

Open hardware for liquid transfer in self-driving laboratories

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Self Driving Labs for Chemistry

- ▶ Self-driving labs built with **general purpose robots** and with common hardware can democratize chemical laboratory automation
- ▶ Specialized hardware for lab automation is expensive and lacks flexibility
- ▶ Precise liquid handling is an essential task in chemistry labs

Problems with Automated Liquid Transfer

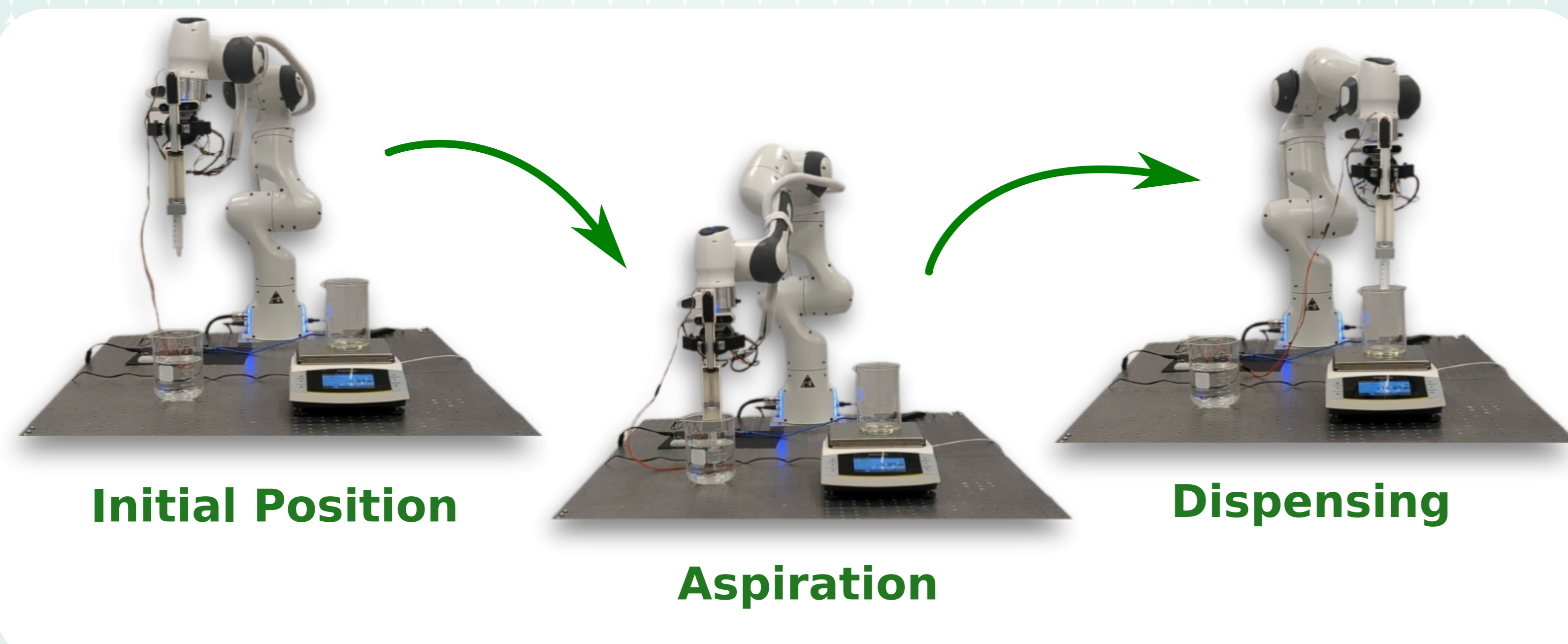
- ▶ **Accuracy is limited when pouring** liquids with a robotic arm [1]
- ▶ Existing pipette automation requires **expensive specialized hardware**
- ▶ Specialized solutions for operating commercial pipettes with robotic grippers **limit manipulation abilities** [2]

Accuracy is limited when pouring!

Expensive, no manipulation, not general purpose!

