

Roblonski: A Material-Efficient Robo-Fluidic Toolbox for Rapid Photochemical Characterization

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Highlights

A hybrid flow/batch system automating Stern-Volmer, Beer-Lambert, PLQY assays.

Key Specifications

- Footprint: 87 cm x 47 cm x 66 cm (~0.3 m³). Glovebox ready.
- Cost: < \$30,000 (Utilizing aftermarket LH).
- Three distinct photophysical assays.

Roblonski is a tireless lab assistant which can fit in a glovebox, run overnight, and never get tired of pipetting.

Introduction



Conventional approach is driven only by human knowledge and intuition!

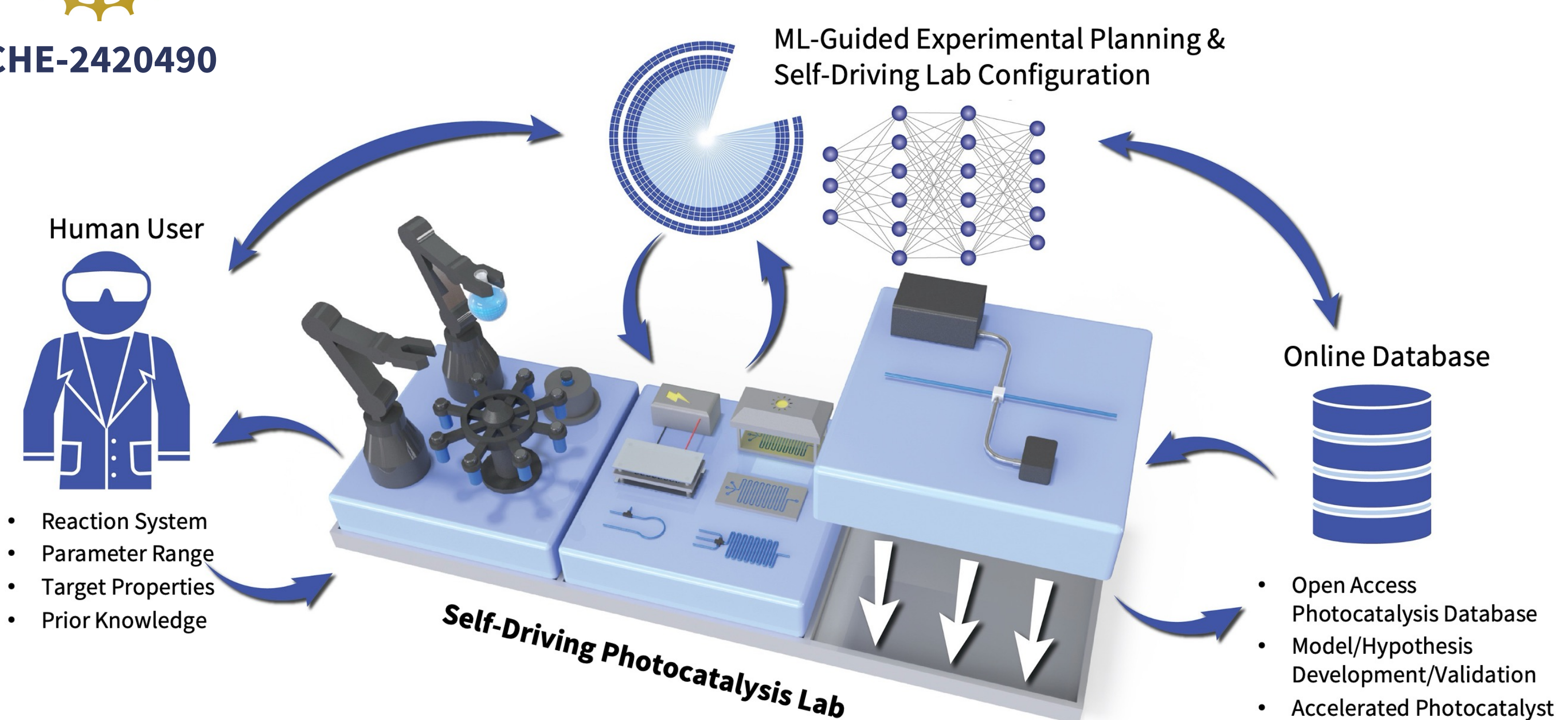
- One-experiment-at-a-time
- Photon absorption-limited batch reactors
- Labor/Cost/Time intensive
- Waste generation

Limits discovery and mechanistic understanding!



