

Overview

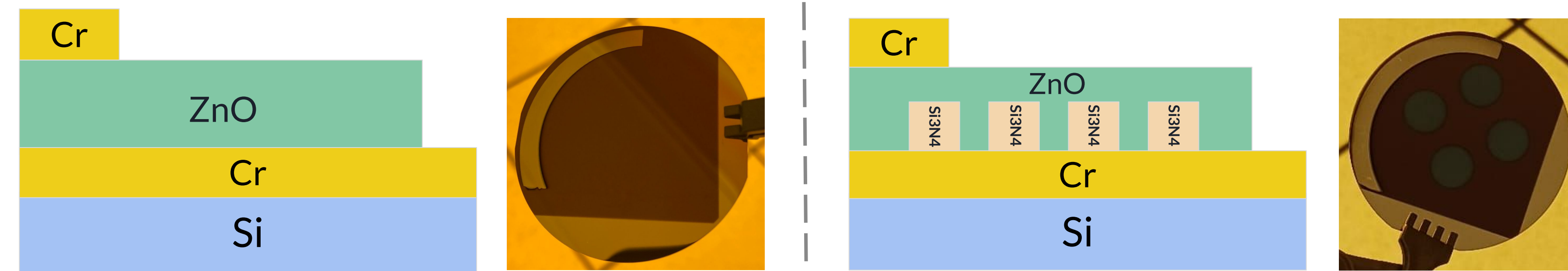
- Demonstration of a Novel detection scheme utilizing the piezo-pyroelectric properties of ZnO thin films for a zero bias Vacuum Ultraviolet (VUV) detector.
- Enhanced detection of the VUV light due to stress-engineering.
- Control device made of a non-piezoelectric material for establishment of the hypothesis.
- COMSOL simulation of stress and temperature variation for optimization of device architecture.
- Application in rare event search in high energy physics using liquid noble detectors.
- Additional applications in space sensors, and other areas requiring low-power cryogenic performance

MOTIVATION

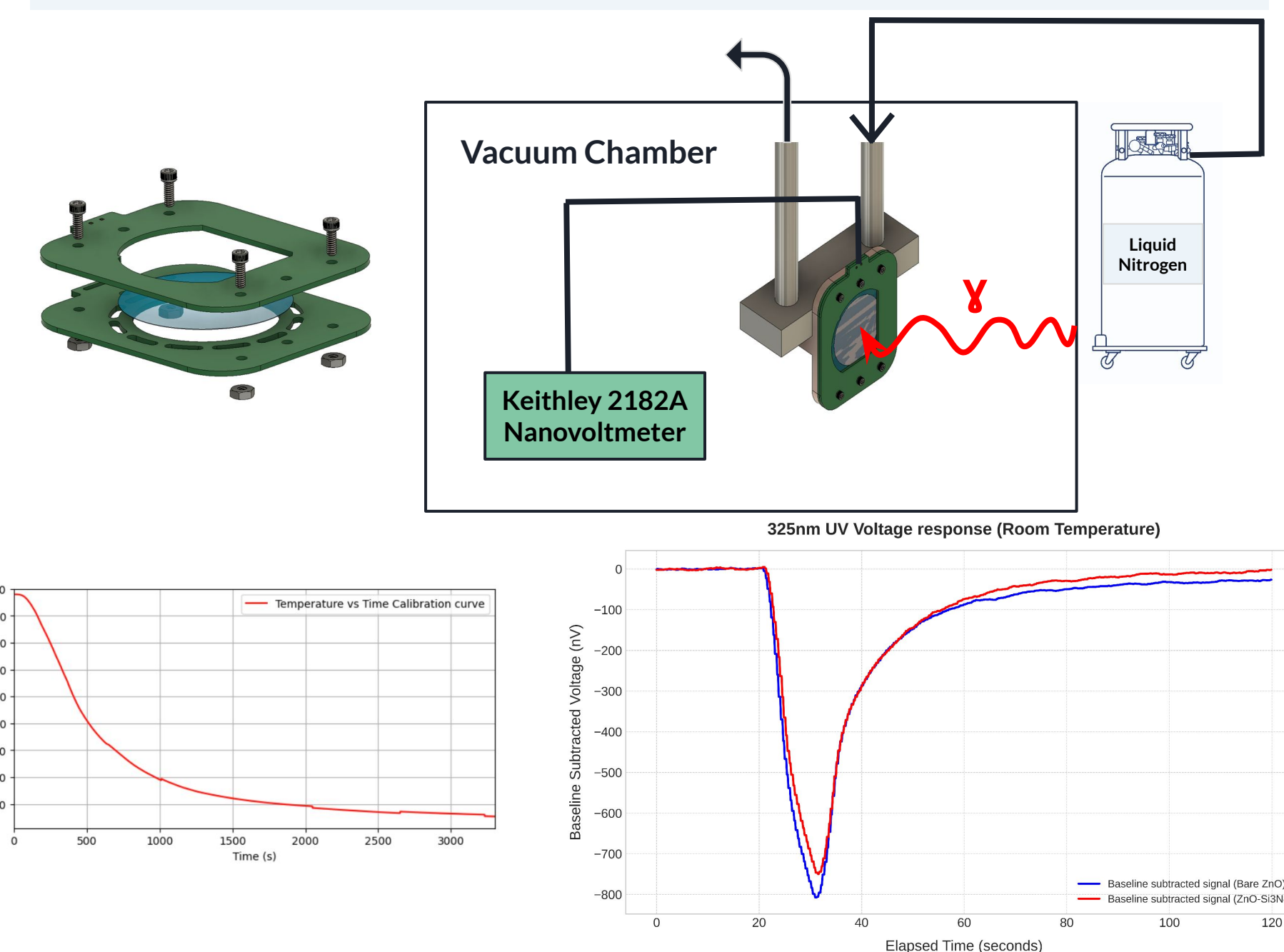
- Need for low powered VUV Scintillation detectors for applications in Space Physics, HEP and electronic industries [1].
- Favourable optoelectronic properties of ZnO [2].
 - wide band gap
 - piezo & pyroelectricity

