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Summary

- Measurement of each single dispensed droplet with **five** independent measurement methods in parallel (gravimetric method, imaging method, capacitive sensor, flow sensor, optical sensor)
- Fully automated procedure including dispenser control, environment monitoring and analogue sampling

Motivation

The miniaturization in liquid handling requires new methods and standards for the calibration in the sub- μ l volume range. The presented fully-automated multi-principle droplet calibration system constitutes a significant progress beyond the state-of-the-art in terms of new technologies, multi-principle combination and benchmark. This novel and powerful system might support the final breakthrough of new standardizations for micro and nano-liter liquid handling calibration.

Calibration method and setup

After leaving the nozzle a dispensed droplet passes a capacitive sensor, a 3mm gap for stroboscopic imaging and an optical sensor consecutively. Finally it impinges on an ultra-microbalance, see Figure 1. A flow sensor measures the balancing air flow into the liquid reservoir caused by the droplet ejection. The whole setup is isolated from environment by a PMMA cover and installed on a vibration isolated table. A THB-meter monitors the surrounding condition. A PipeJet P9 dispenser (BioFluidix GmbH) is used as dispenser unit for the droplet generation.

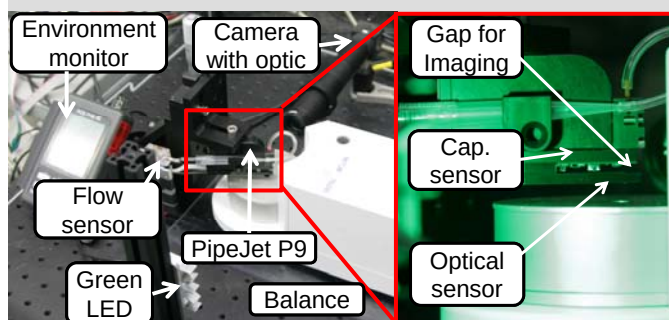


Figure 1: Measurement setup.

The measurement procedure is executed by a self-designed software "SharpDrop". Figure 2 shows the "SharpDrop" GUI. The individual measurement methods can be addressed by the software individually. The documentation of the generated data is managed by an included database application.

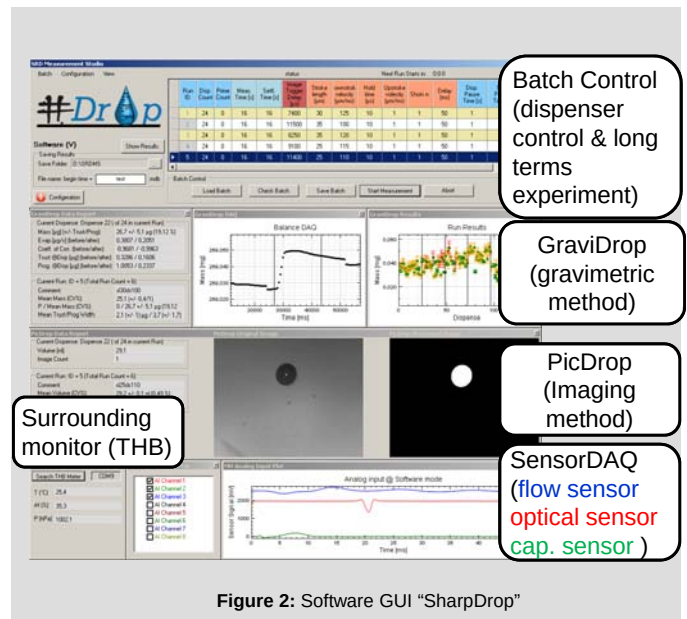


Figure 2: Software GUI "SharpDrop"

Results and conclusion

In Figure 3 the experimental results with double distilled water are shown. Imaging method and the three sensor methods were calibrated with the gravimetric results. Except of the optical sensor, the other four technologies presented good consistence. The gravimetric and imaging method provides very good precision (CV < 2%).

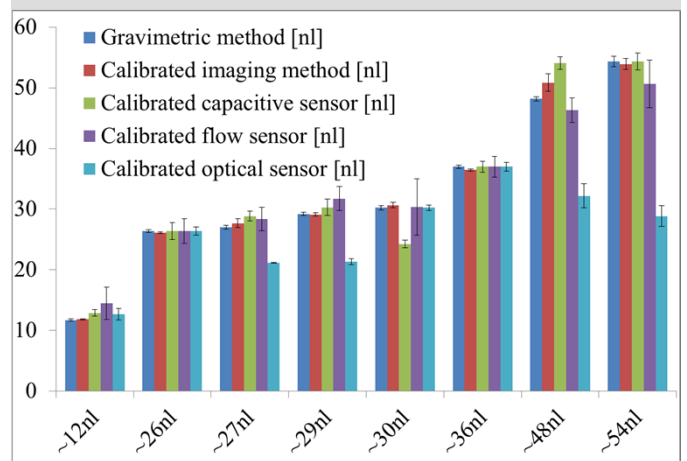


Figure 3: Experiment results

Acknowledgments

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