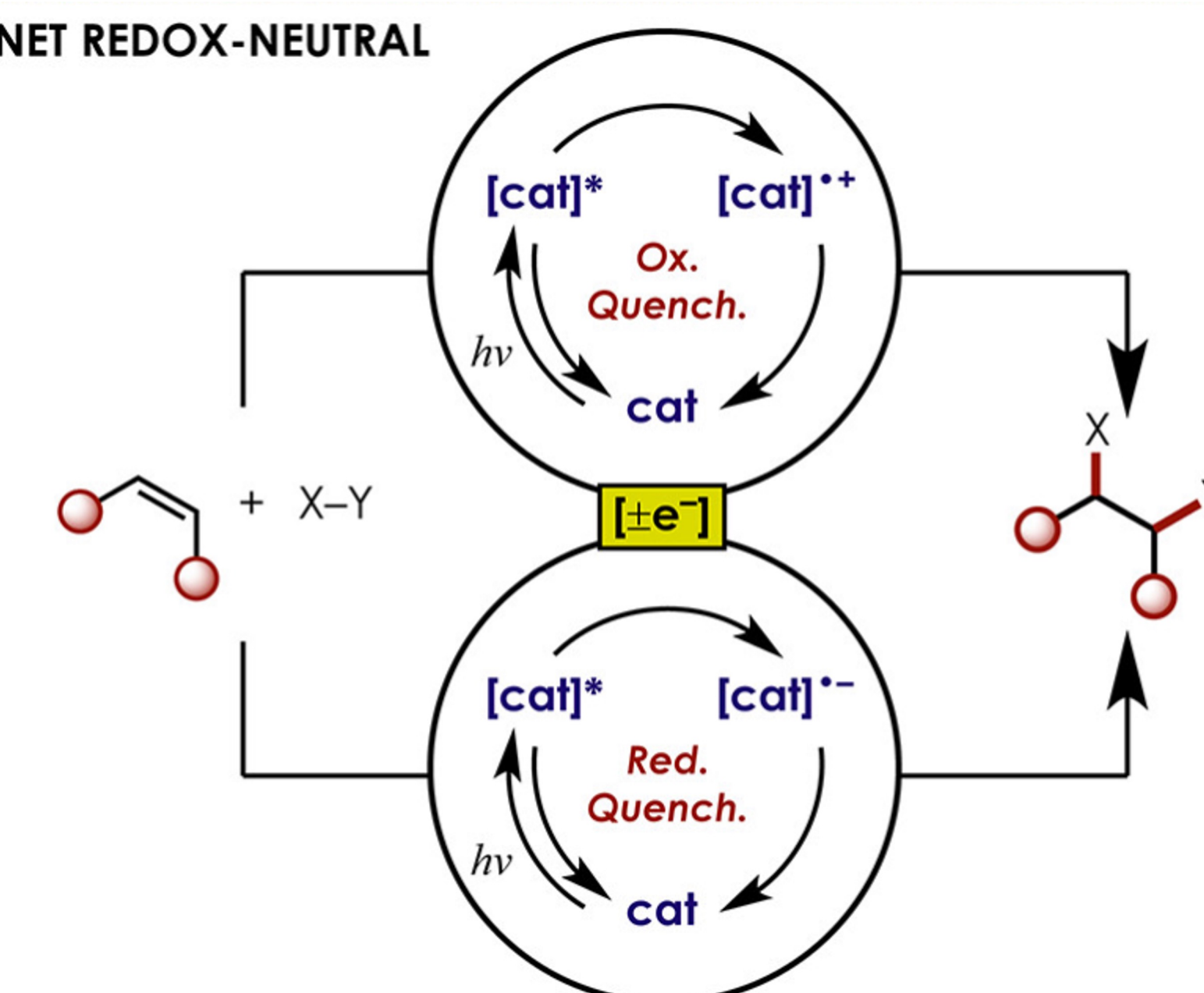
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Center for Accelerated Photocatalysis