OT-2 [3]
~\$10 000

Robotic Pipetting with Digital Pipette



Links



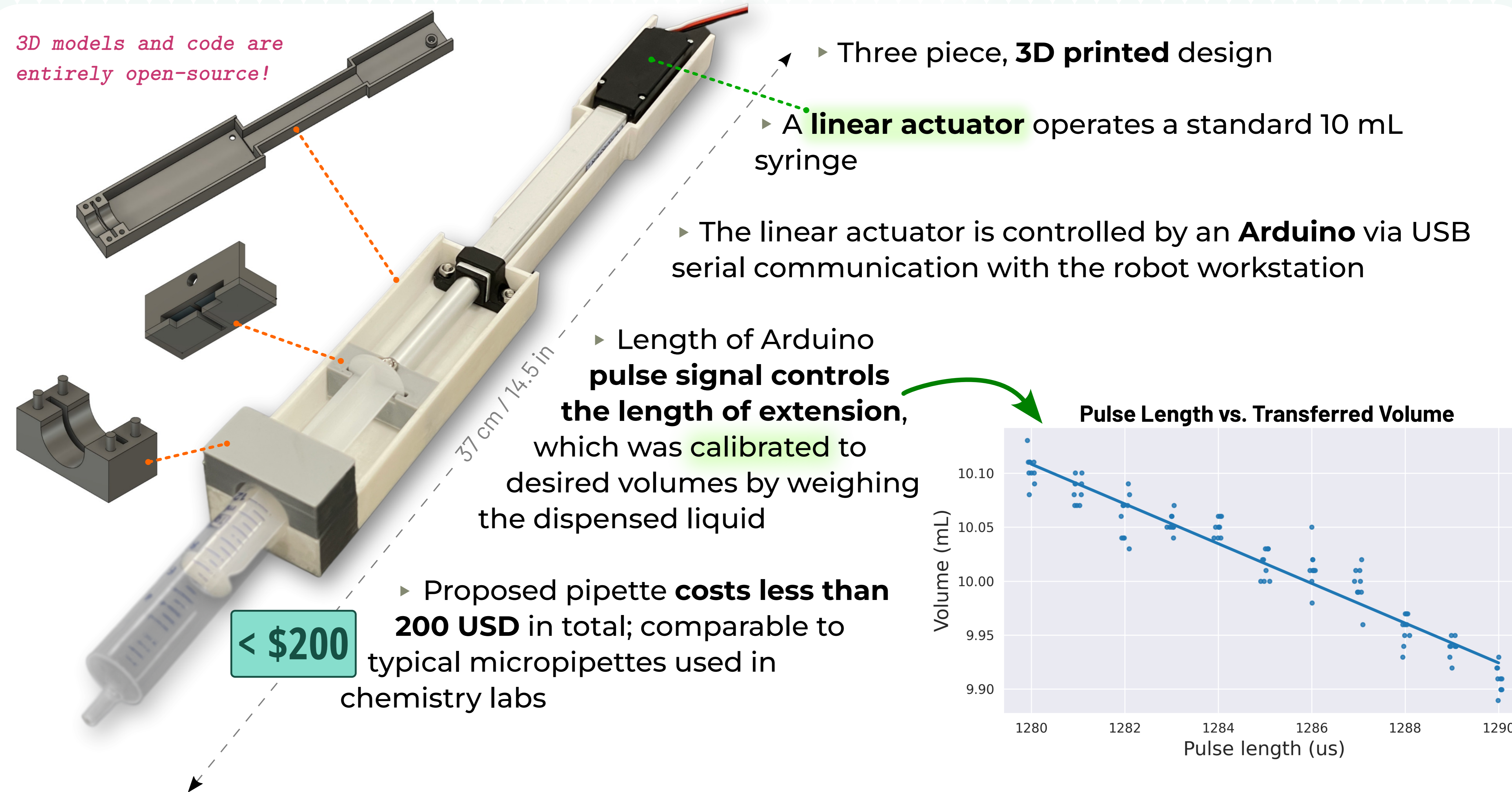
CHEMRXIV PAPER
<https://doi.org/10.26434/chemrxiv-2023-nvxkg>

