# 2020 Research Day
Implementing Logic Gates In ReRAM

## Barak Hoffer, Advised by Prof. Shahar Kvatinsky

Motivation

- The performance of computers is limited by data transfer from memory to CPU, due to the memory wall.

- Resistive random-access memory (ReRAM) is an NVM device, based on the resistive switching phenomenon.

- ReRAM arrays can also be used to implement logic gates using Memristor Aided loGIC (MAGIC).

- By enabling processing of data in the memory we can reduce the amount of data transfer and improve performance.

Equipment

ReRAM Crossbar
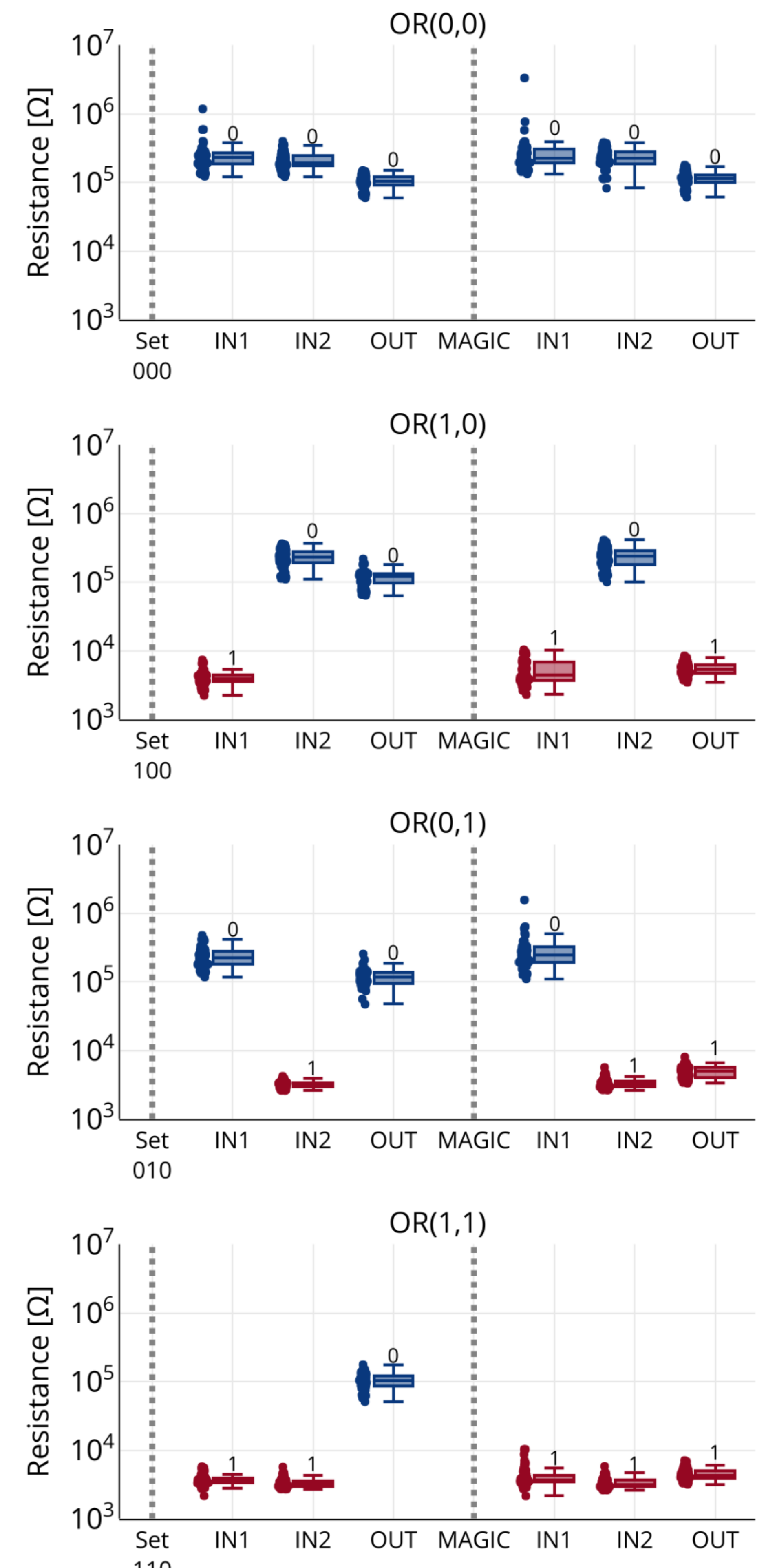

WL1 WL2 WL3

BL1 BL2 BL3
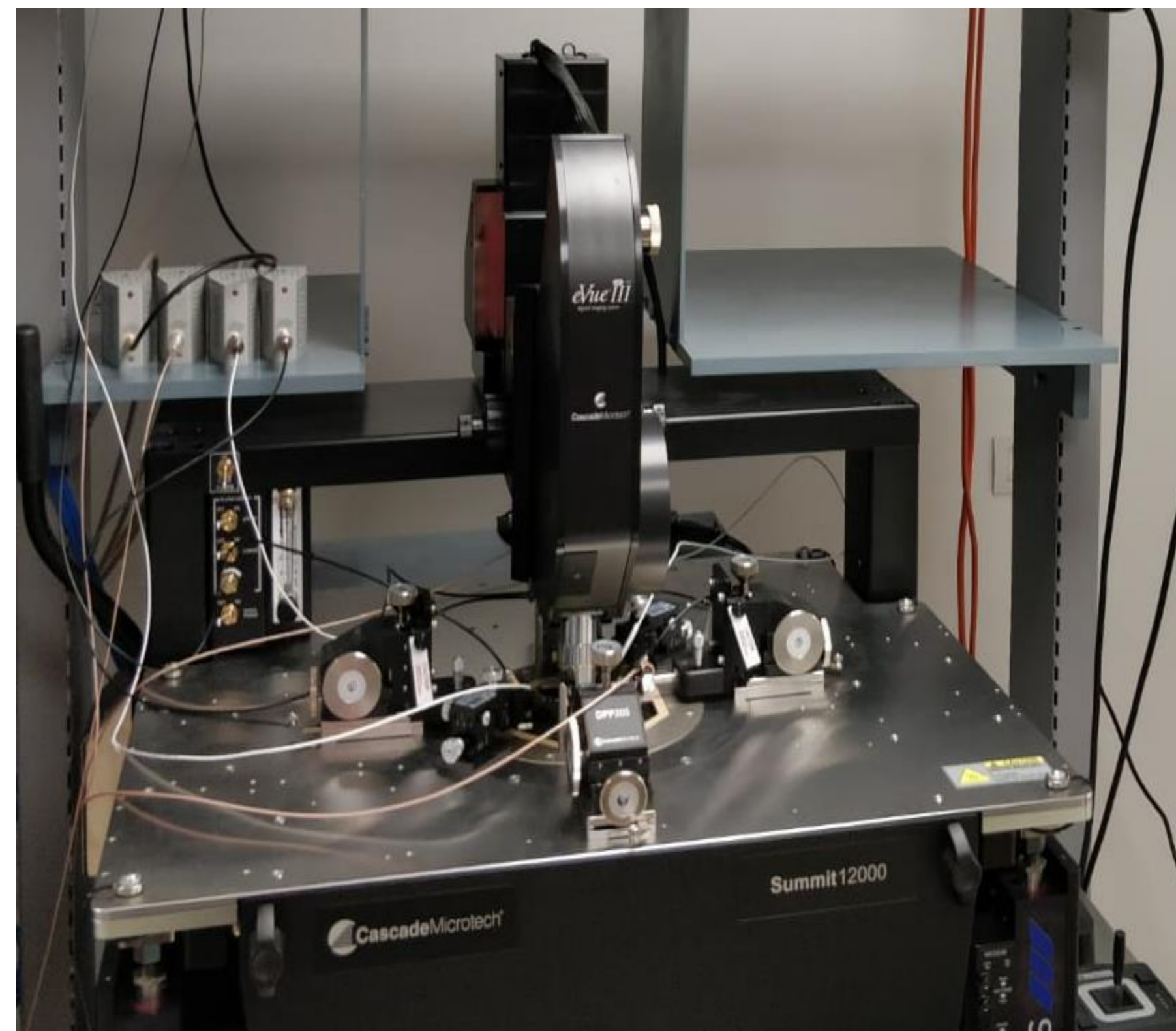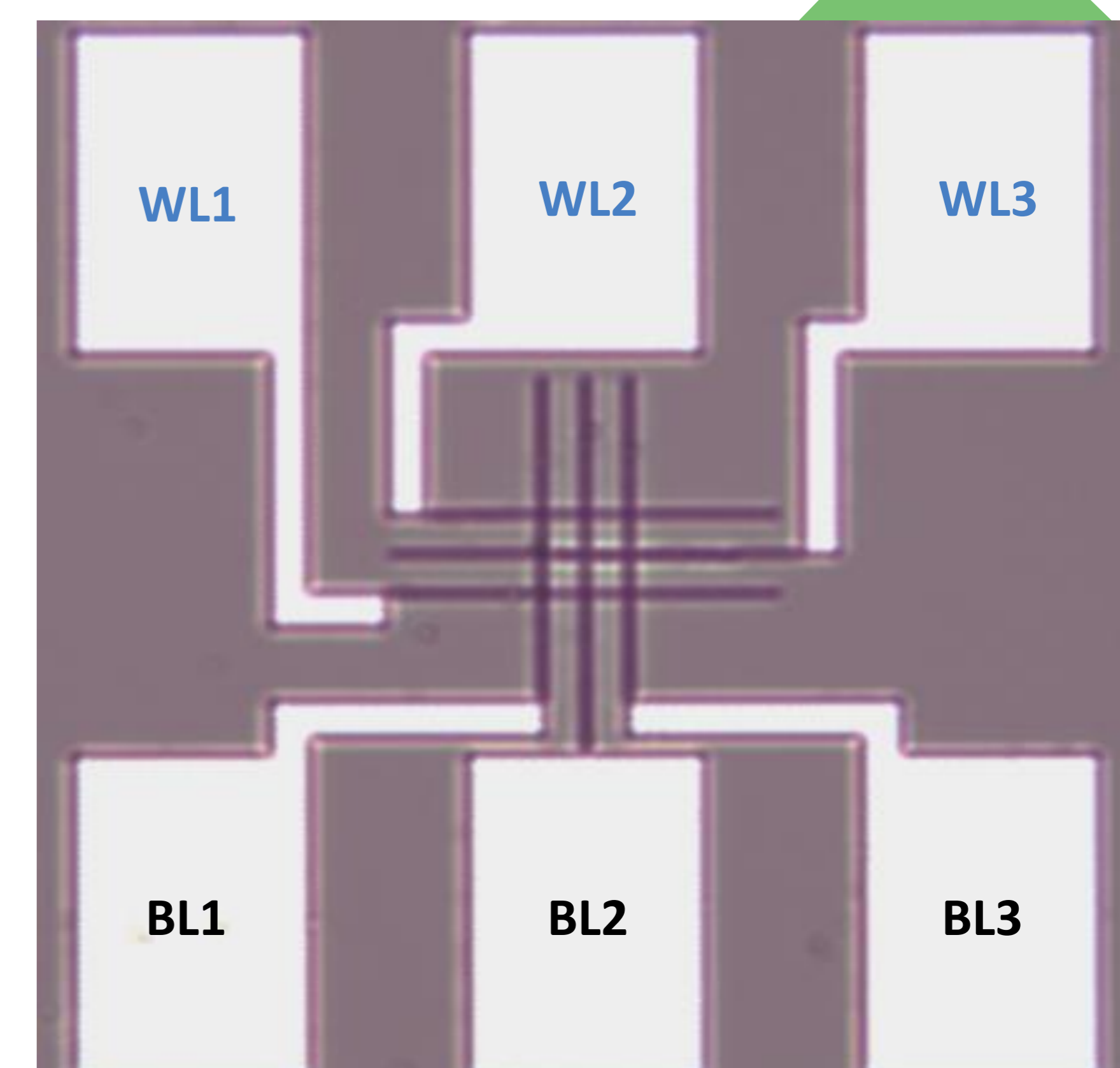
Methodology

