

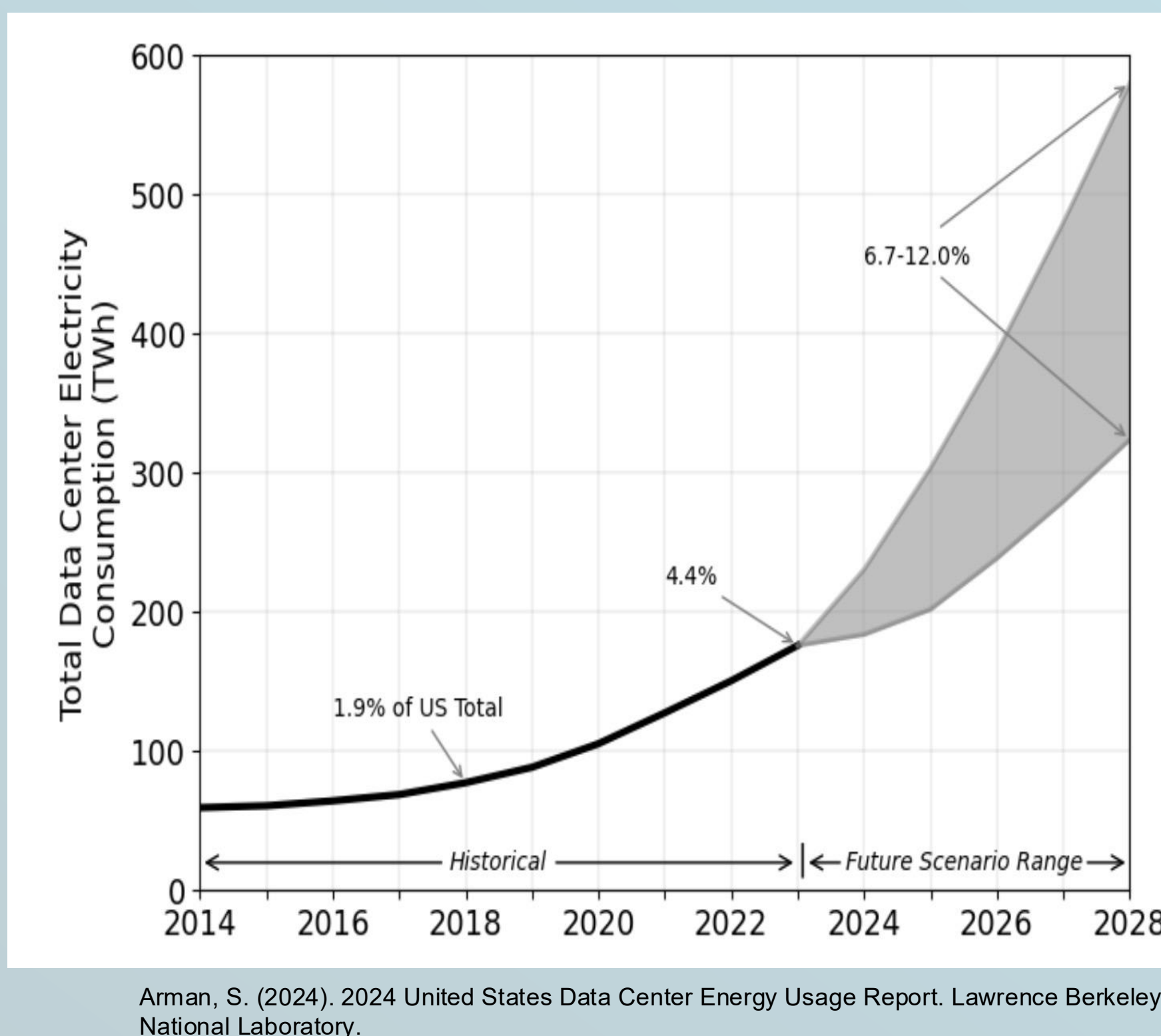
# Visible Light Communication (VLC) via Gallium Nitride (GaN) $\mu$ LEDs

Srini Arumugham | Charles King | Robin Teng | Deven Tseng | Alex West



## The Interconnect Problem

An AI data center consumes the equivalent of one million US households annually. A huge fraction of this energy is spent moving data through copper interconnects.

