

# System Support for Generally Programmable Digital Microfluidic Biochip Devices<sup>1</sup> (#1035603) Cyber-physical Digital Microfluidics based on Active Matrix Electrowetting Technology: Software-programmable High-density Pixel Arrays<sup>2</sup> (#1545907)

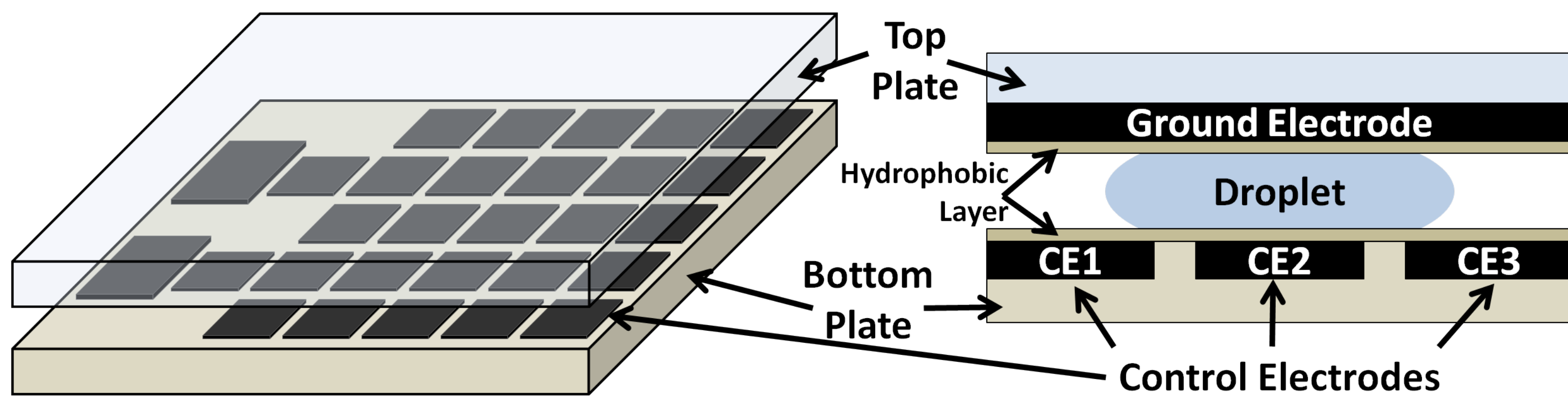


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Philip Rack (University of Tennessee)<sup>2</sup>



