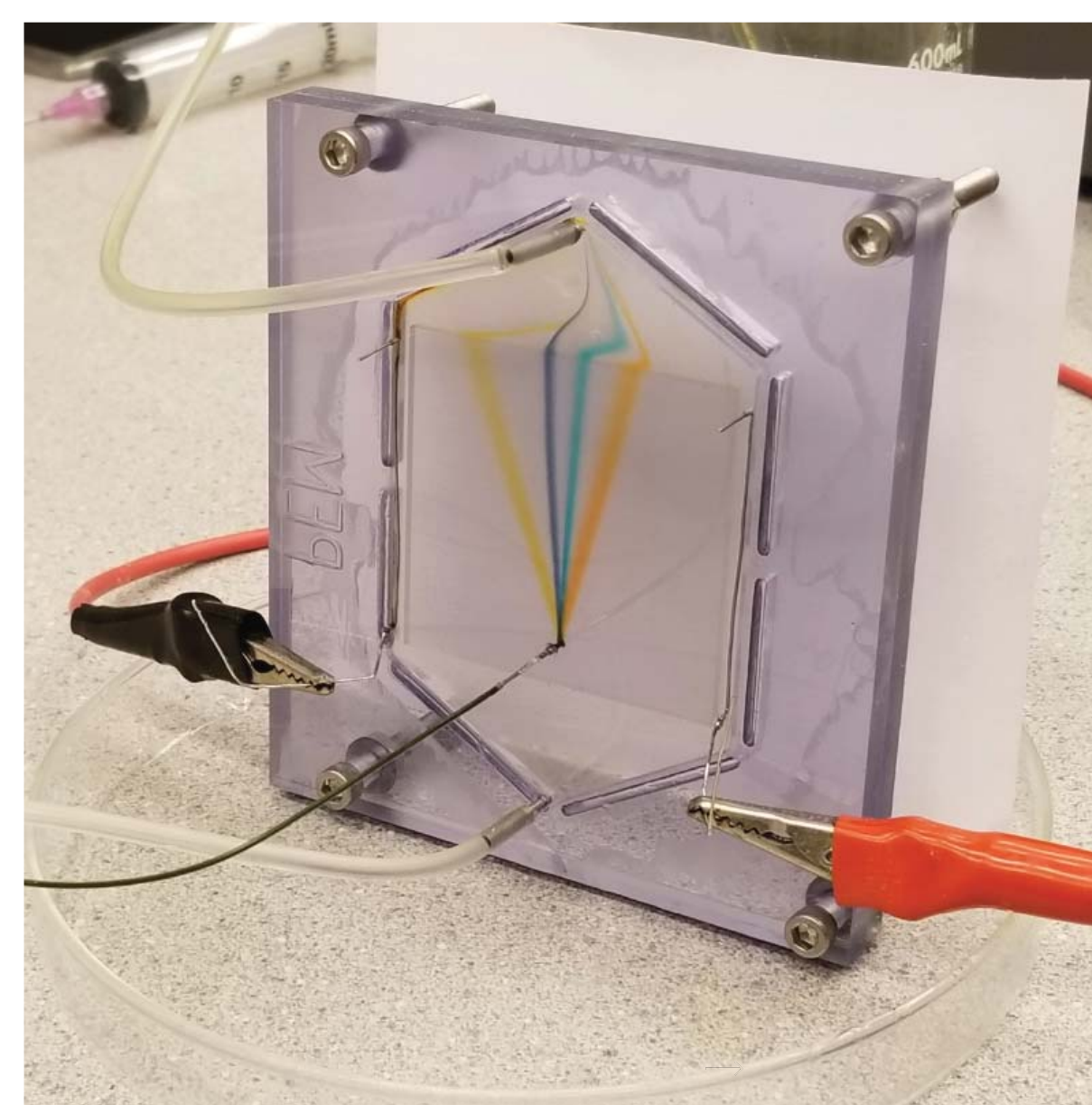
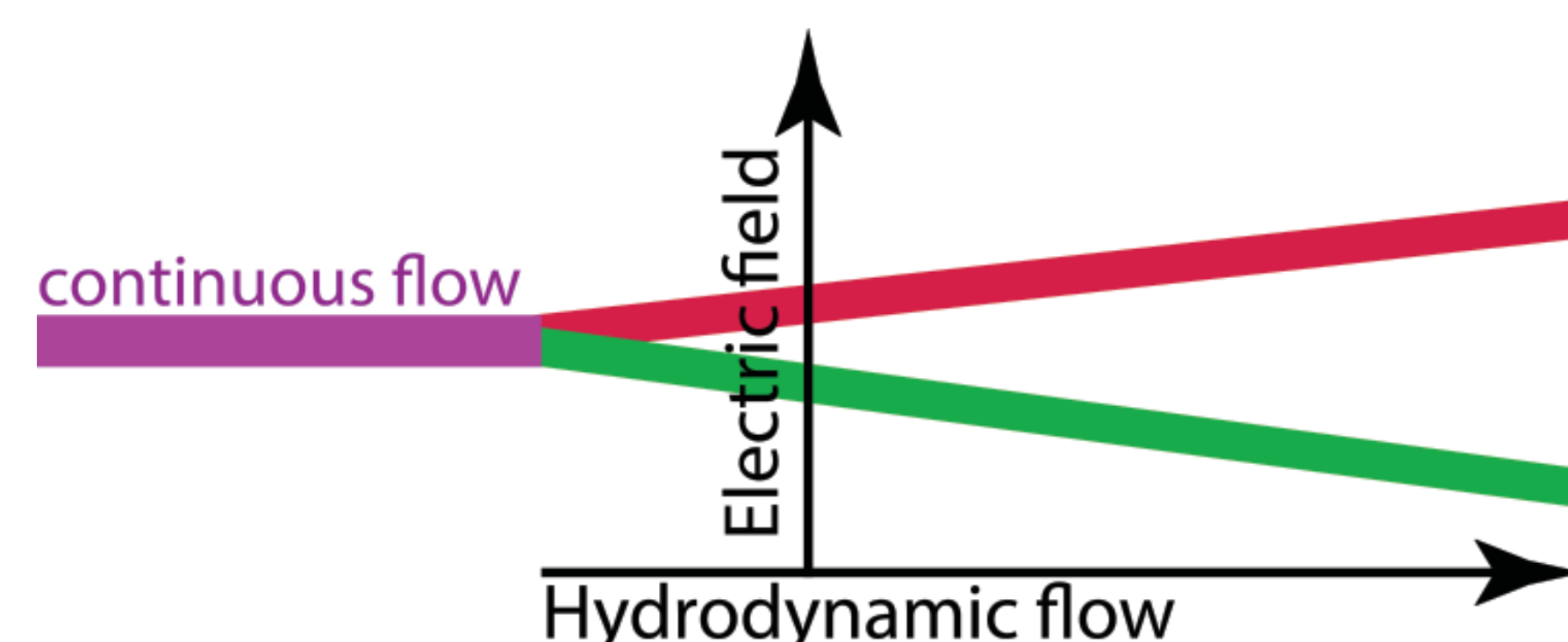