- A testing die of Ta_2O_5-based ReRAM crossbars was fabricated.
- A new set of MAGIC gates was introduced in order to support the switching behavior of Ta_2O_5-based cells.
- Lab measurements were conducted in order to evaluate the functionality and robustness of MAGIC gates.
- Each gate was evaluated for fifty cycles.
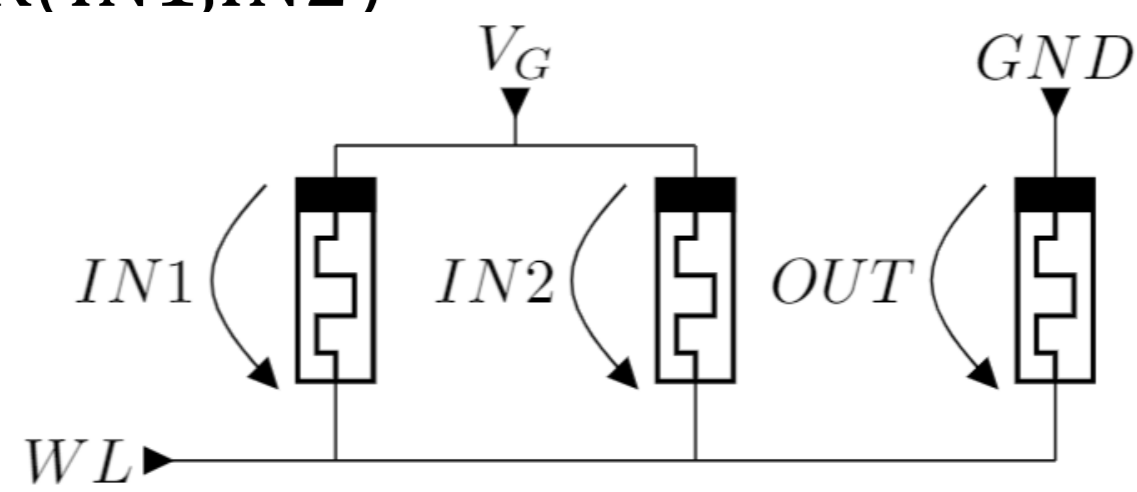- The results show correct logic operation for both gates, while maintaining input stability.