## Digital Microfluidic Technology



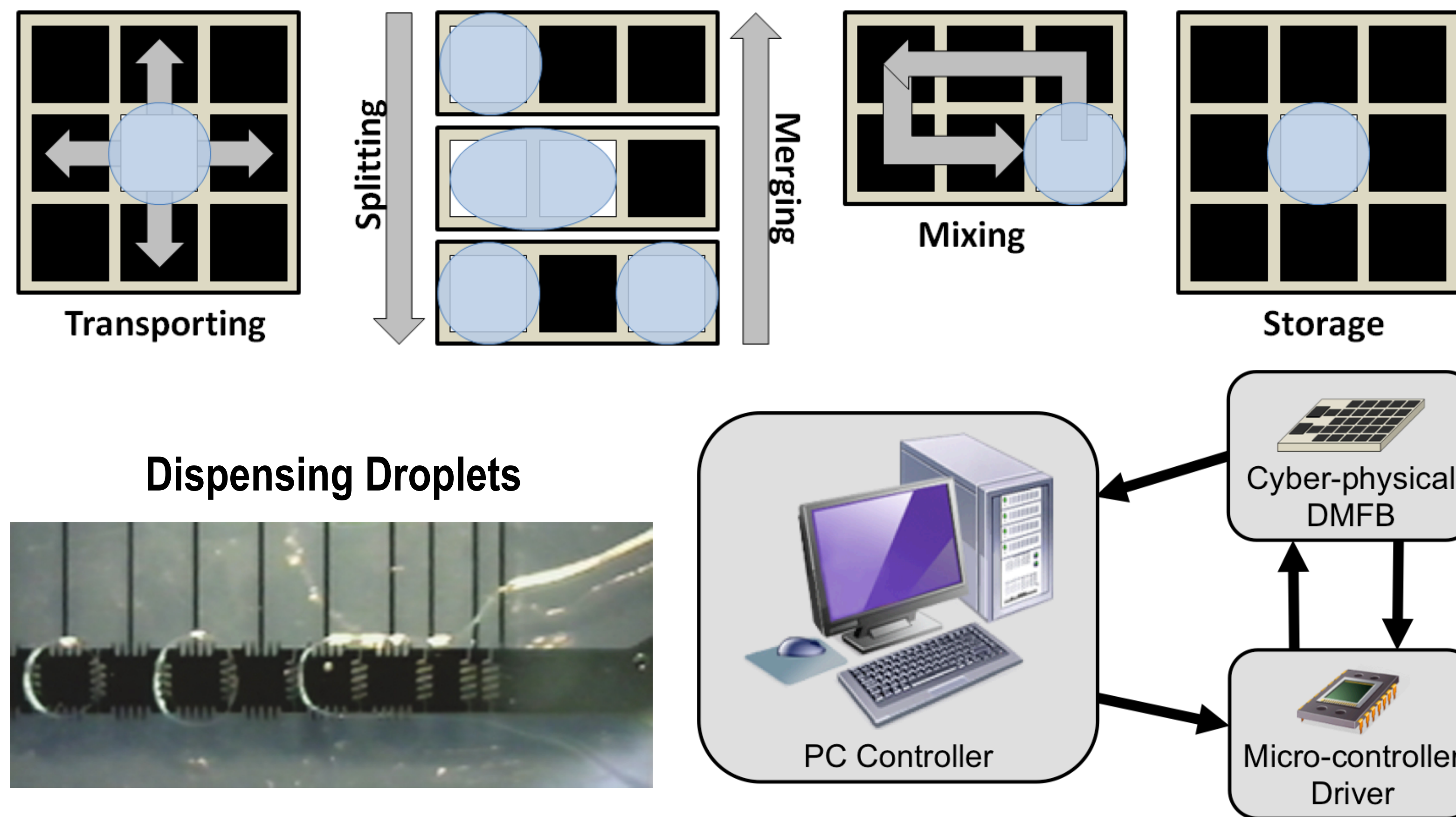
### Key advantages:

- Reduced cost
- Reduced reagent and sample sizes