Fabrication, Experimental Setup and COMSOL Simulation

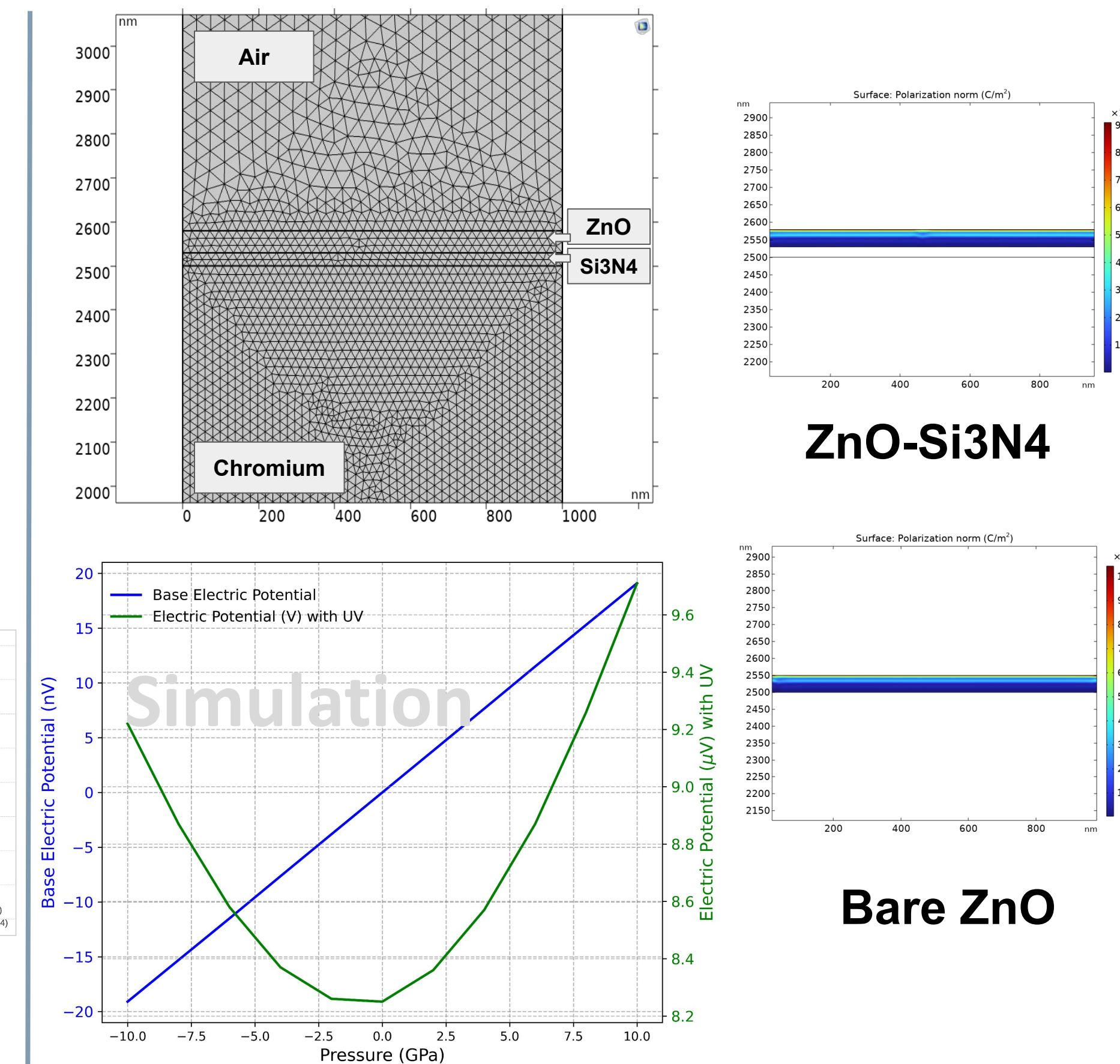
- Stacked vertical thin-film heterostructure based photodetector
- Active layer - ZnO, grown using targeted plasma sputtering
- strain engineering and piezoelectric optimization using in device strain due to Si₃N₄.