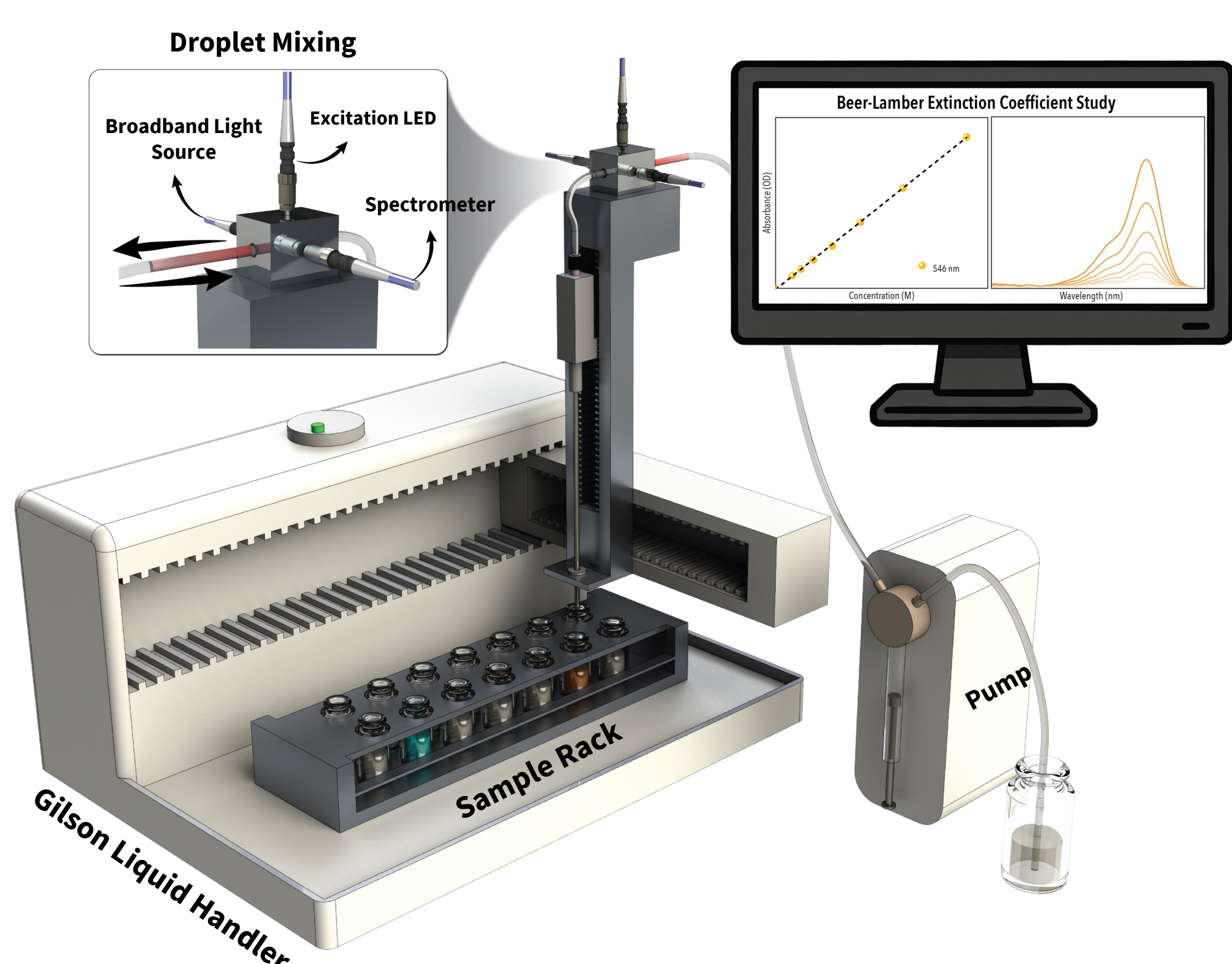
Key Photophysical Experiments

NET REDOX-NEUTRAL

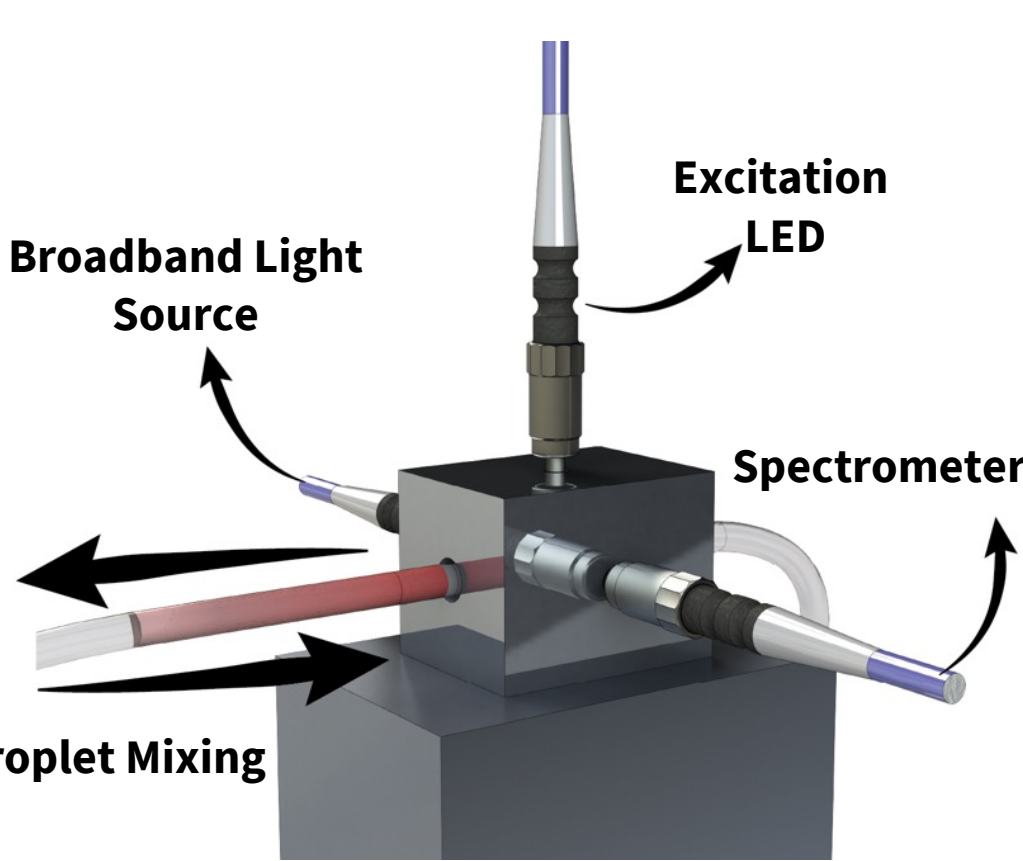


- Stern-Volmer Analysis
- Beer-Lambert Analysis
- PLQY Determination