- Increased throughput and efficiency
- Increased sensitivity and accuracy
- Automation and miniaturization

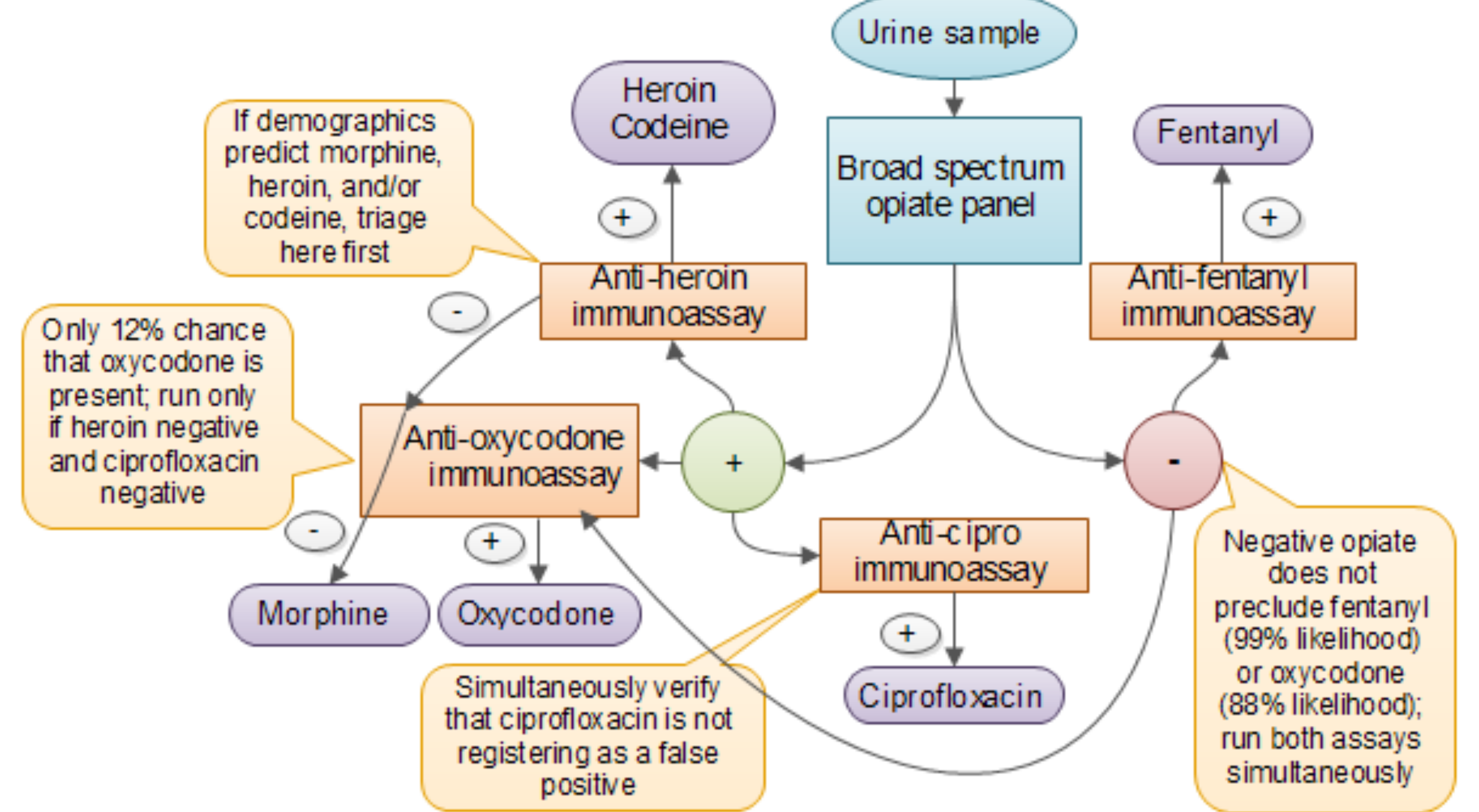
### Applications:

- Clinical pathology
- Point of care diagnostics
- Drug discovery
- Proteomics, DNA, PCR, etc.
- Real-time detection of biochemical terror attacks

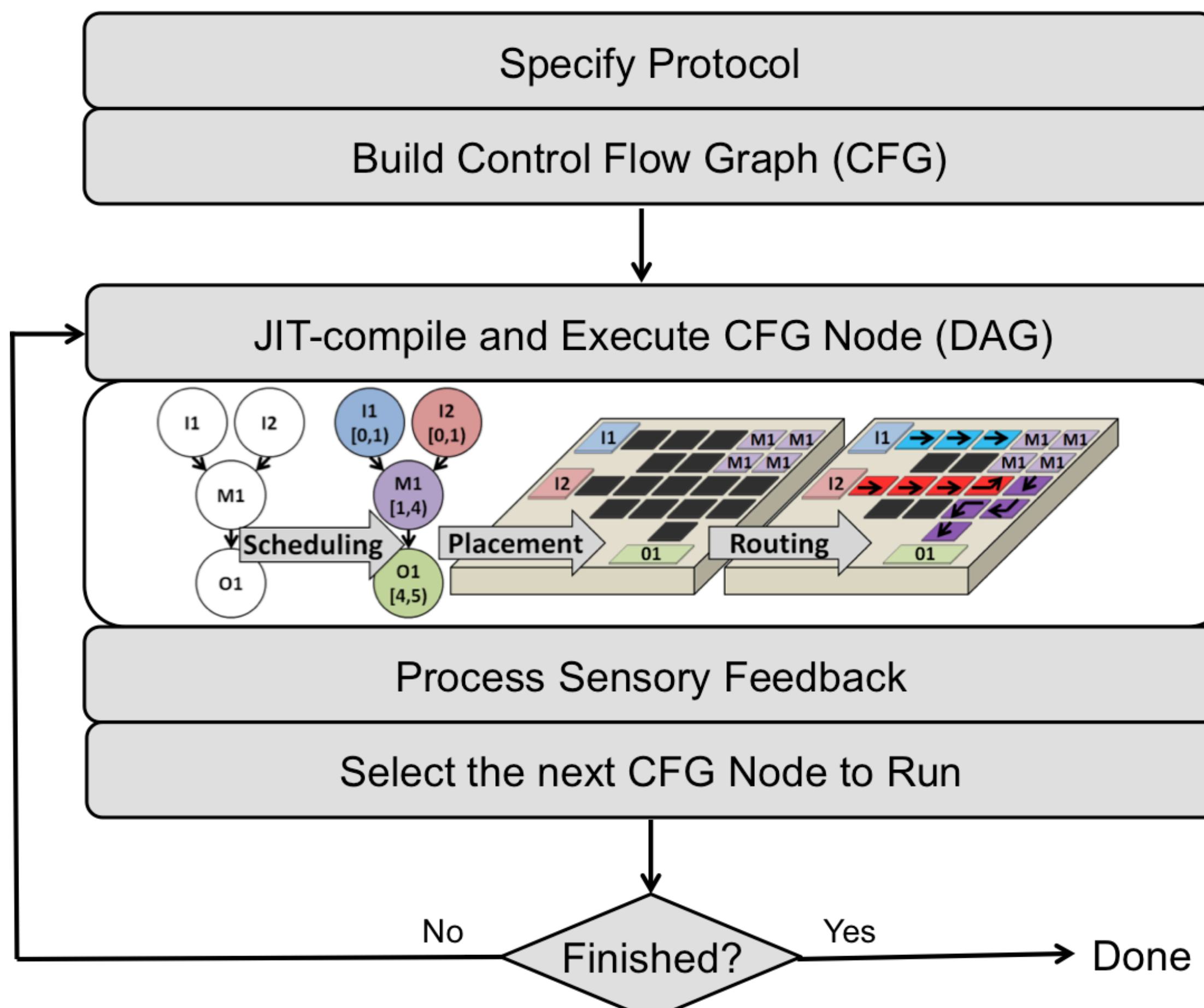
## Droplet Operations and Cyber-Physical Control