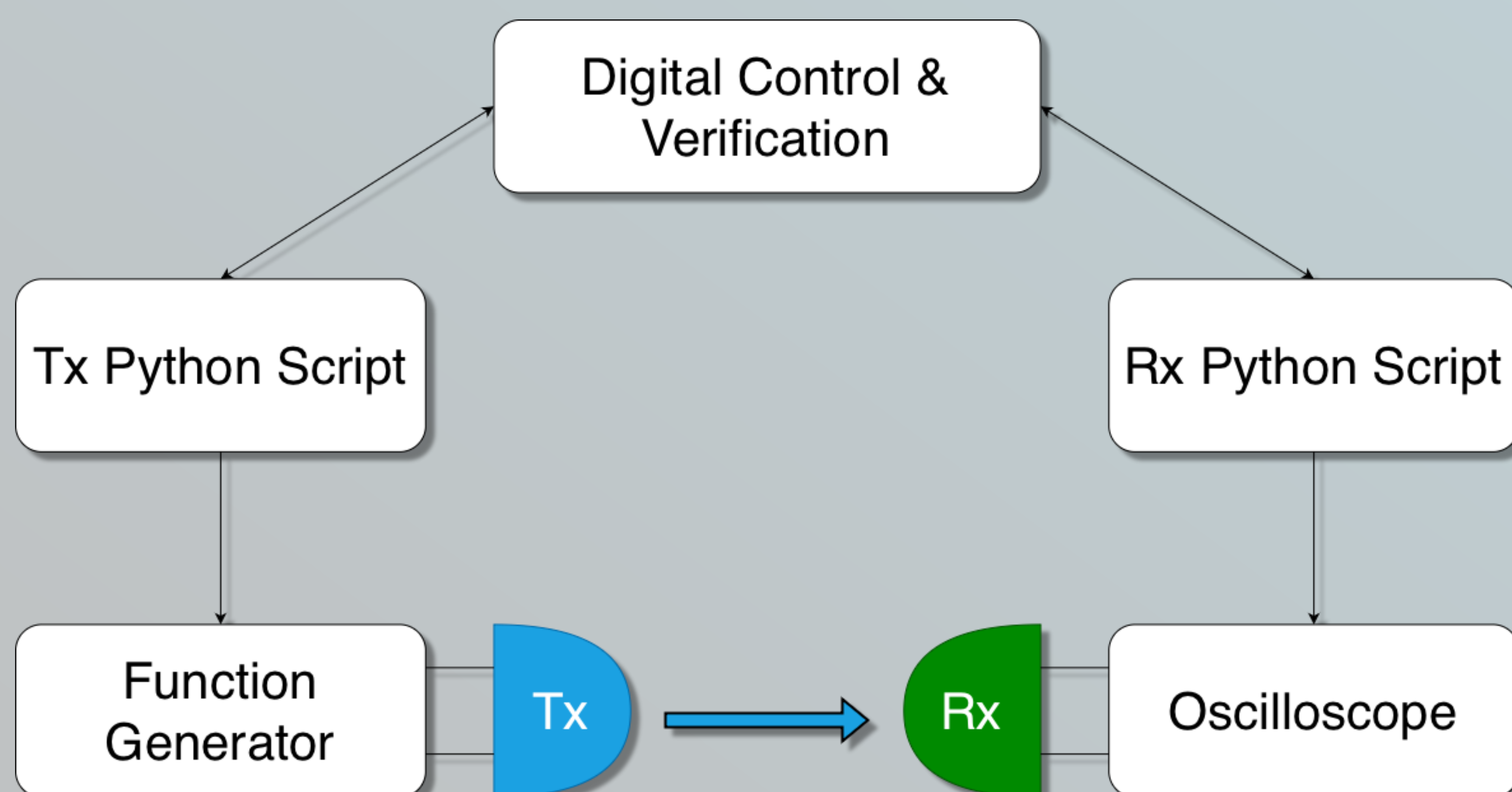


## Lighthouse Solution

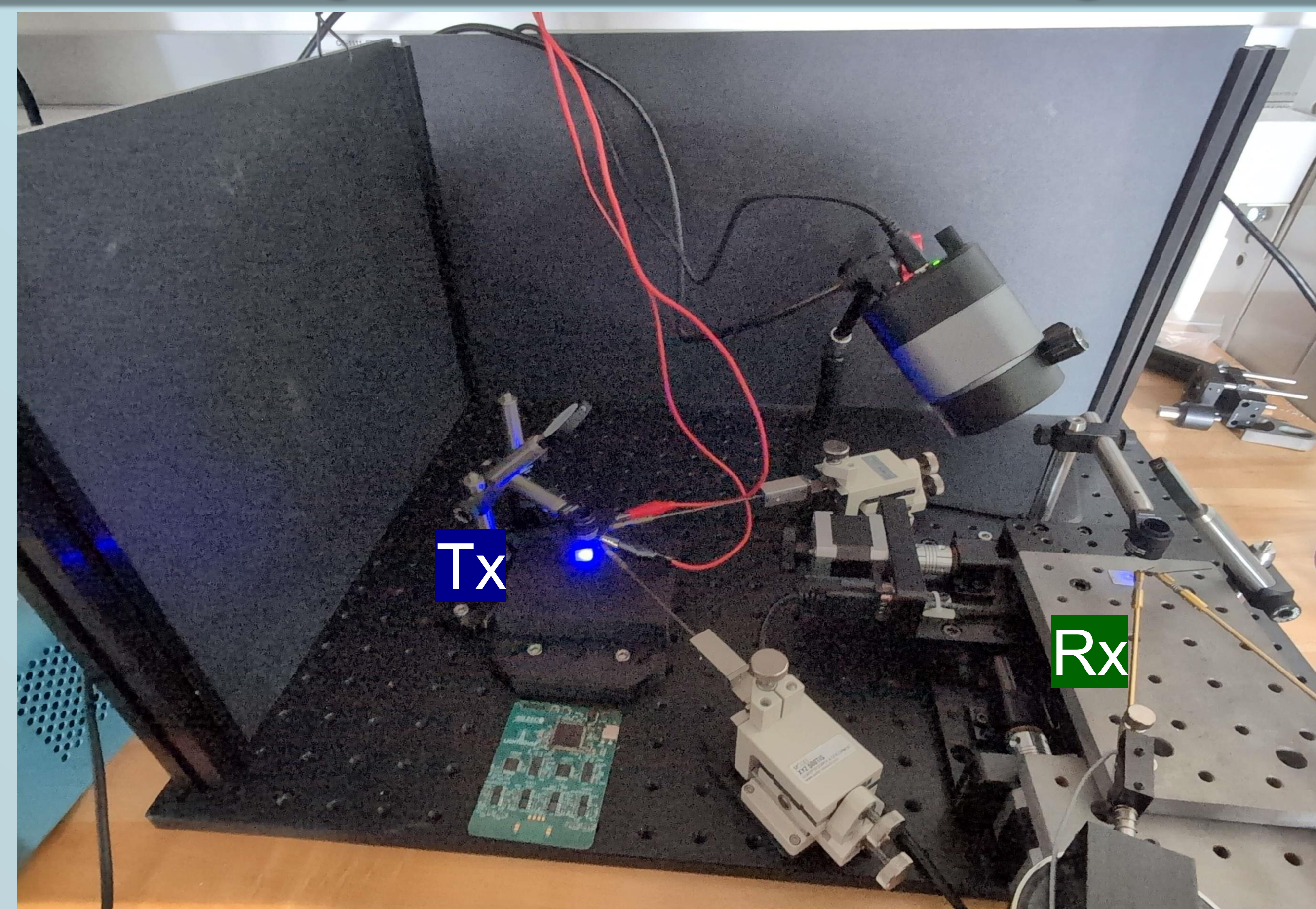
Replacing conventional copper interconnects with optical links driven by energy-efficient Gallium Nitride (GaN)  $\mu$ LEDs can dramatically increase data transmission speeds while reducing energy consumption.