1. Continuous-flow electrophoresis

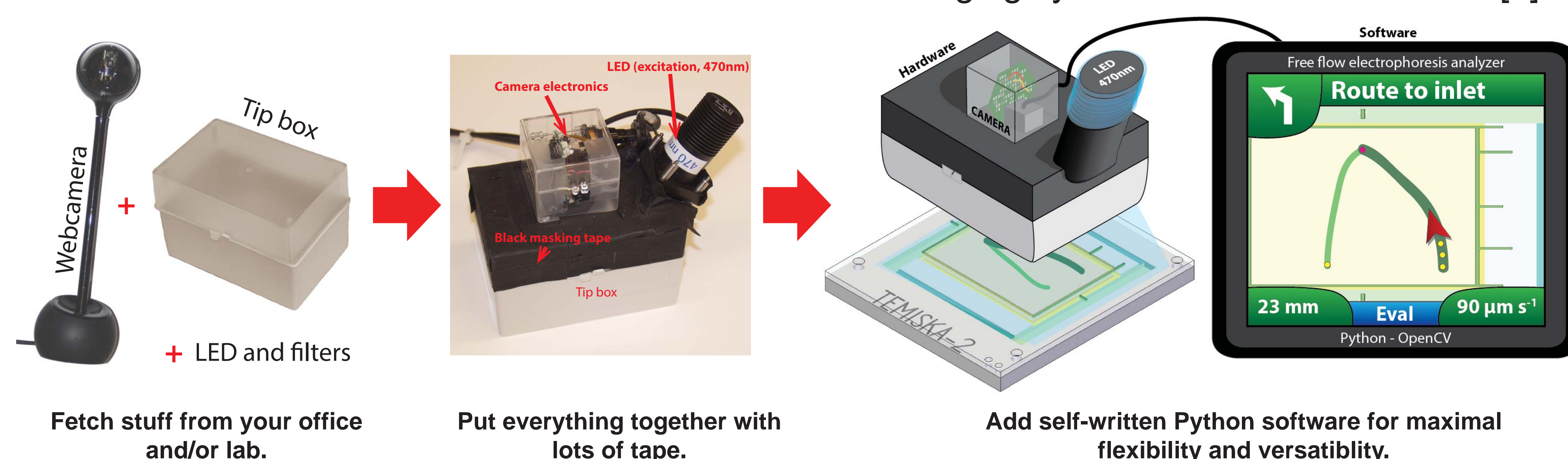
Continuous-flow electrophoresis (CFE), also known as free-flow electrophoresis, separates a stream of a multi-component mixture into multiple streams of individual components inside a thin rectangular chamber with an electric field perpendicular to the hydrodynamic flow [1–3].