## Cyber-physical Application: Opiate Detection



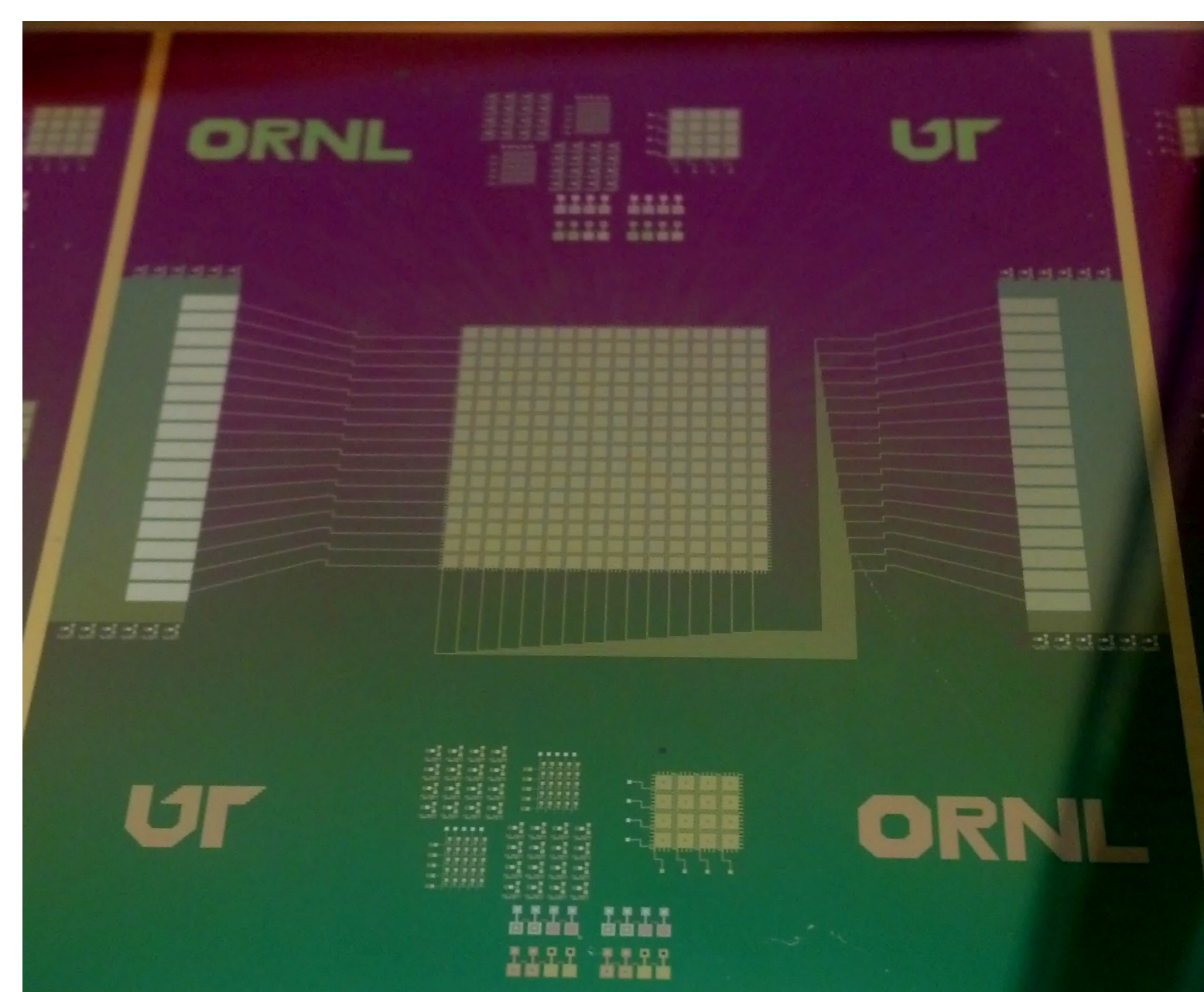
