

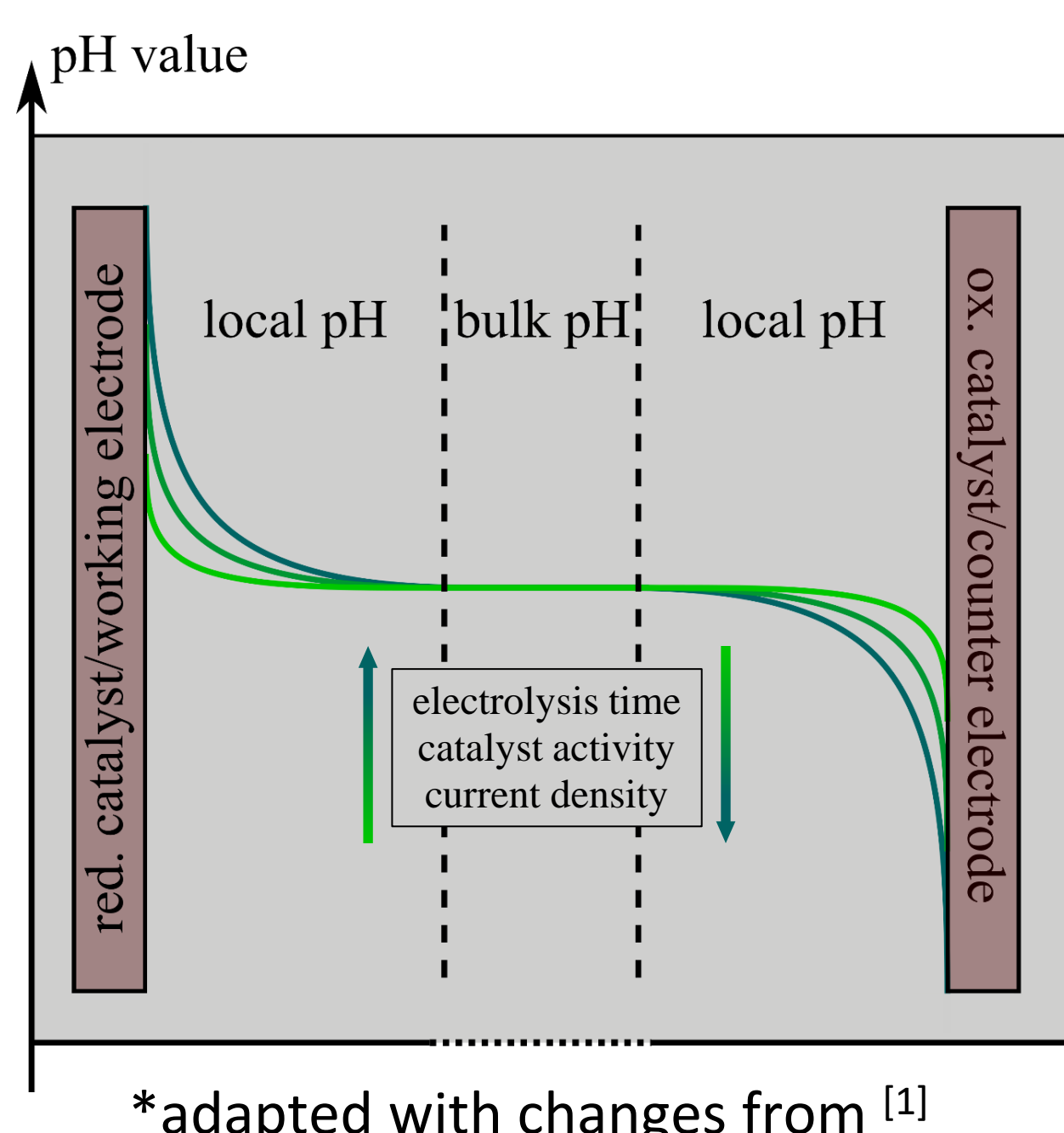
In operando NMR investigations of advanced aqueous CO₂RR systems