CFE has great potential for applications that require continuous downstream separation, such as continuous-flow synthesis [4]. Despite its potential, CFE still needs to be greatly advanced. Research on CFE requires quantitative assessment of chips and characterization of streams.

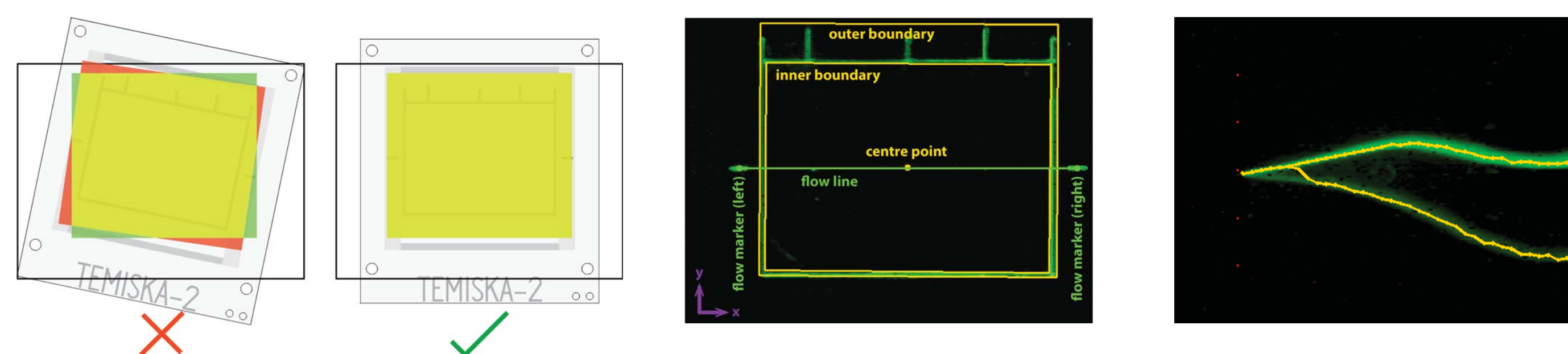
2. Building a fluorescence imaging system

We demonstrated how to build a versatile fluorescence imaging system for CFE from scratch [5]:



Pro-tip: Buy your PhD-students/PDF tools (μ-drills, milling machine, 3D printers...) to build things!

The software of our image system possesses some advanced features like alignment helper, feature detection, and stream tracking.



References:

- [1] Castro, E. R.; Manz, A. *J. Chromatogr. A* **2015**, 1382, 66–85.
- [2] Nove, P.; Janasek, D. *Anal. Chim. Acta* **2017**, 991, 9–29.
- [3] Johnson, A. C.; Bowser, M. T. *Lab Chip* **2018**, 18, 27–40.
- [4] Kochmann, S.; Krylov, S. N. *Anal. Chem.* **2018**, 90, 9504–9509.
- [5] Kochmann, S.; Krylov, S. N. *Lab Chip* **2017**, 17, 256–266.
- [6] Ivanov, N. A.; Kochmann, S.; Krylov, S. N. *Anal. Chem.* **2020**, 92, 2907–2910.
- [7] Ivanov, N. A.; Liu, Y.; Kochmann, S.; Krylov, S. N. *Lab Chip* **2019**, 19, 2156–2160.

Github repositories:

<https://github.com/Schallaven/fieimg>; DOI: 10.5281/zenodo.1001785.
<https://github.com/Schallaven/angulagram>; DOI: 10.5281/zenodo.2592588.