## System Integration

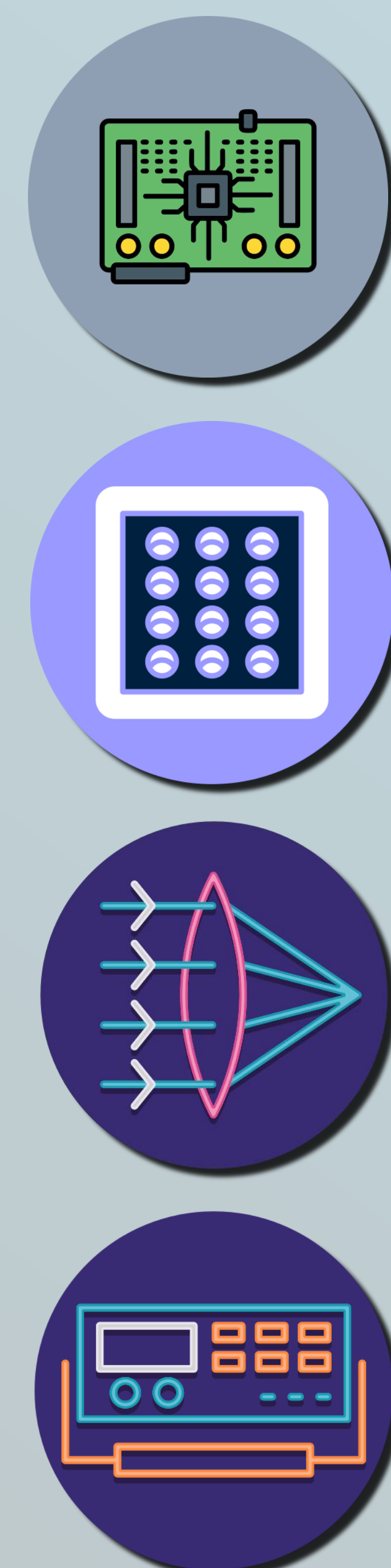


## Lighthouse VLC Design



Data transmission in our custom Visible Light Communication (VLC) system using GaN  $\mu$ LEDs.