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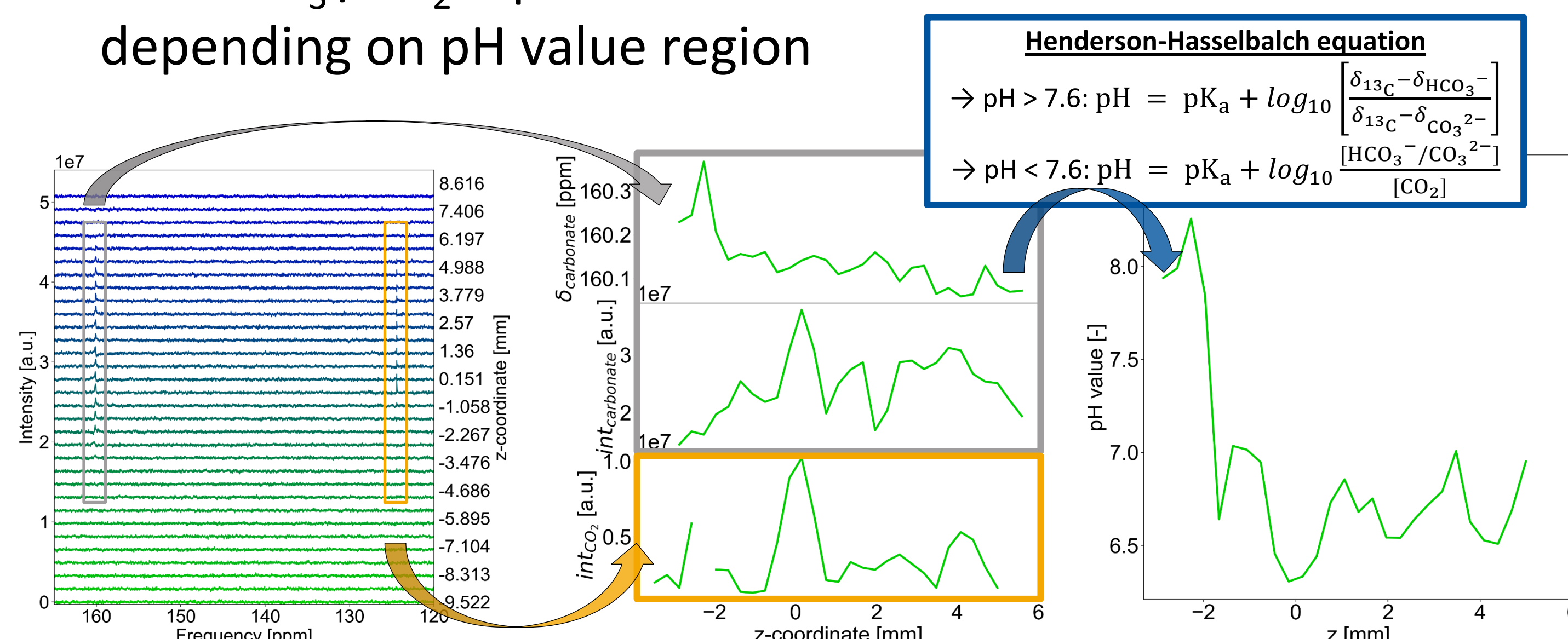
Why is local pH important?

- influences product selectivity
- determines CO₂ and H⁺ availability on the WE
- may impact electrode stability

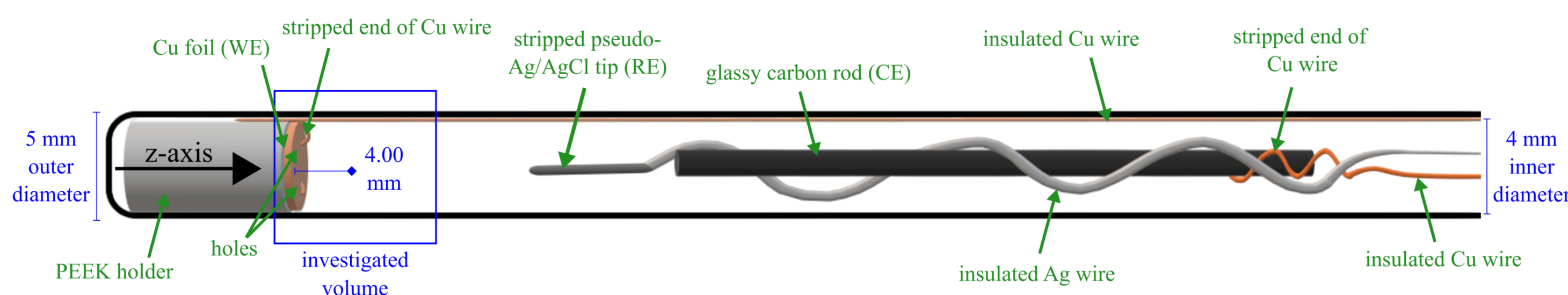


pH values from ¹³C resonances

- pH values are determined by using the CO₃²⁻/HCO₃⁻ and HCO₃⁻/CO₂ equilibria depending on pH value region