Roblonski Hardware

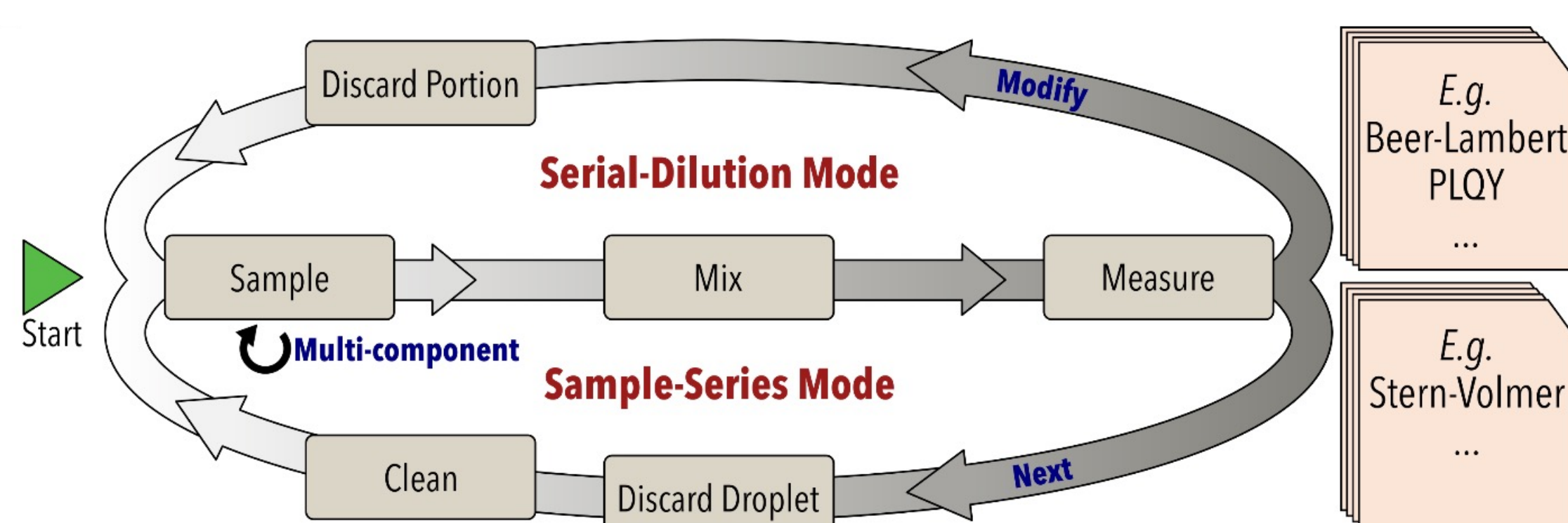


Design Innovation and Benefits



- Integrated directly onto the liquid handler.
- Eliminates extra pumps/injection ports.
- Minimizes dead volume.
- Uses FEP tubing which offers a large chemical resistance against most organic solvents.
- Optimized photon utilization due to small reaction volumes (50 μ L) and optical pathlength (0.1 \pm 0.004 cm)!