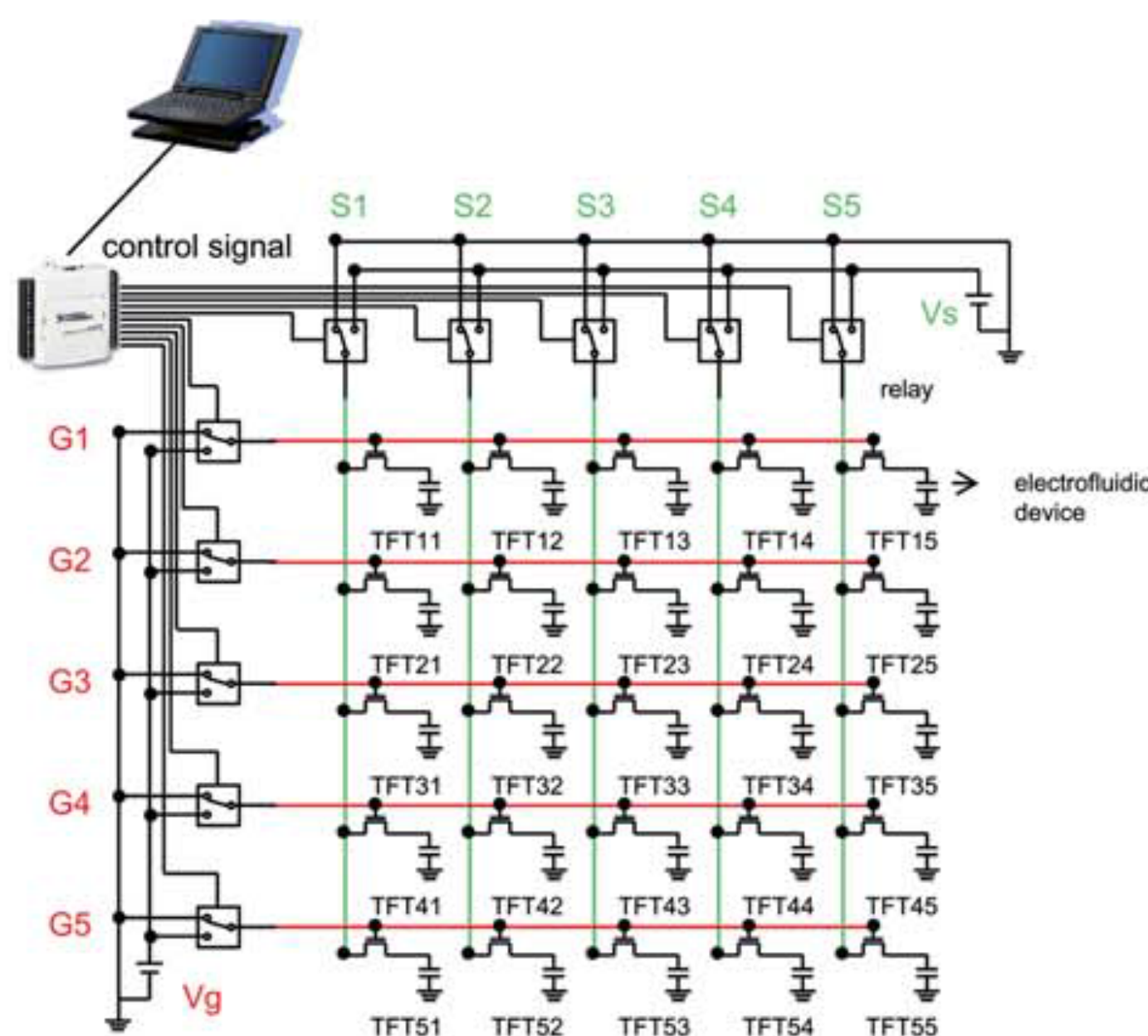
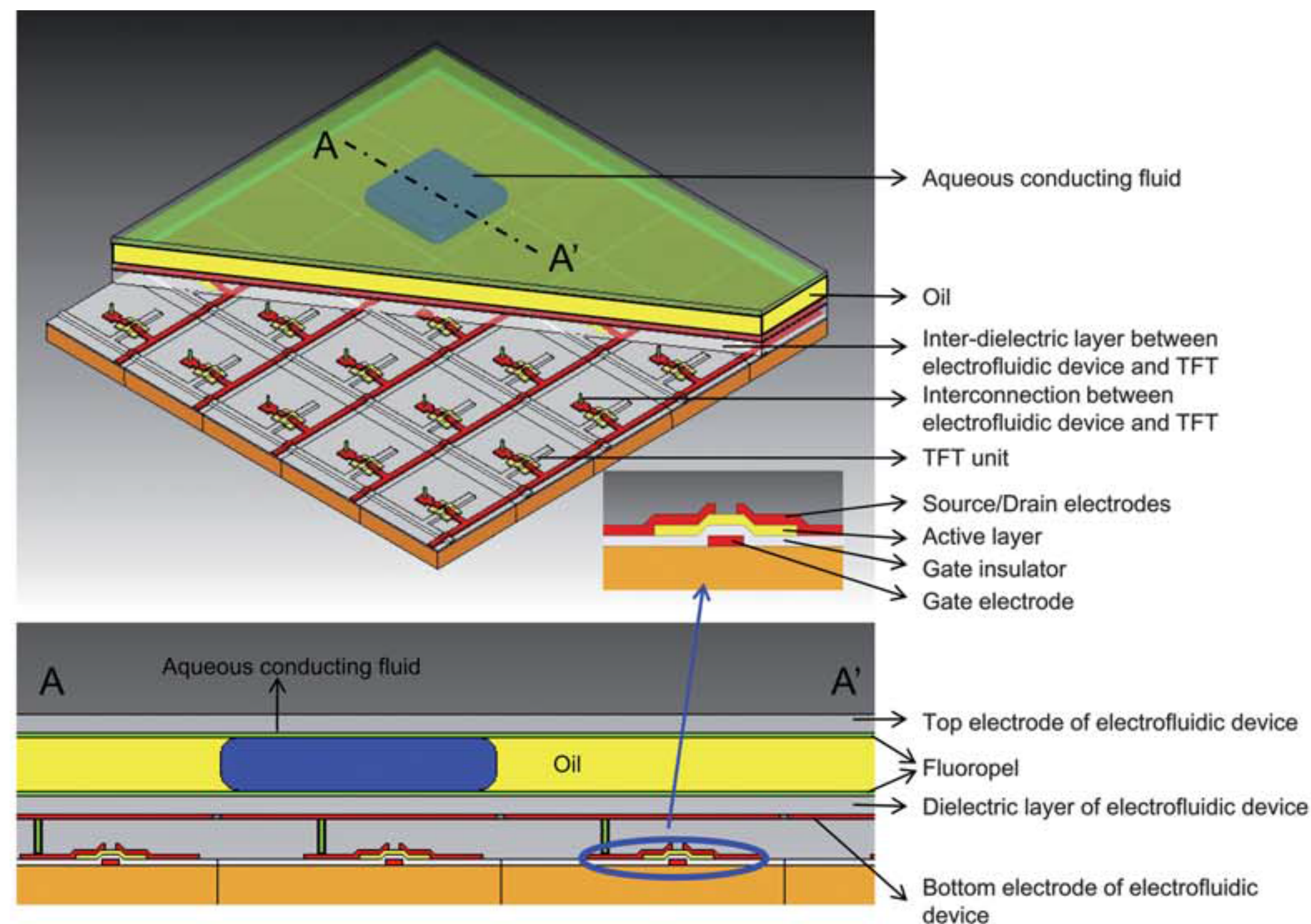
## Execution Model