- Enhancement of the piezo voltage due to Si₃N₄ in device strain engineering



- Room temperature measurements for detection of 325 nm VUV photons



REFERENCES

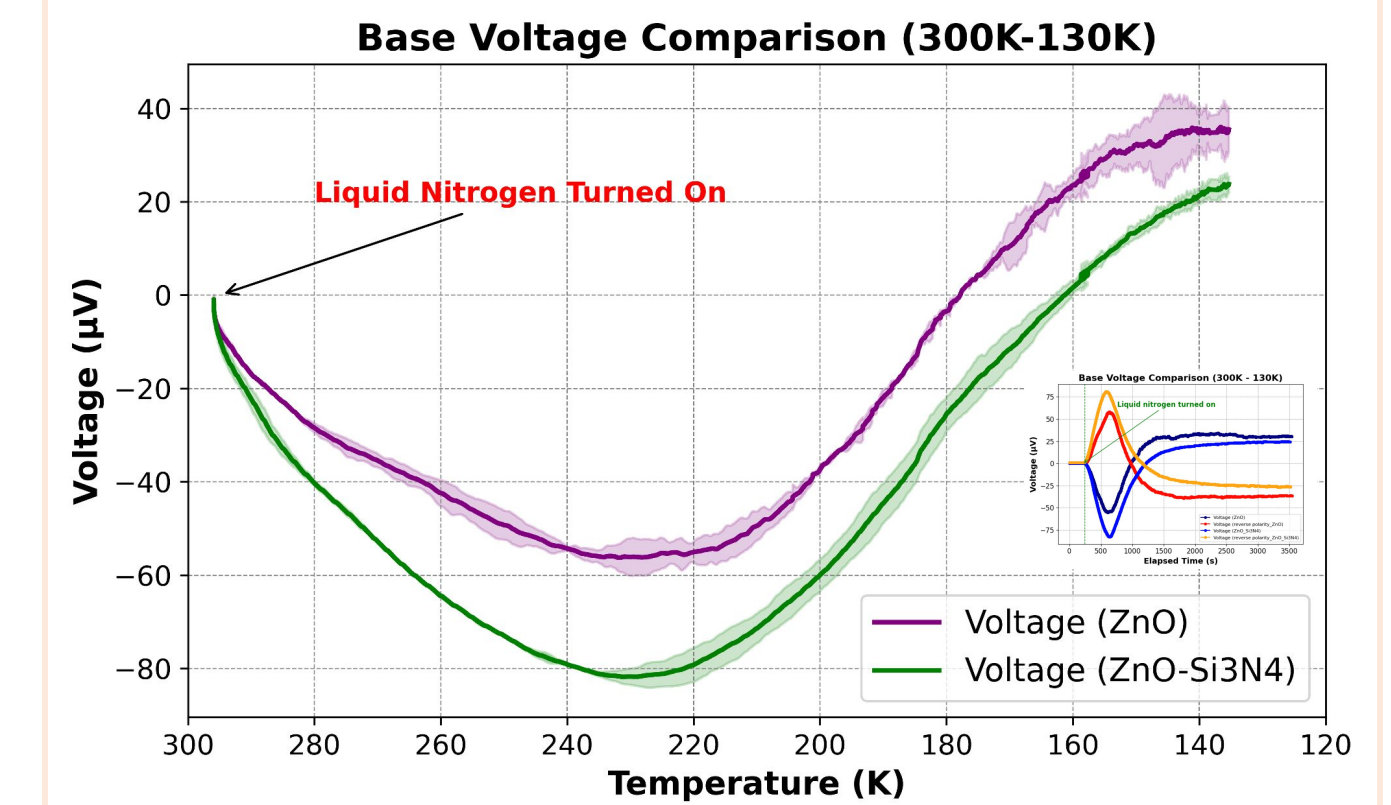
1. Zheng, Wei, Lemin Jia, and Feng Huang. "Vacuum-ultraviolet photon detections." *Iscience* 23.6 (2020).
2. Boruah, Buddha Deka. "Zinc oxide ultraviolet photodetectors: rapid progress from conventional to self-powered photodetectors." *Nanoscale Advances* 1.6 (2019): 2059-2085.