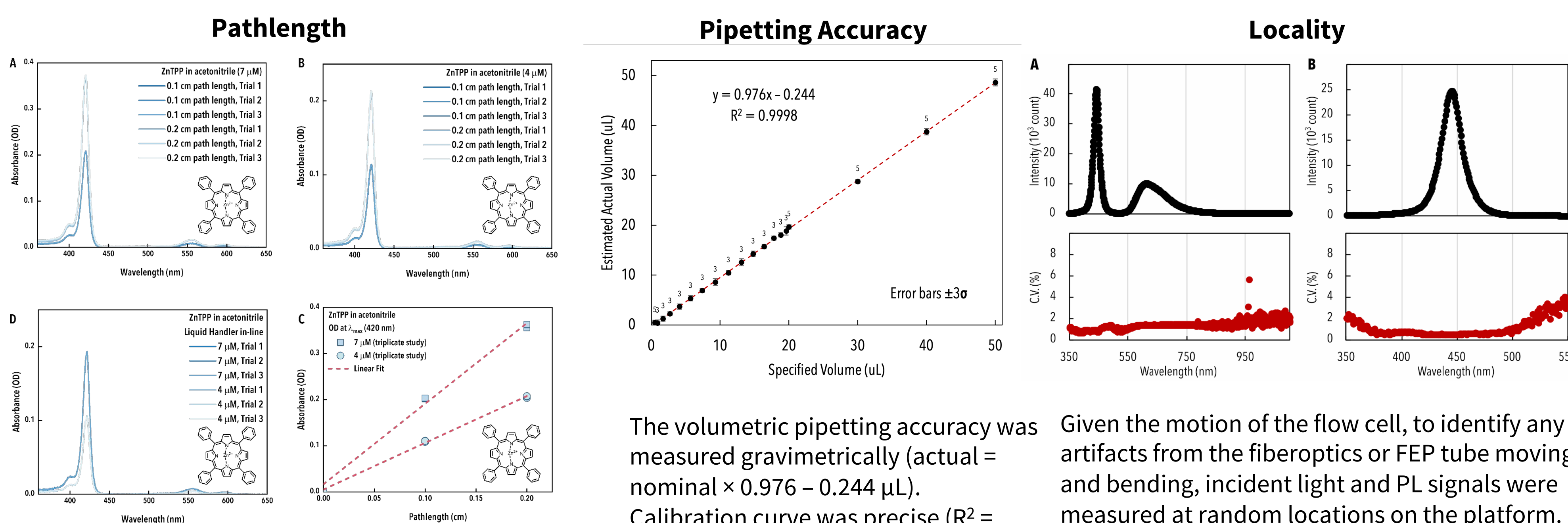
Software Logic and Smart Features



Smart Features:

- Auto-Dilution:** Detects stock's absorbance and dilutes automatically according to user-defined thresholds.
- Quality Control:** If R² < 0.97, automatically augments data with replicates.
- Experimental Fidelity:** Randomized measurement.

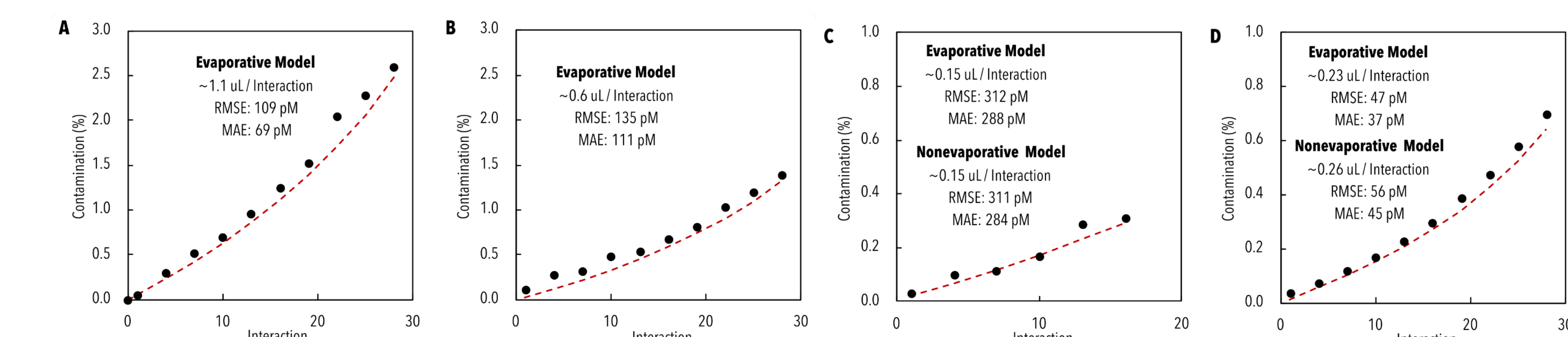
Platform Characterization



The effective optical path length of FEP tube was determined to be **0.102 \pm 0.004 cm (0.039")** using a cuvette-measured zinc(II) meso-tetraphenylporphyrin in acetonitrile calibration.