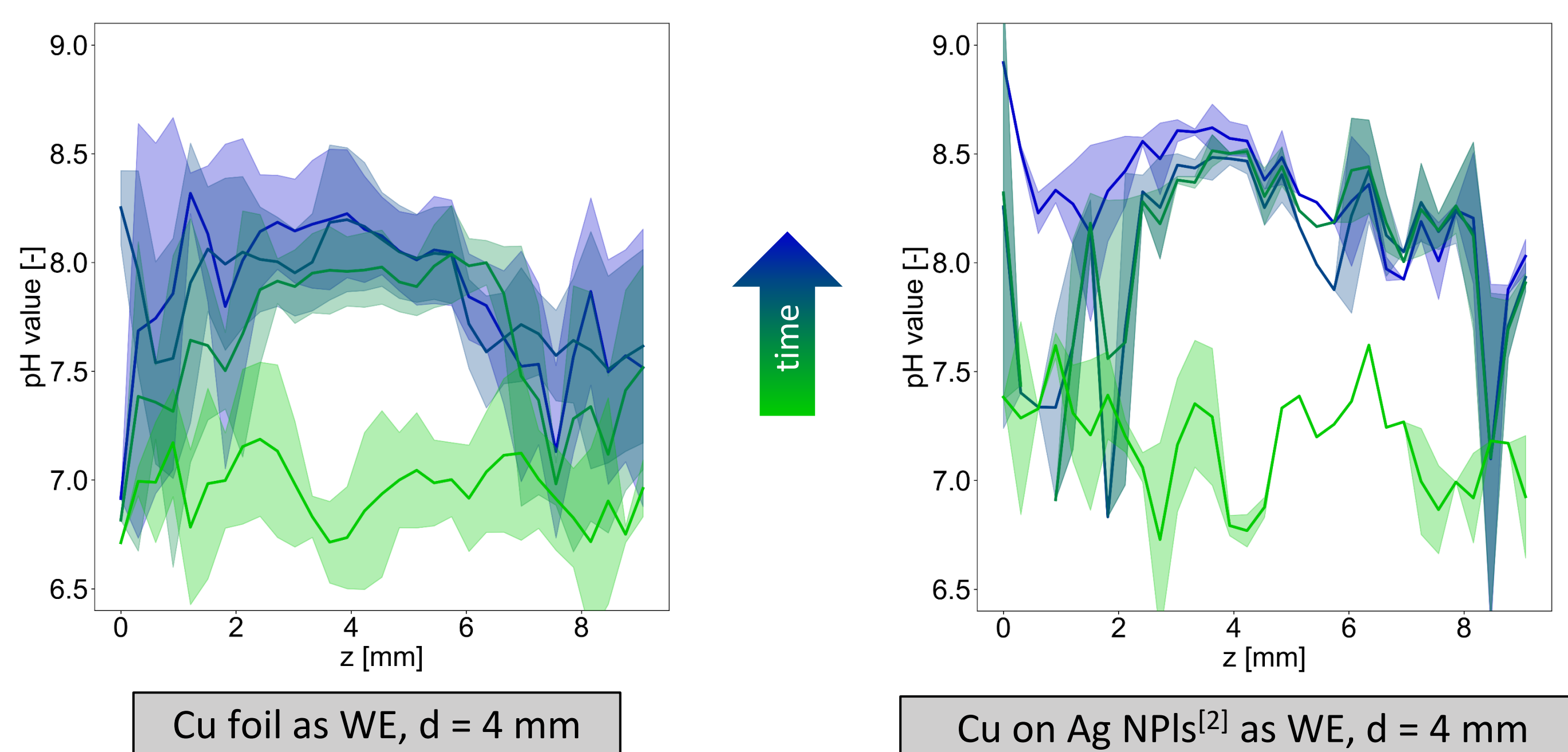


Current in operando NMR setup



Comparison Cu & Cu on Ag NPLs

- electrolysis was conducted for 1 h in a ¹³CO₂-saturated 0.1 M KH¹³CO₃. Averaged over (i) 3 and (ii) 2 experiments.

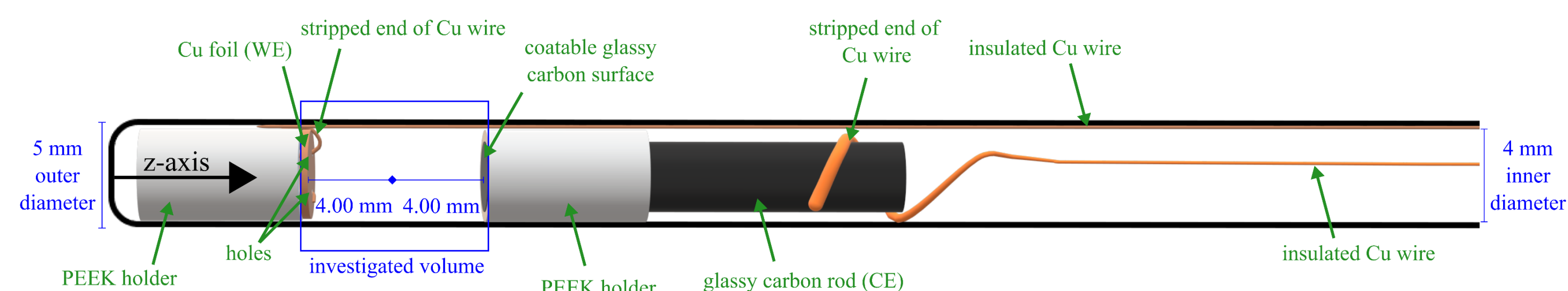


- local pH values are slightly higher for the novel catalyst

Outlook

- local pH evolution will be compared to Ag foil to correlate Cu content and pH values
- investigation of various selected cell potentials to evaluate the impact of electrochemical potential on local pH