ACKNOWLEDGEMENTS

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✉ pratyantik.sau@uta.edu

RESULTS

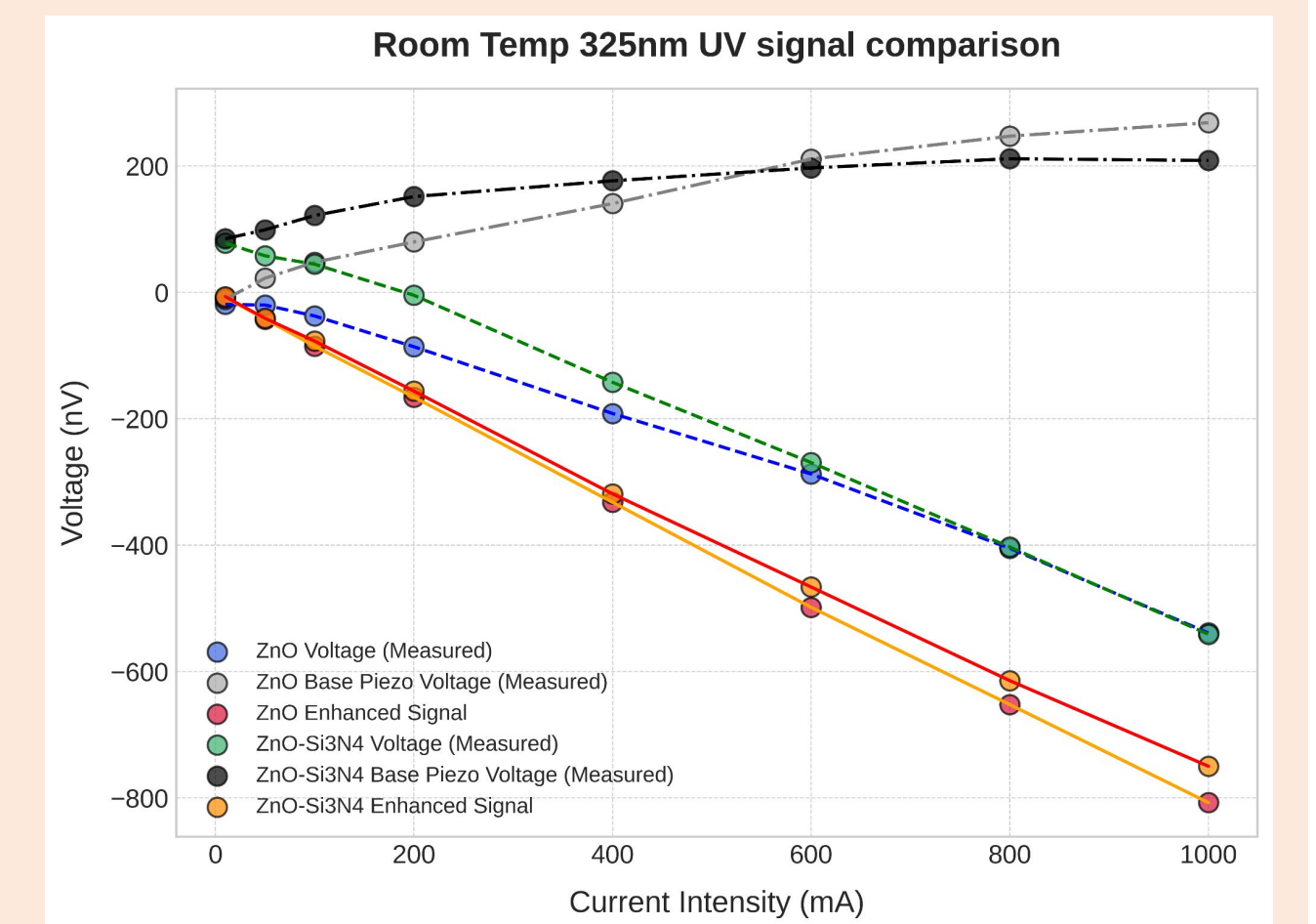


Pyroelectric Effect

$$I_p = A \cdot p \cdot \frac{dT}{dt}$$

Seebeck Effect

$$V_S = S \cdot \Delta T$$



ONGOING STUDIES

- Quantification of the contributions of various process for cryogenic measurements.
- The Piezo-Plasmonic properties of ZnO heterostructure for cryogenic applications is currently being investigated.
- Device characterization and performance optimization.
- Application specific development.