GITHUB - DEMO VIDEO - SOURCE FILES
<https://github.com/ac-rad/digital-pipette>

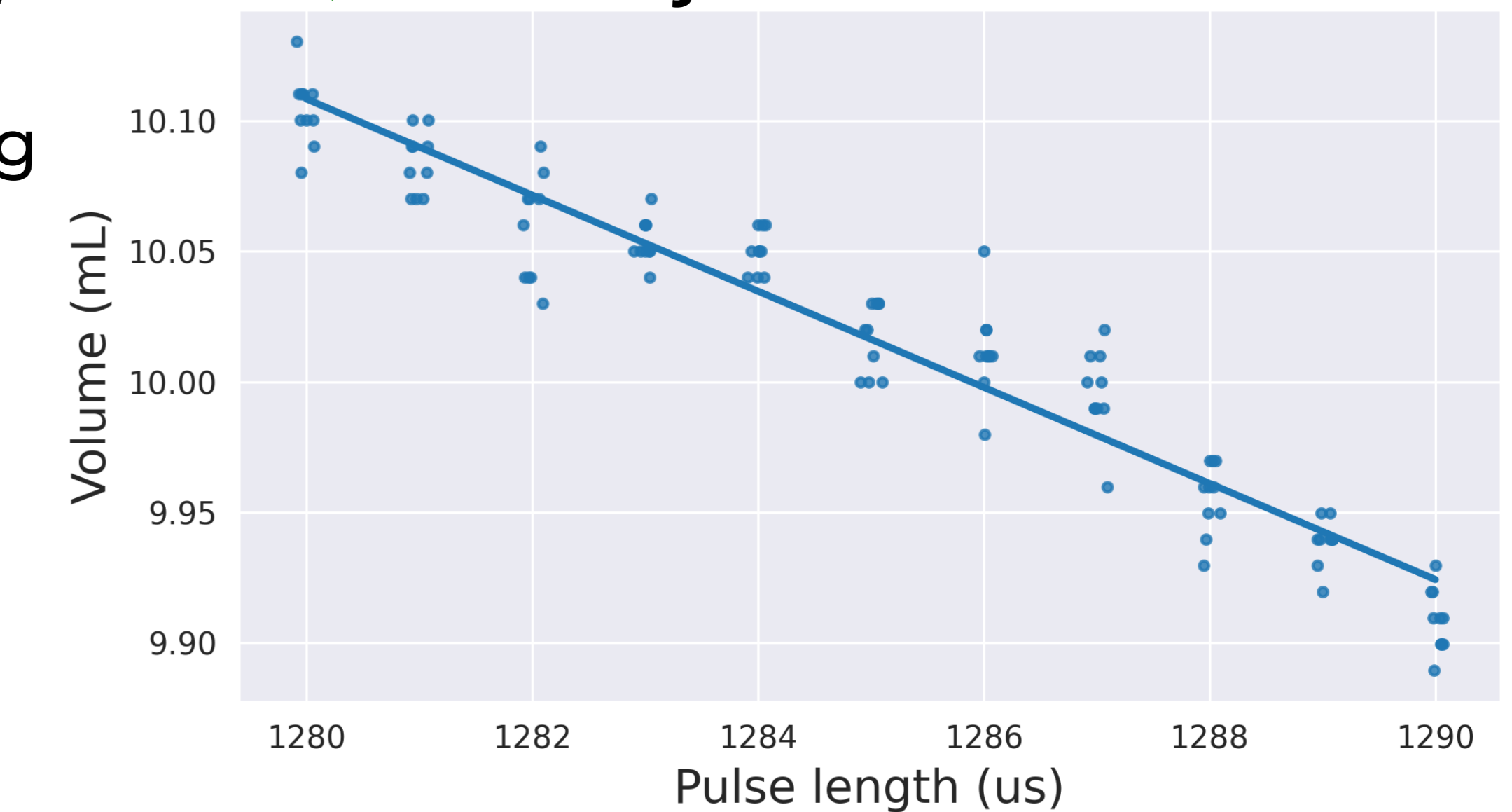


Performance is comparable to commercial micropipettes!