## Key Components



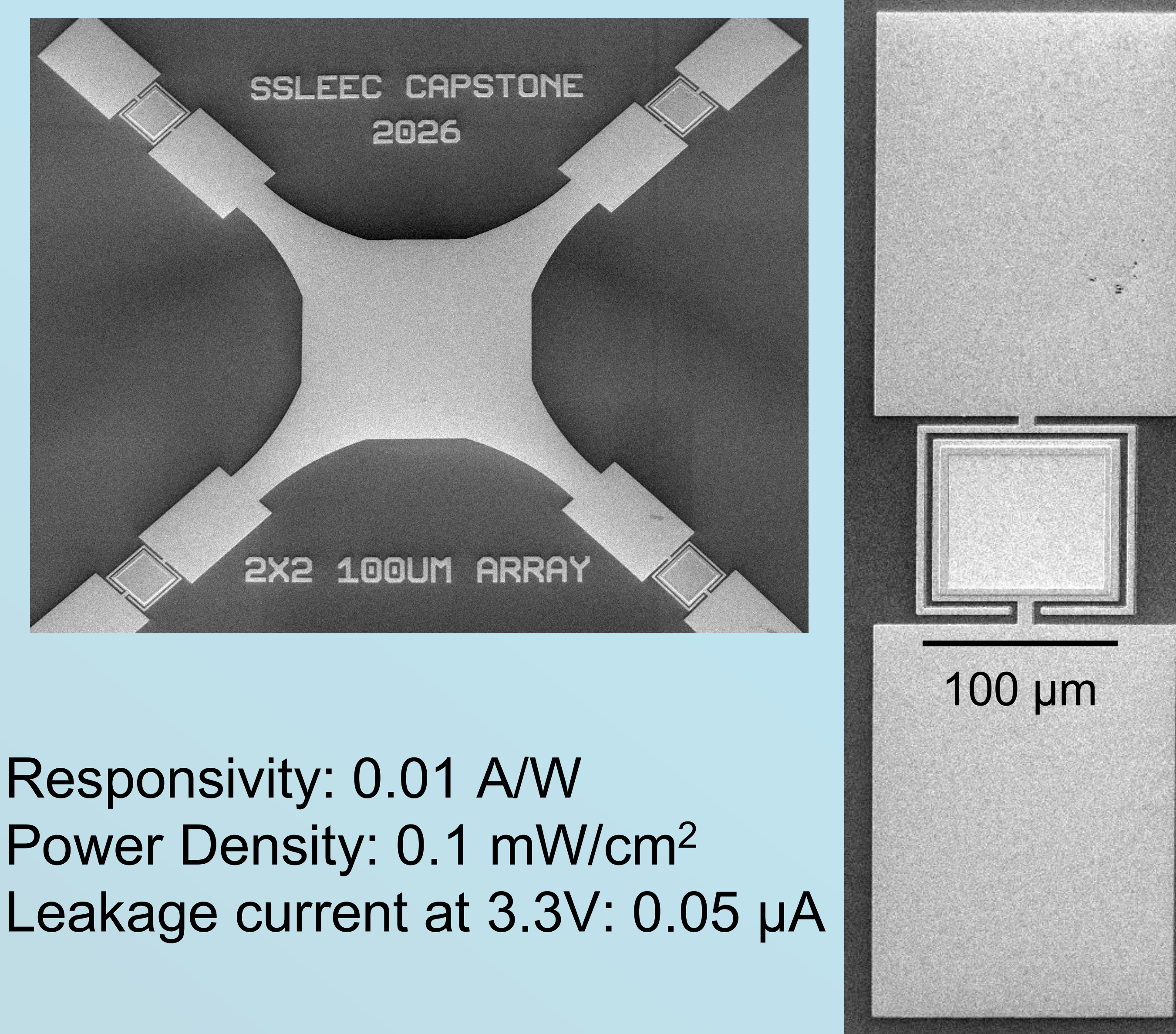
**PCB**  
STM32H7 microcontroller on PCB to address  $\mu$ LEDs and read photocurrent