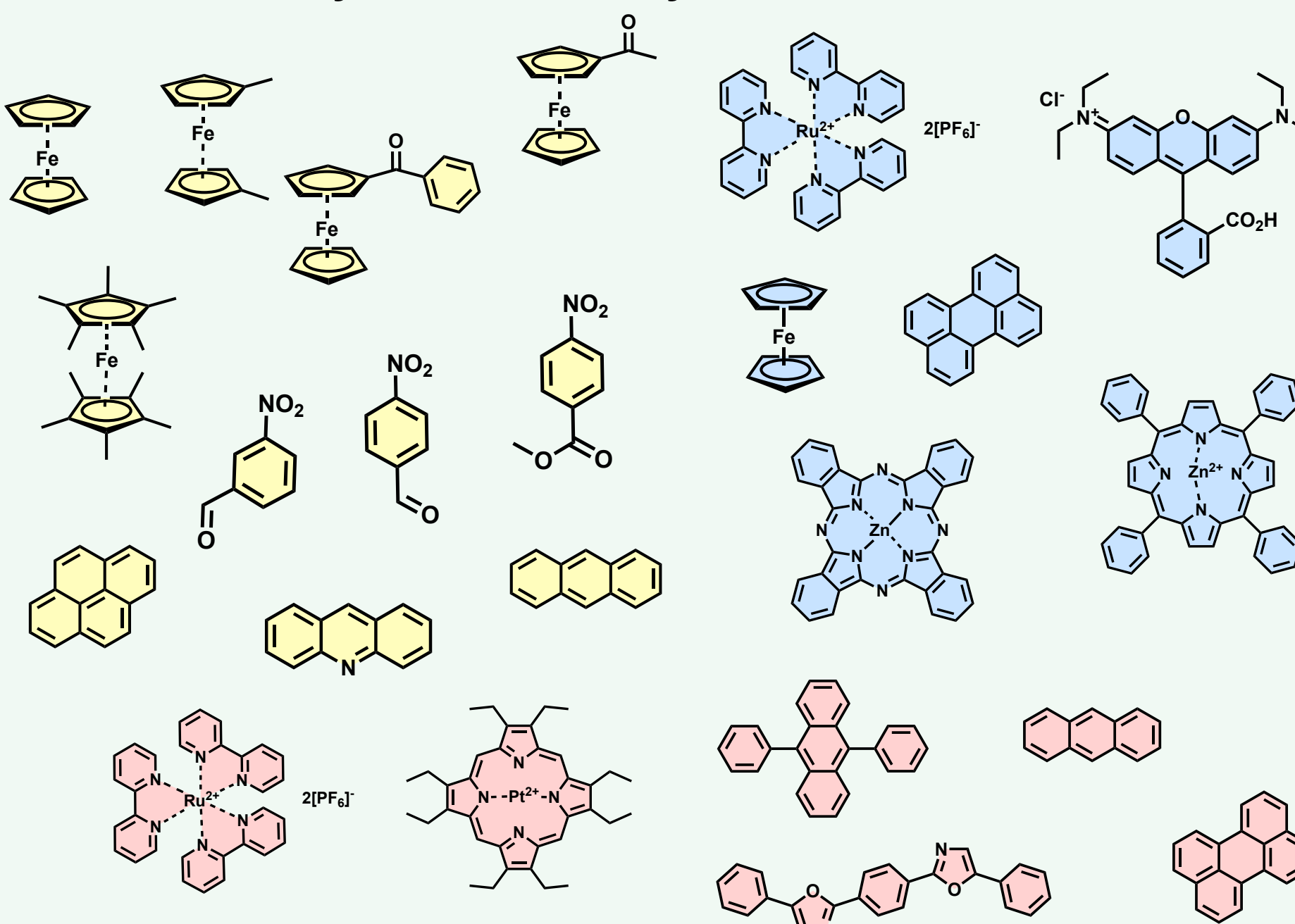
The volumetric pipetting accuracy was measured gravimetrically (actual = nominal \times 0.976 - 0.244 μ L). Calibration curve was precise (R² = 0.9998) over the 0.5–50 μ L aliquot range. No-transfer measurements permitted corrections for evaporation (~0.25 μ L/min).

Given the motion of the flow cell, to identify any artifacts from the fiberoptics or FEP tube moving and bending, incident light and PL signals were measured at random locations on the platform. No appreciable variation was found with coefficients of variation (CV; sample standard deviation normalized by the mean) less than 0.65% and 1.5%, respectively.