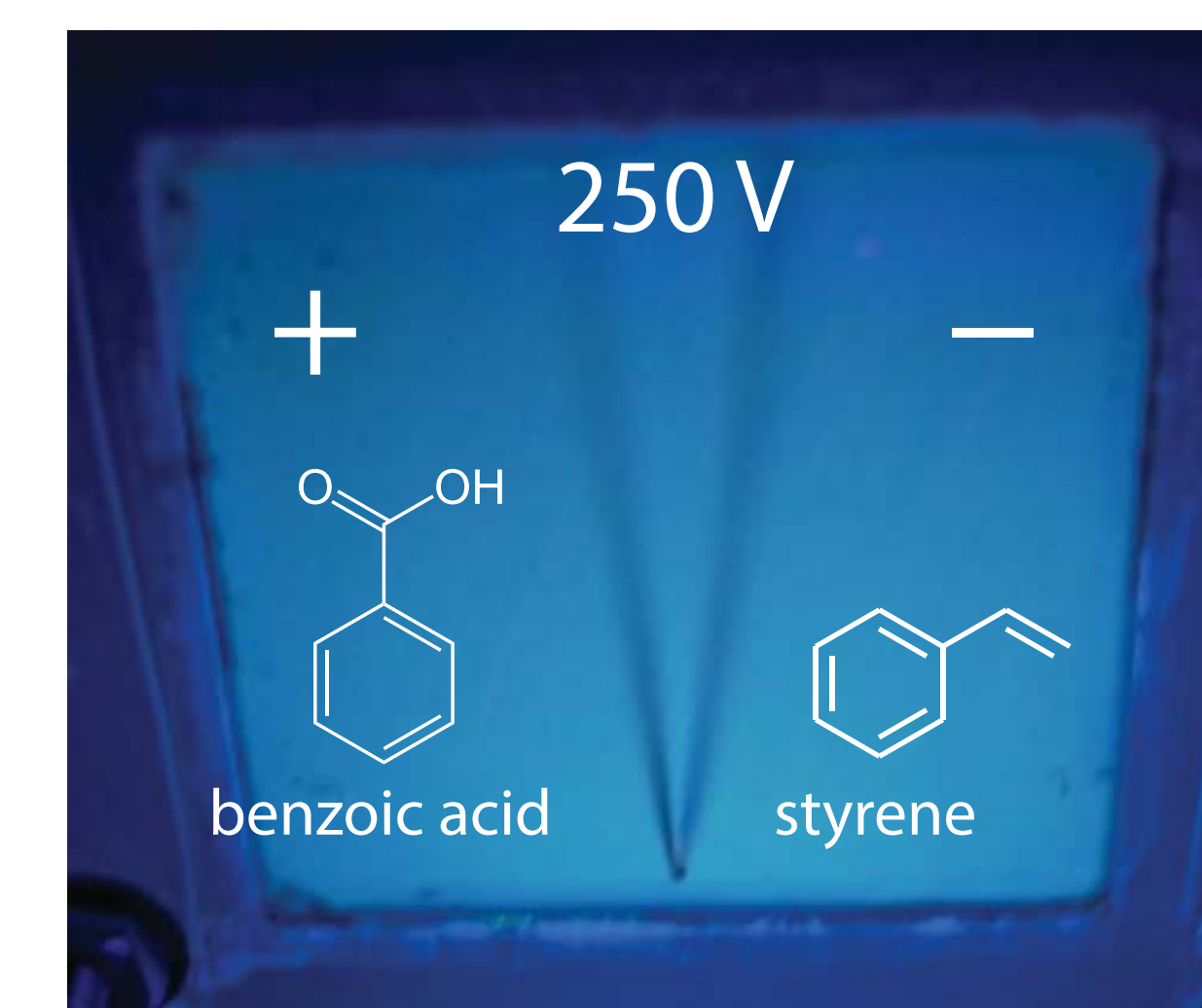
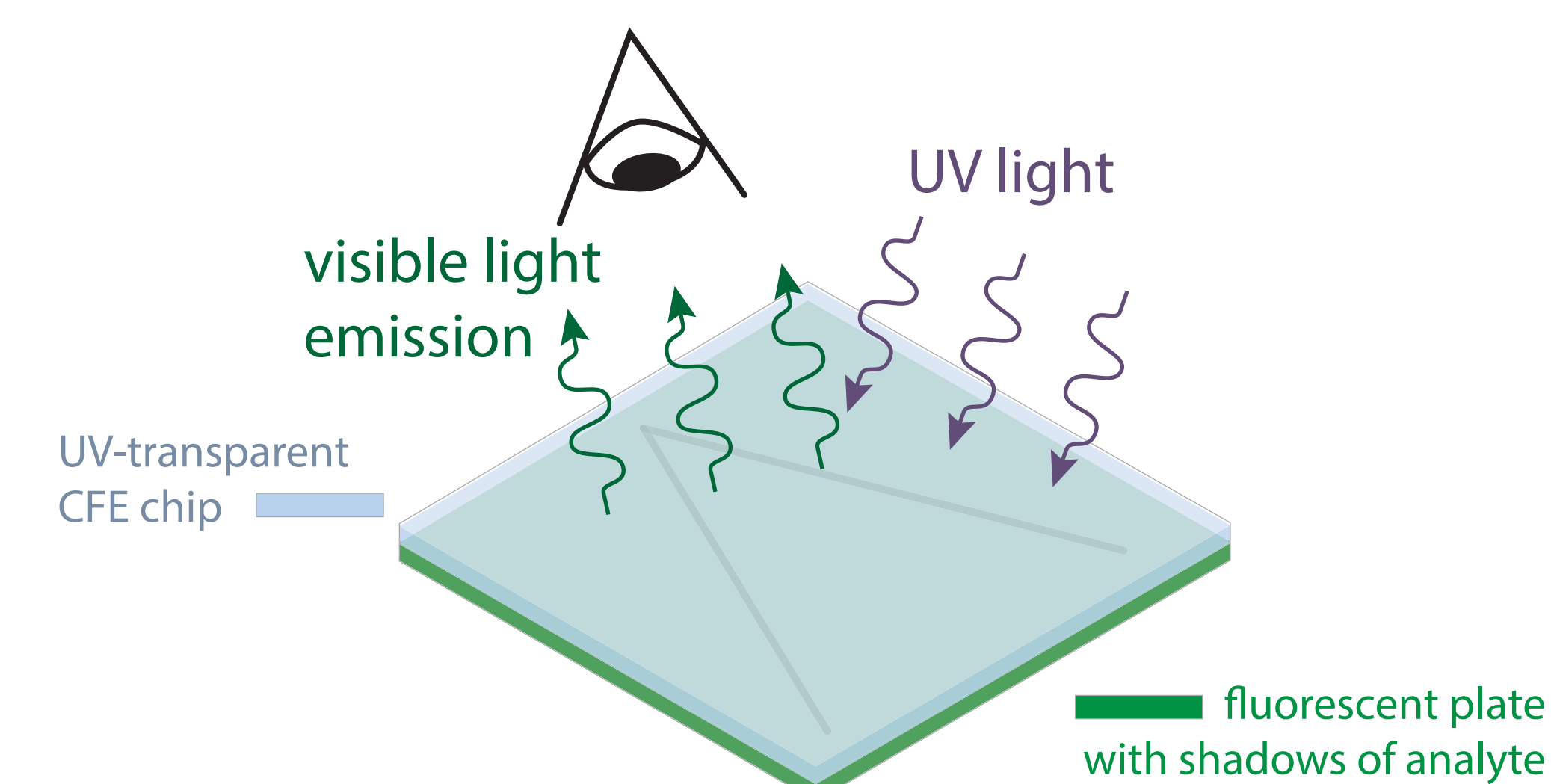
Group page:

<https://www.yorku.ca/skrylov/>



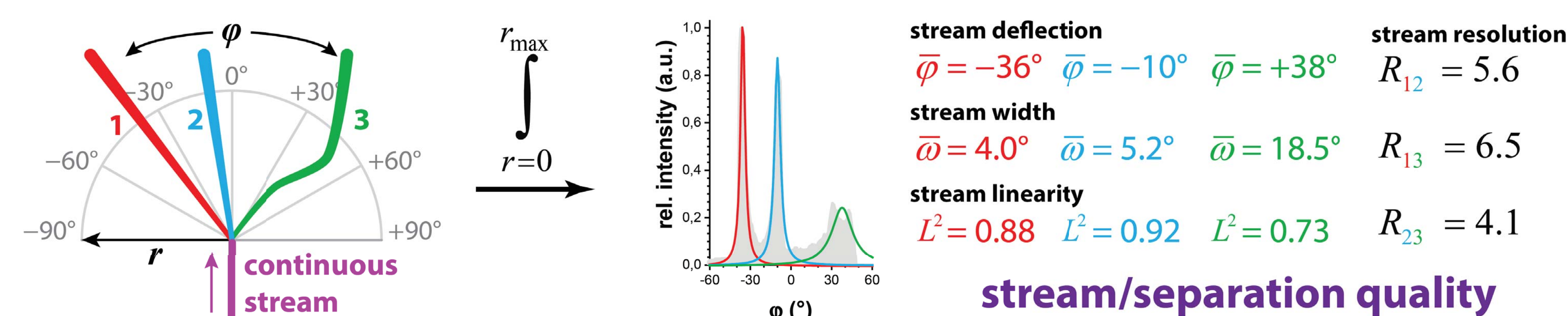
3. Visualization of small organic molecules