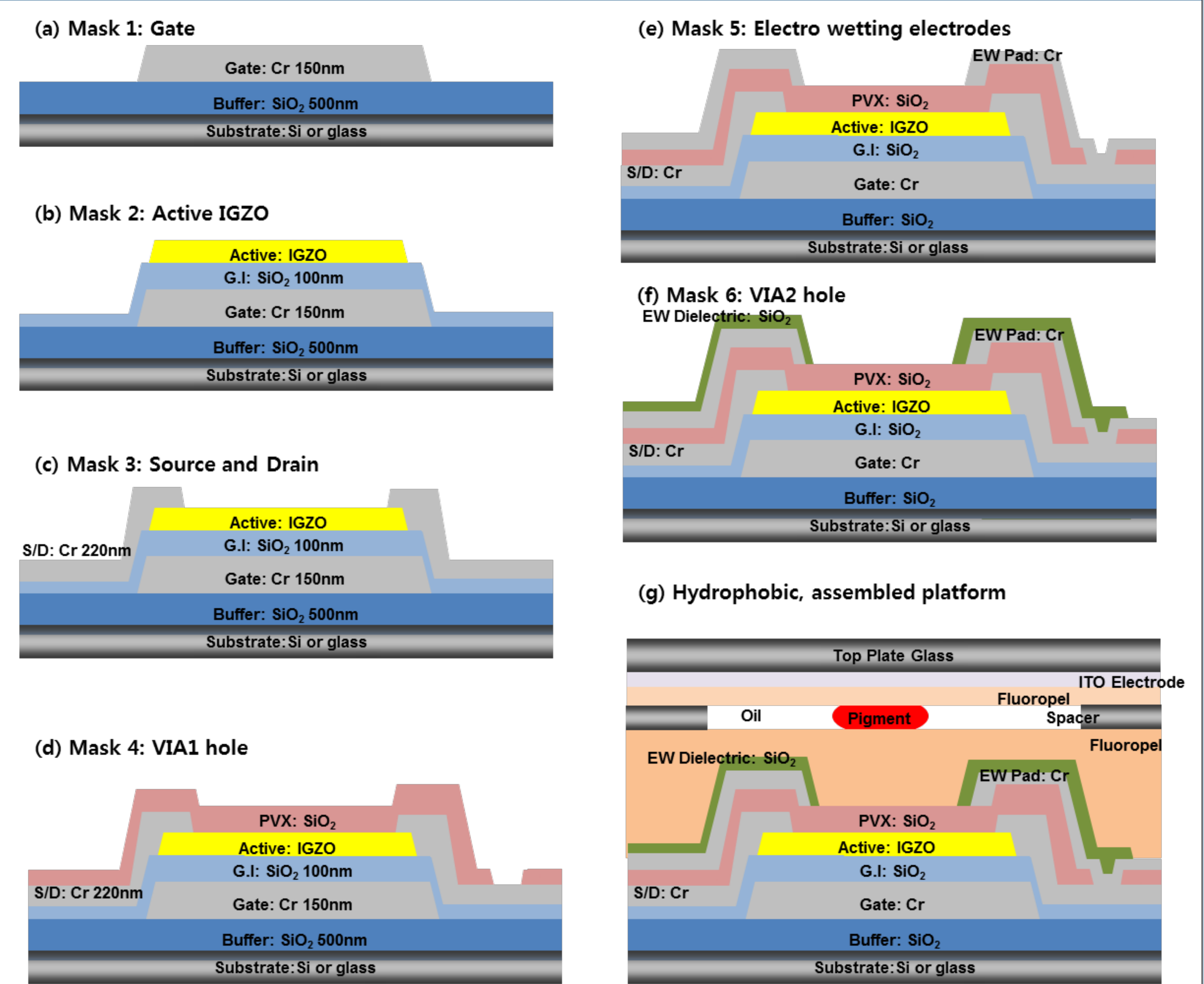
### CPS Challenges:

- Programming language and compiler design
- Fluid type system to ensure safety and correctness
- Deadlock-free droplet routing
- Cyber-physical sensor-actuation interface
- Device fabrication and validation

## Active Matrix Addressing



## Device Fabrication and Process Flow



## Contact

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