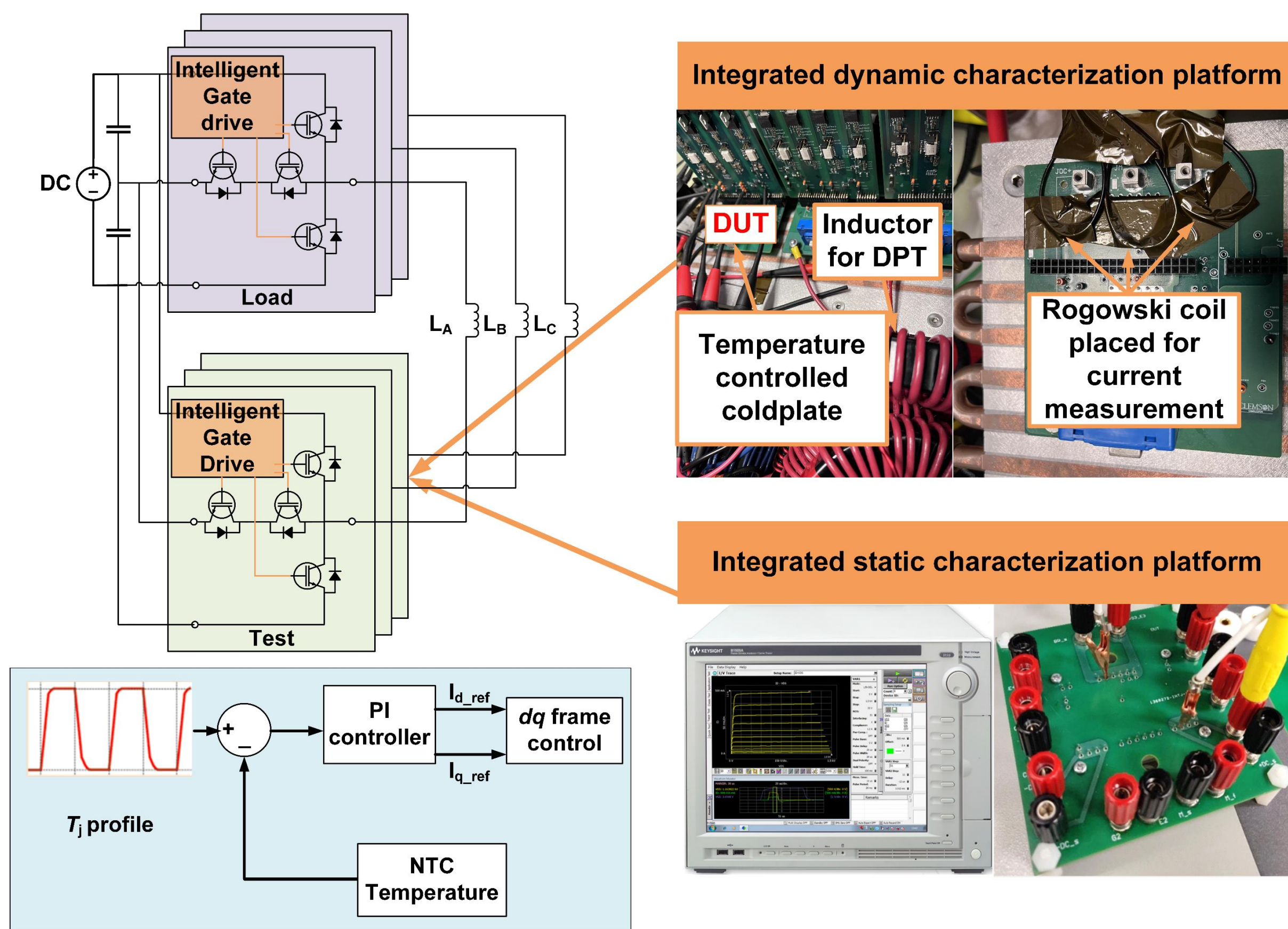


Fig 1: Overview of the AC Power Cycling Platform

- Three phase three level for T-type power module
- dq rotating frame PI controller
- Junction temperature main control variable
- Enhanced ΔT_j and flexible $\Delta T_j/dt$ regulation by the programmable driving voltage
- Ambient temperature range from $-20\text{ }^\circ\text{C}$ to $60\text{ }^\circ\text{C}$ for the PV application by dedicated mechanical design to ensure a condensation-free environment
- Integrated automated static and dynamic characterization for key parameters' degradation tracking and modeling