**GaN  $\mu$ LEDs**  
Fabricated blue and green GaN  $\mu$ LEDs based on InGaN/GaN Multi-Quantum Well (MQWs)

**Free Space Optics**  
Alignment of optical components using Thorlabs mirrors, lenses, and a motorized XY stage

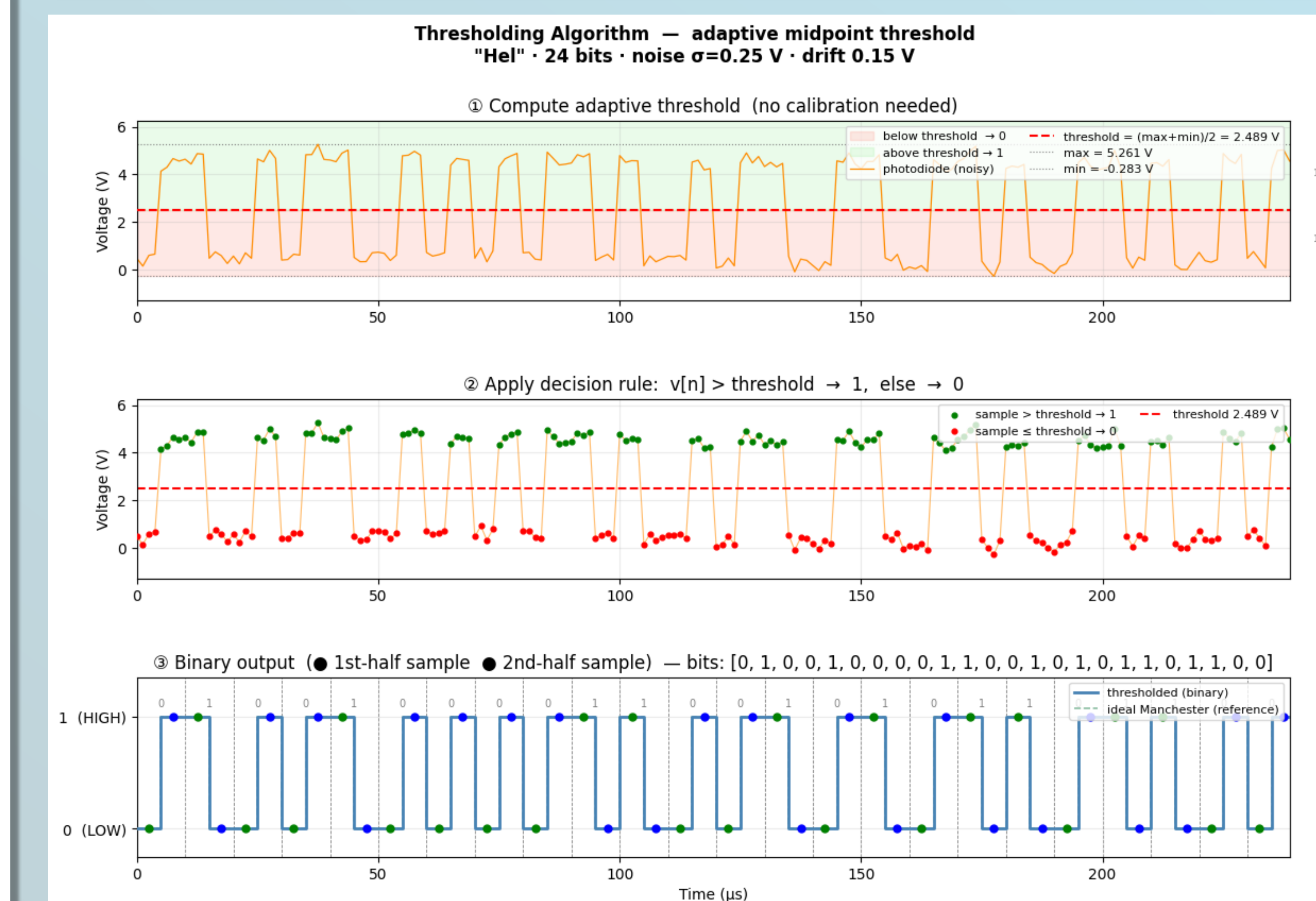
**Driver electronics**  
Keithley, Tektronix function generator to send data and drive LEDs

## Fabricated GaN $\mu$ LED



- Responsivity: 0.01 A/W
- Power Density: 0.1 mW/cm<sup>2</sup>
- Leakage current at 3.3V: 0.05  $\mu$ A

## Data Transmission Metrics



- Modulation bandwidth: 4Mhz
- Data Rate: 1 Mbps
- Bit Error Rate: 10<sup>-4</sup> @ 1Mbps



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UC SANTA BARBARA  
Robert Mehrabian  
College of Engineering