Advanced setup for pH near CE

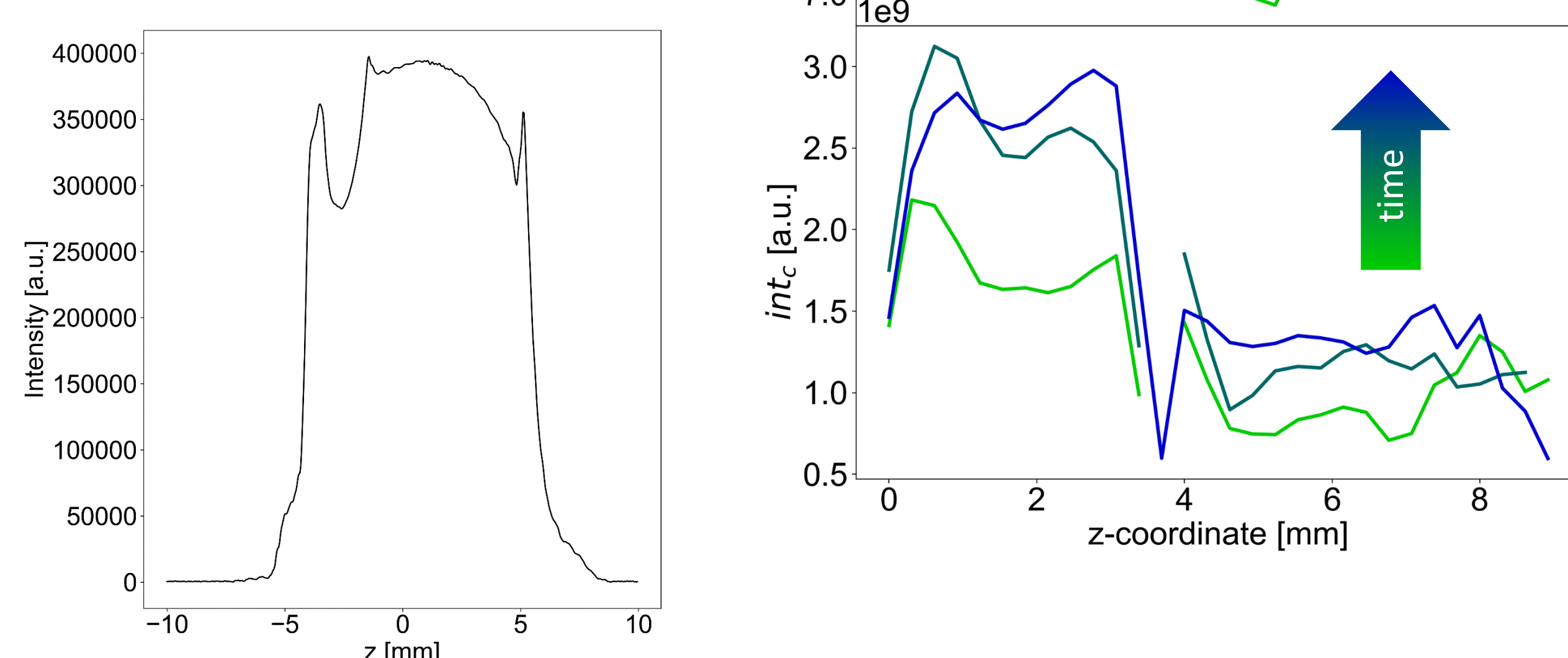


Outlook

- optimization of cell setup to prevent bubble distortions
- application of Ni-Co-O ink to the GC CE (d = 2 or 3 mm)
- influence of OER-optimized catalyst and electrolyte on the CO₂RR as well as effect of local pH on catalyst stability

First tests

- pH value increases at both electrodes, but why?
- bubble distortions identified by HCO₃⁻/CO₃²⁻ integral and ¹H image



Acknowledgement

This research has been supported by the German Research Foundation (DFG) under Germany's Excellence Strategy Cluster of Excellence 2186 "The Fuel Science Center" (grant no. 390919832).

Literature

- [1] A. S. Varela, Current Opinion in Green and Sustainable Chemistry 2020, 26, 100371.
- [2] E. Robens, B. Hecker, H. Kungl, H. Tempel, R.-A. Eichel, ACS Appl. Energy Mater. 2023, 6, 7571.