ACTUAL TEST BENCH AND EXPERIMENTAL RESULTS

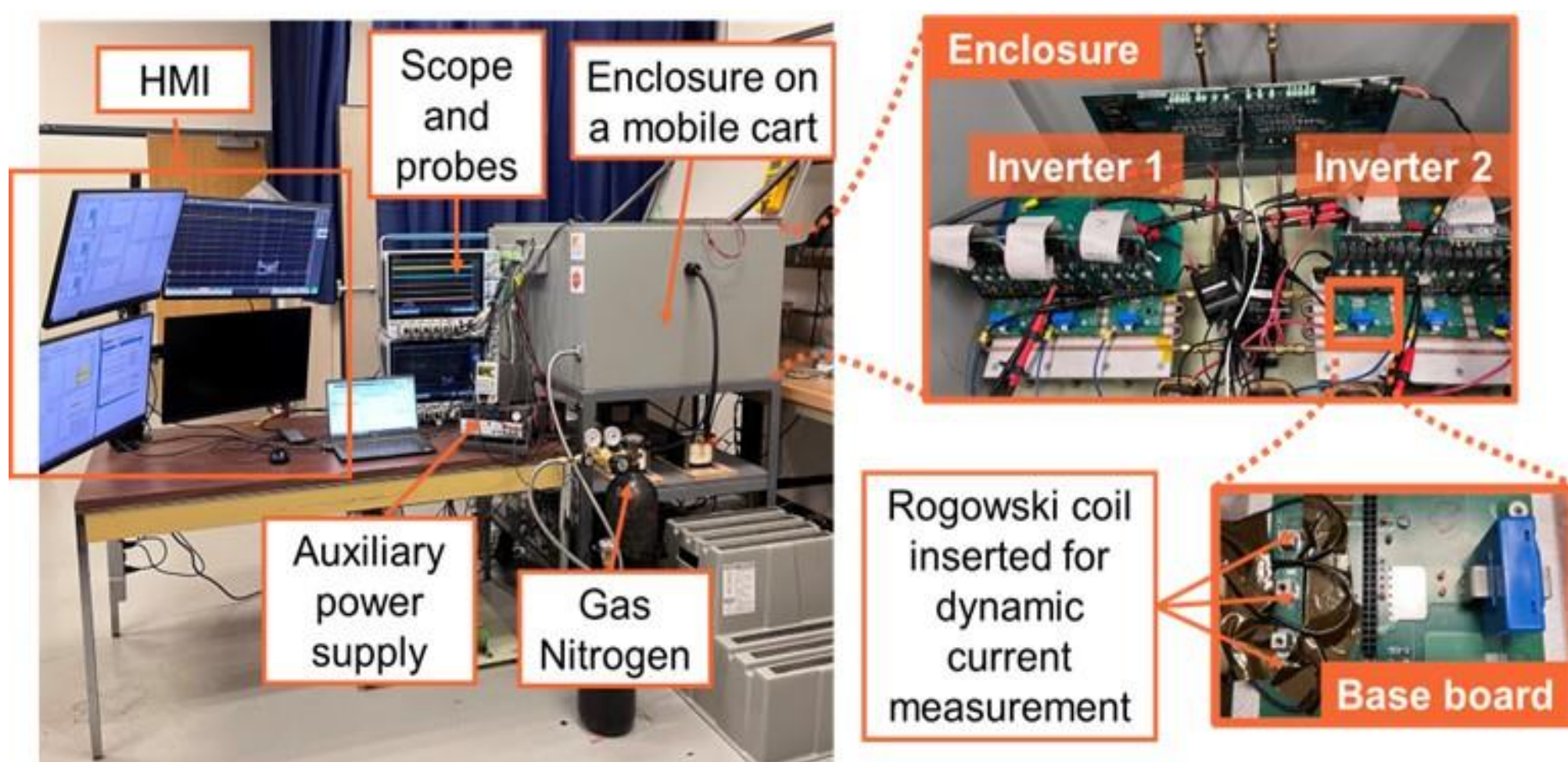


Fig 2: Actual AC Power Cycling Platform

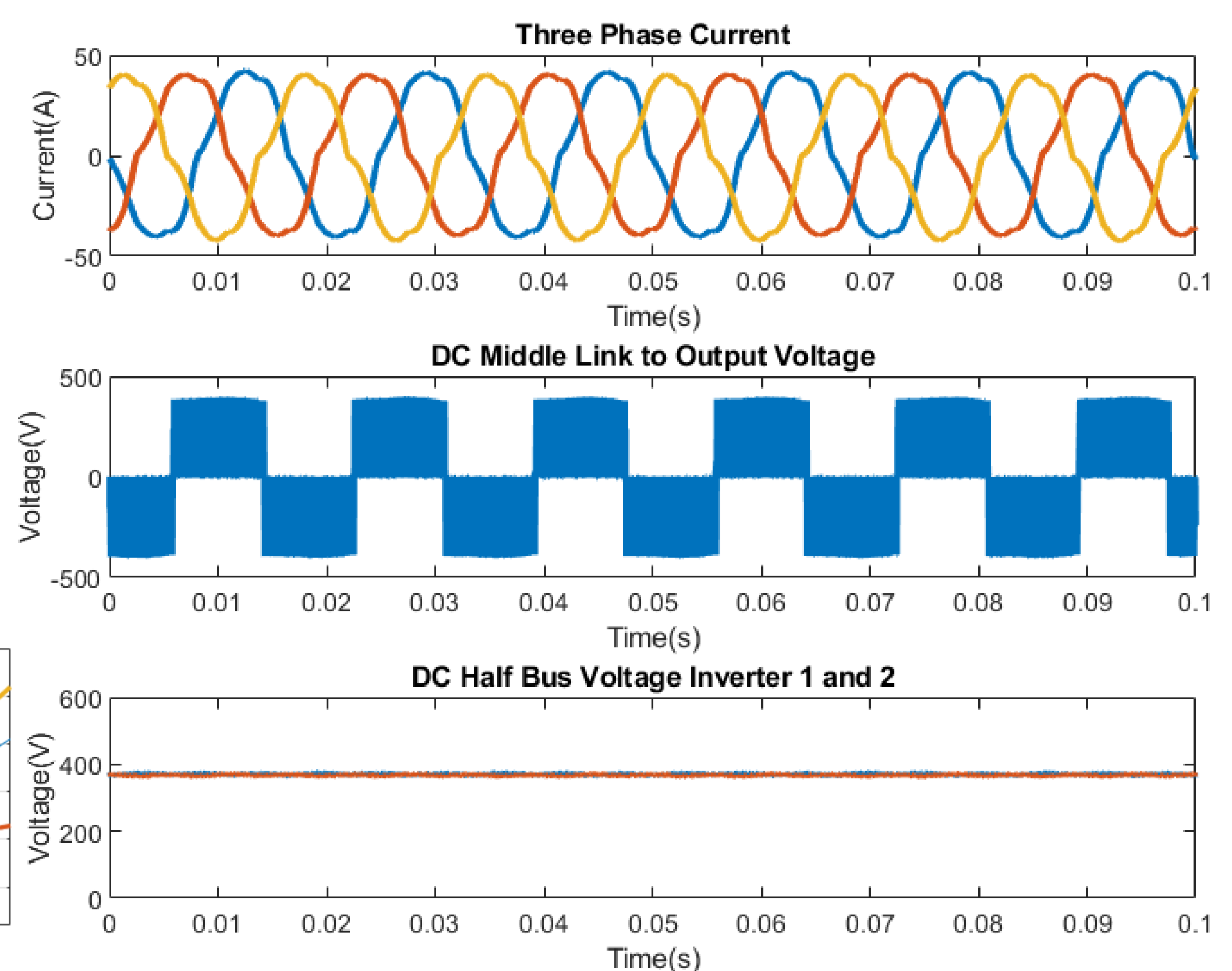


Fig 4: Experimental Results

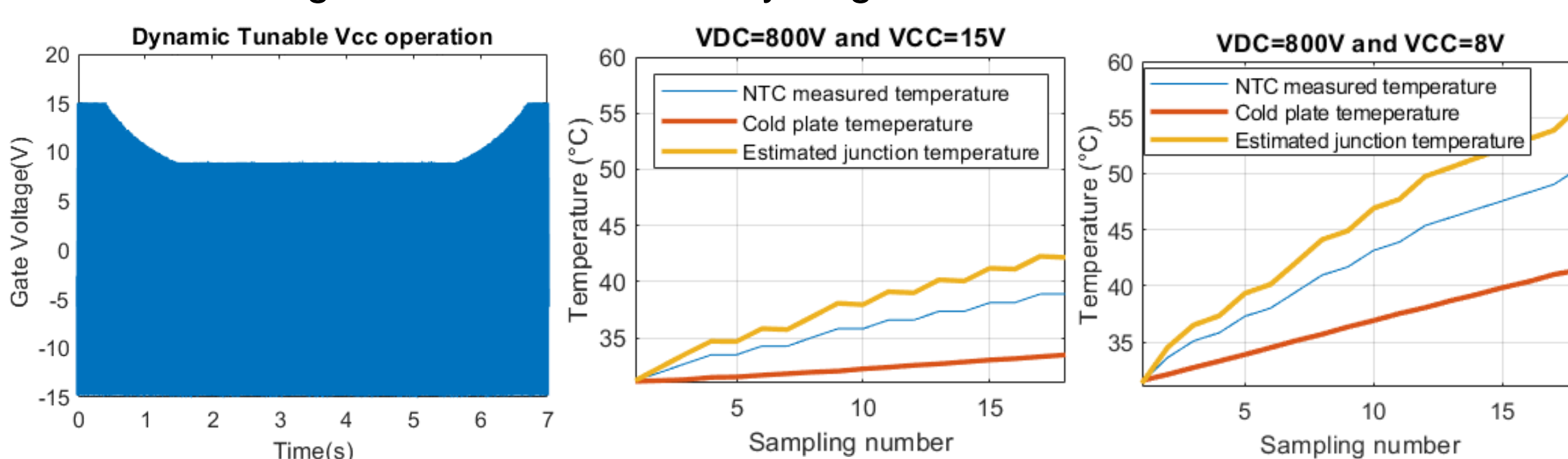


Fig 3: Dynamic Tunable V_{cc} Operation and Junction Temperature Control

CONCLUSION

- AC power cycling platform close loop control achieved for 800V and 60kW
- The measurement accuracy of the proposed static characterization test methodology deviated around 2% from the datasheet value, whereas the classical methodology deviated around 20% from the datasheet values

