Why microfluidics for emulsification?
Better control over the polydispersity and droplet size compared to other conventional emulsification methods

Why electric fields in microfluidics?
Droplets smaller than the tip can be readily obtained, with potential sizes below the micron

Electro co-flow:

The electric field deforms the liquid meniscus into a conical shape and the apex of the cone opens into a microjet which is the source of the small droplets
**Modes**

By keeping the voltage constant and playing with the flow rate of either the inner or outer liquid, the mode can be changed between con-jet and whipping modes.

**Cone-jet mode**

Conical meniscus opens into a microjet, which can directly break into droplets.

**Whipping mode**

The microjet can undergo a whipping instability before breaking into droplets.

**Dripping mode**

$V < 3\text{kV}$

$d_{\text{droplet}} \sim d_{\text{tip}}$

$V > 3\text{kV}$

$d_{\text{droplet}} < d_{\text{tip}}$
**EMULSION** (preliminary results)

Droplets cross the dielectric/collector interface

- **Inner liquid**
- **Liquid collector (counter-electrode)**

**Droplets crossing the counter-electrode interface**

**Emulsion**

- **Neutral droplets**
- **The droplets remain in the liquid collector => W/O emulsion**

\[ d_n = 3.4\mu m \quad (d_{tip}=10\mu m) \]
\[ \Delta d = 1.75\mu m \]
\[ N = 140 \]