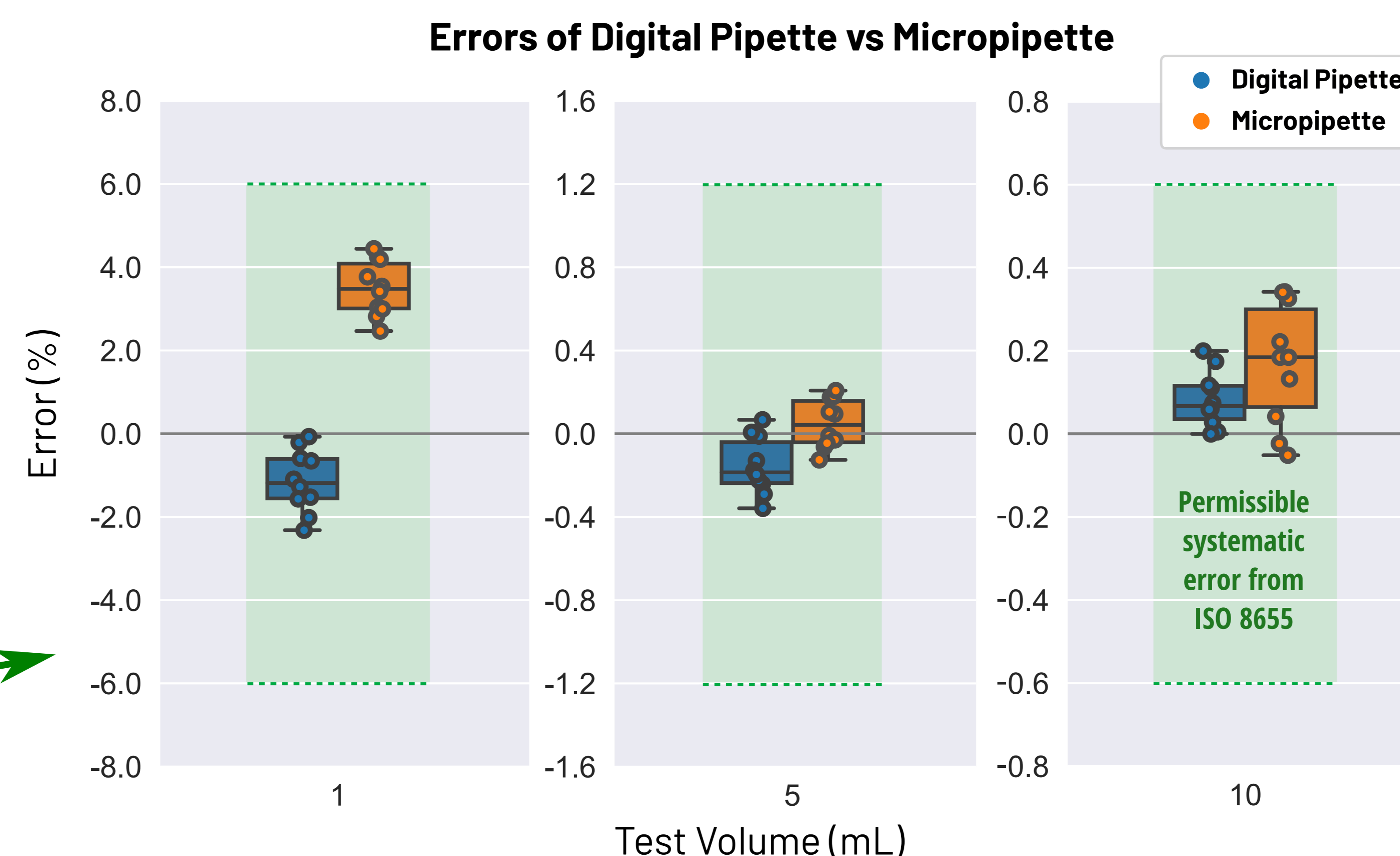
Pipette Design and Calibration



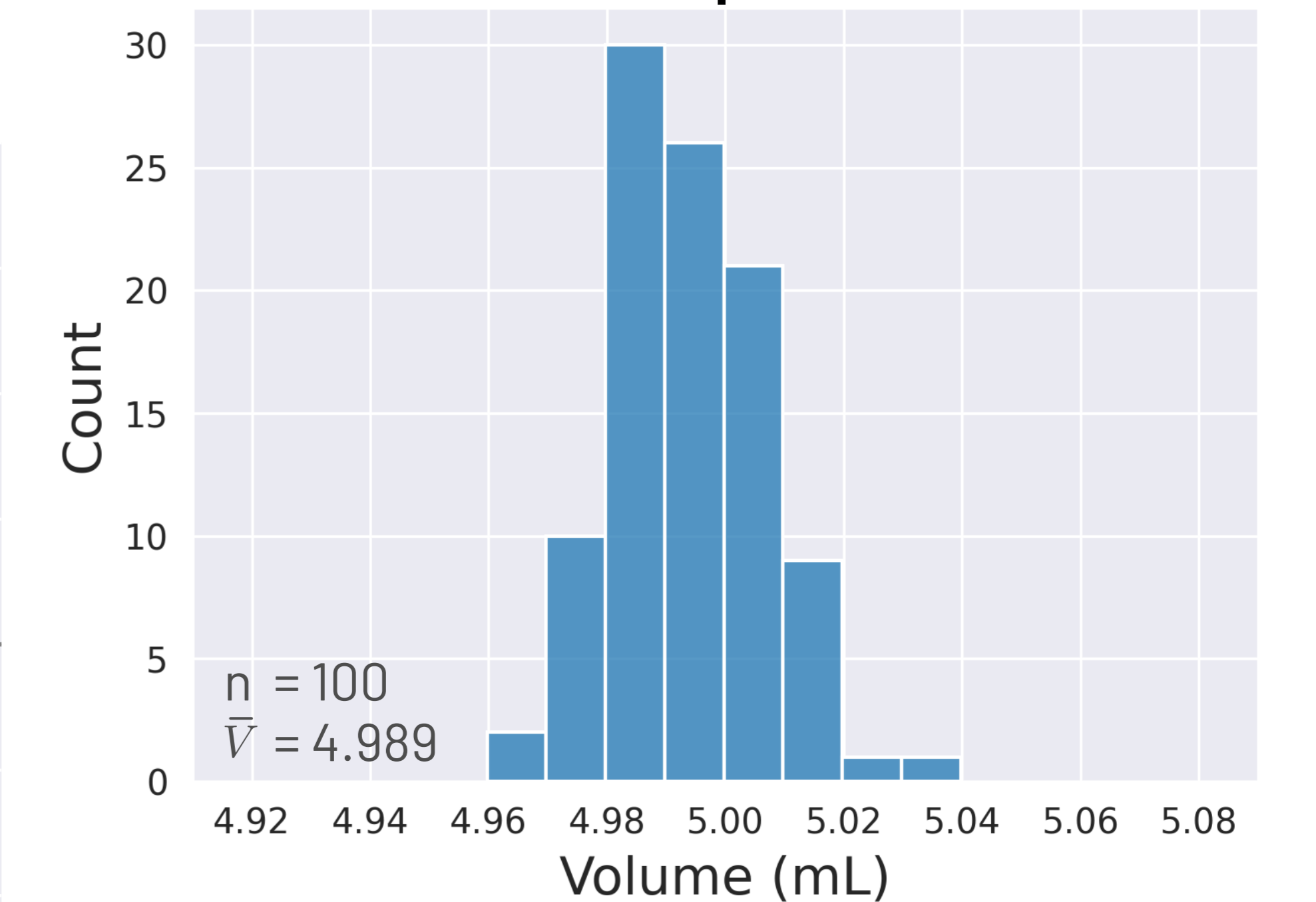
Pulse Length vs. Transferred Volume



Experiments & Validation



Dist. of Transferred Liquid for 5.0 mL Ref. Vol.



- ▶ Systematic error and random error are **within permissible percentage ranges** specified by the international standard on pipettes (ISO 8655-6) [4]