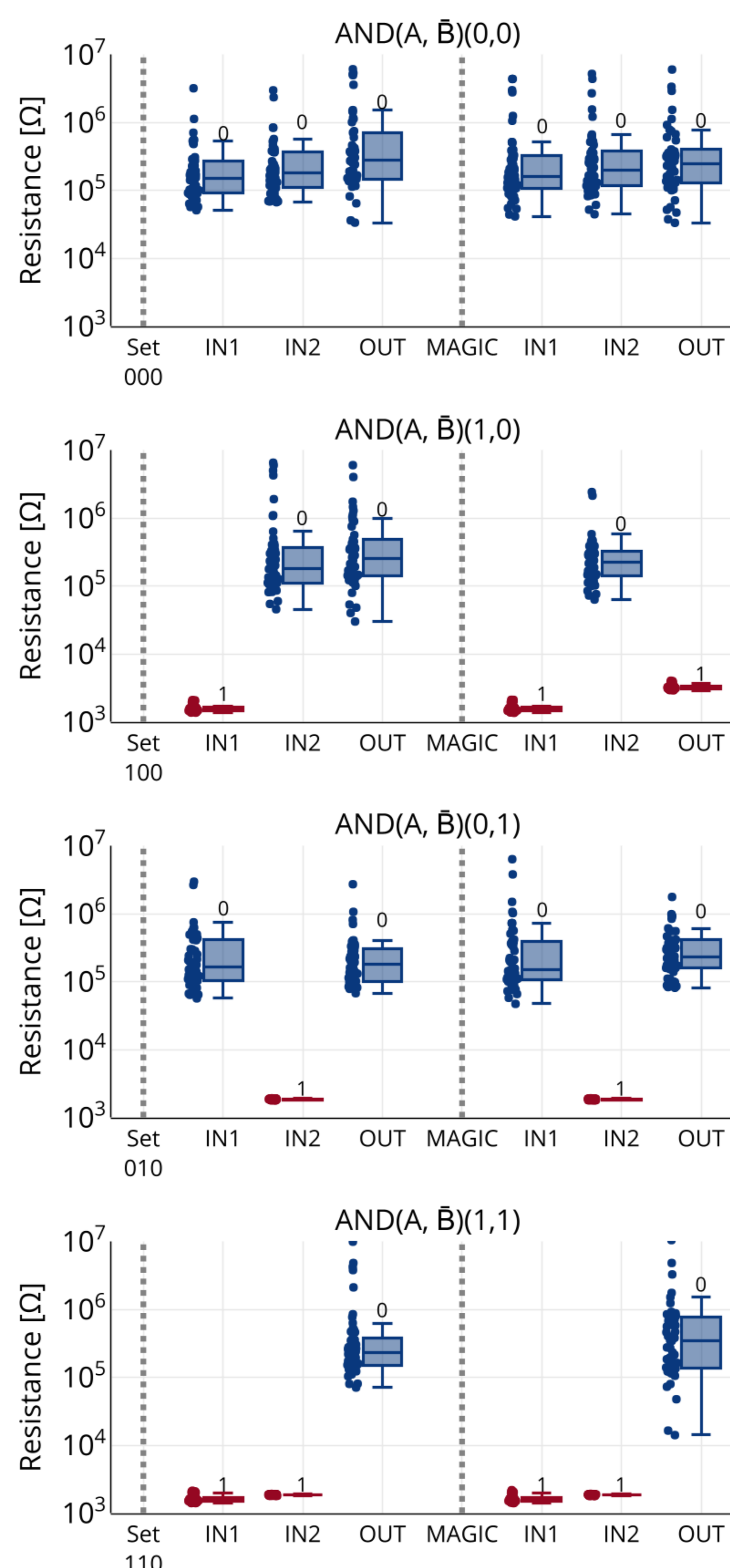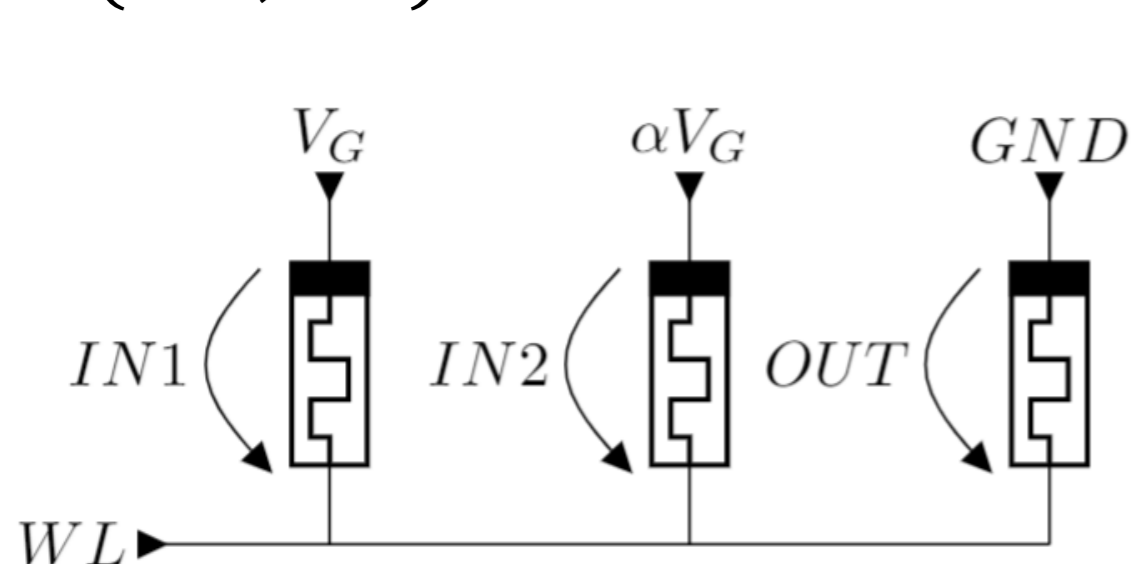
New MAGIC Gates

MAGIC OR(IN1,IN2)

MAGIC AND(IN1,$\overline{IN2}$)

Future Work

- Testing the parallel behavior of logical gates on multiple rows/columns.
- Designing and evaluating the peripheral circuits required to operate MAGIC gates in an integrated design.

AND(IN1,$\overline{IN2}$) Results

OR(IN1,IN2) Results