Not all molecules fluoresce or are visible by naked-eye. Therefore, we developed a general approach for visualization of small organic molecules in CFE via analyte-caused obstruction of excitation of a fluorescent layer underneath the separation zone [6].

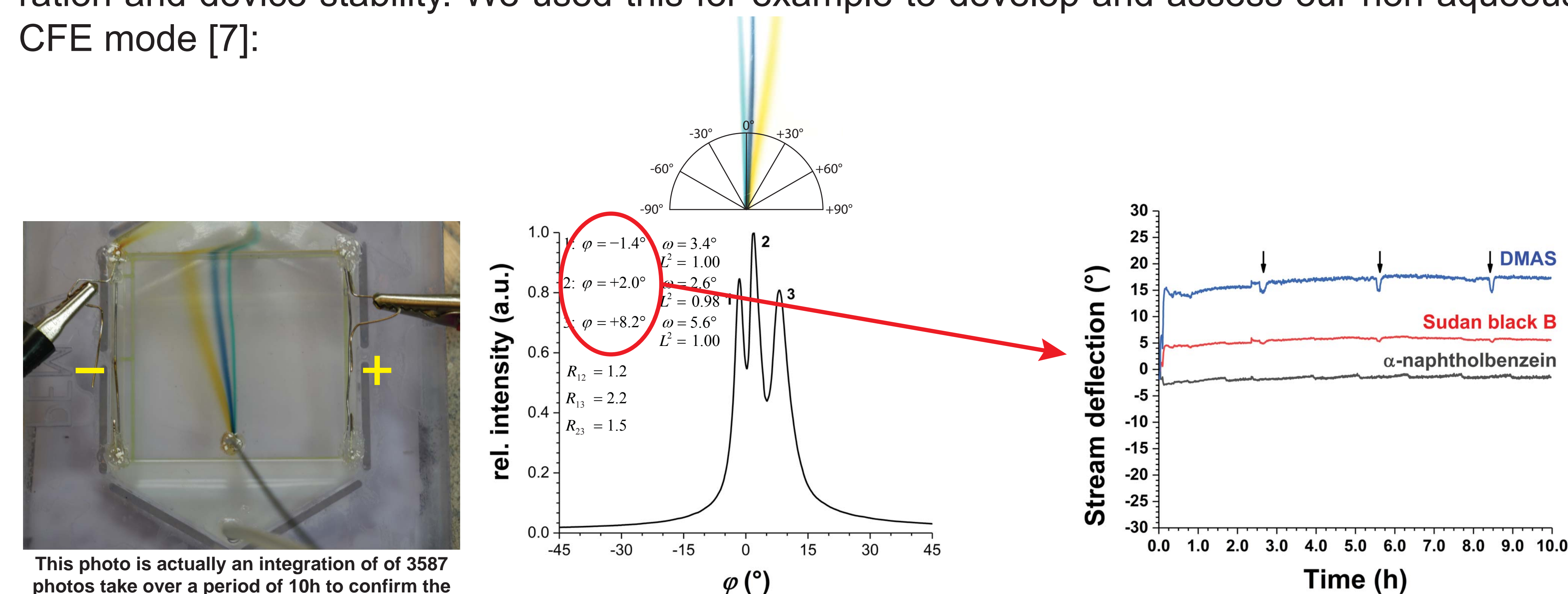


4. Evaluating separations with angulagrams

We developed a method to convolute the 3D image data into a simple 2D plot called *angulagram* by using a polar coordinate system [4]. In contrast to the established method of extracting a simple cross-section, an angulagram covers the whole separation zone and allows extracting quantifiable stream parameters. Angulagrams can be created with any imaging technique [4–6].



Stream parameters can be extracted for individual angulagrams/images to make conclusions about stream and separation quality. They can also be tracked over time allowing to track separation and device stability. We used this for example to develop and assess our non-aqueous CFE mode [7]:



This photo is actually an integration of 3587 photos take over a period of 10h to confirm the stability of our CFE device!