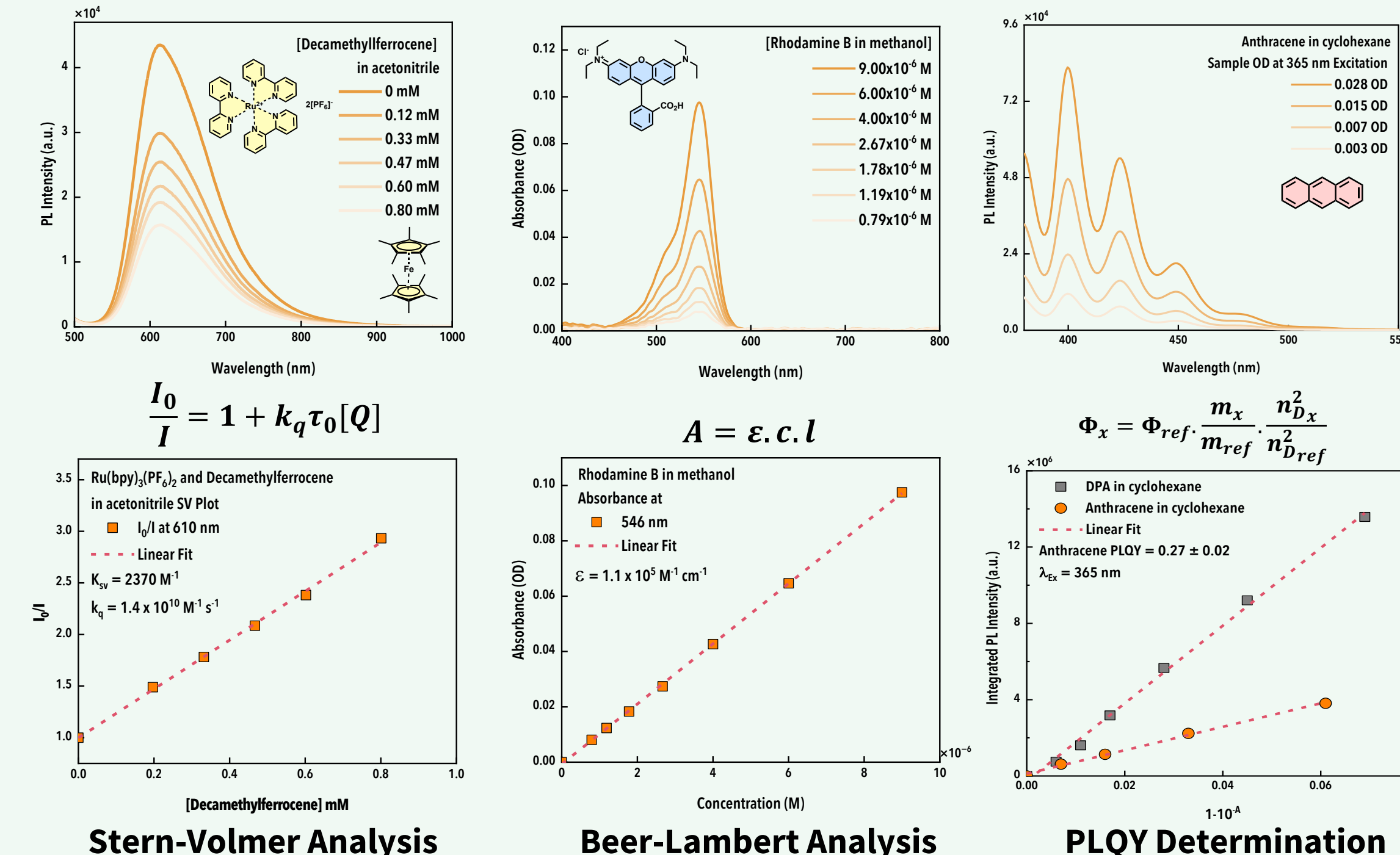


Different cross-contamination mitigation strategies were tested, ultimately resulting in a workflow with an estimated <0.15 μ L contaminant per interaction rate of cross-contamination where vials are capped with a thin septum and no external washing of the LH's needle is performed between samplings.

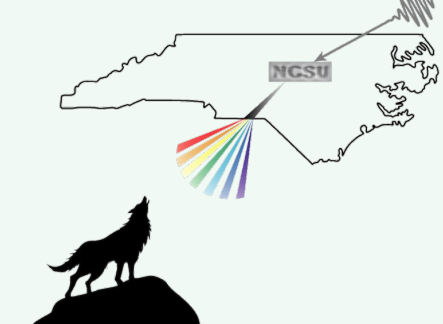
Chemically Diverse Library for Platform Validation



Automating Key Photophysical Experiments in Photocatalysis



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