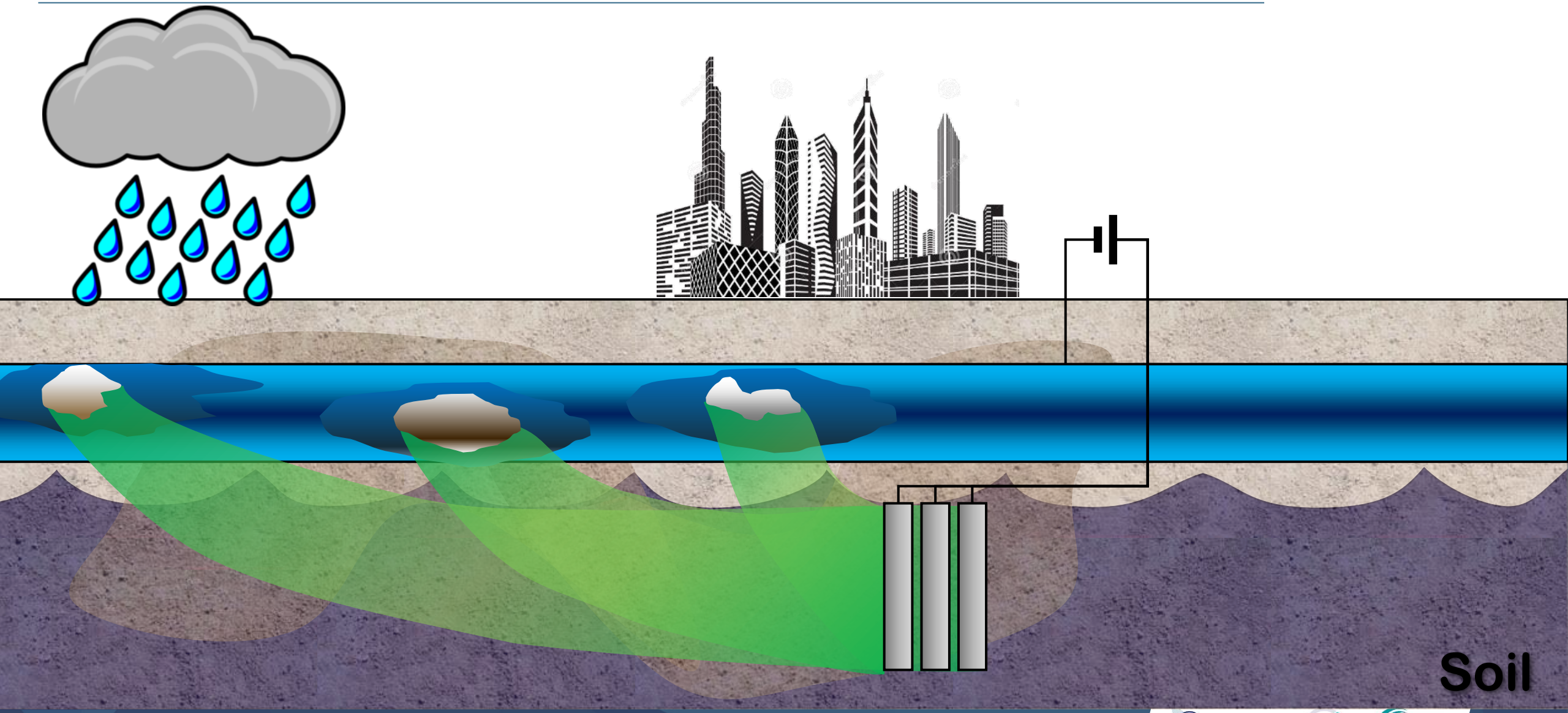
EPRG-PRCI-APGA
23rd Joint Technical Meeting
Edinburgh, Scotland • 6–10 June 2022

CLOSED CONTROL LOOP FOR ICCP BASED ON CORROSION RATE SENSING

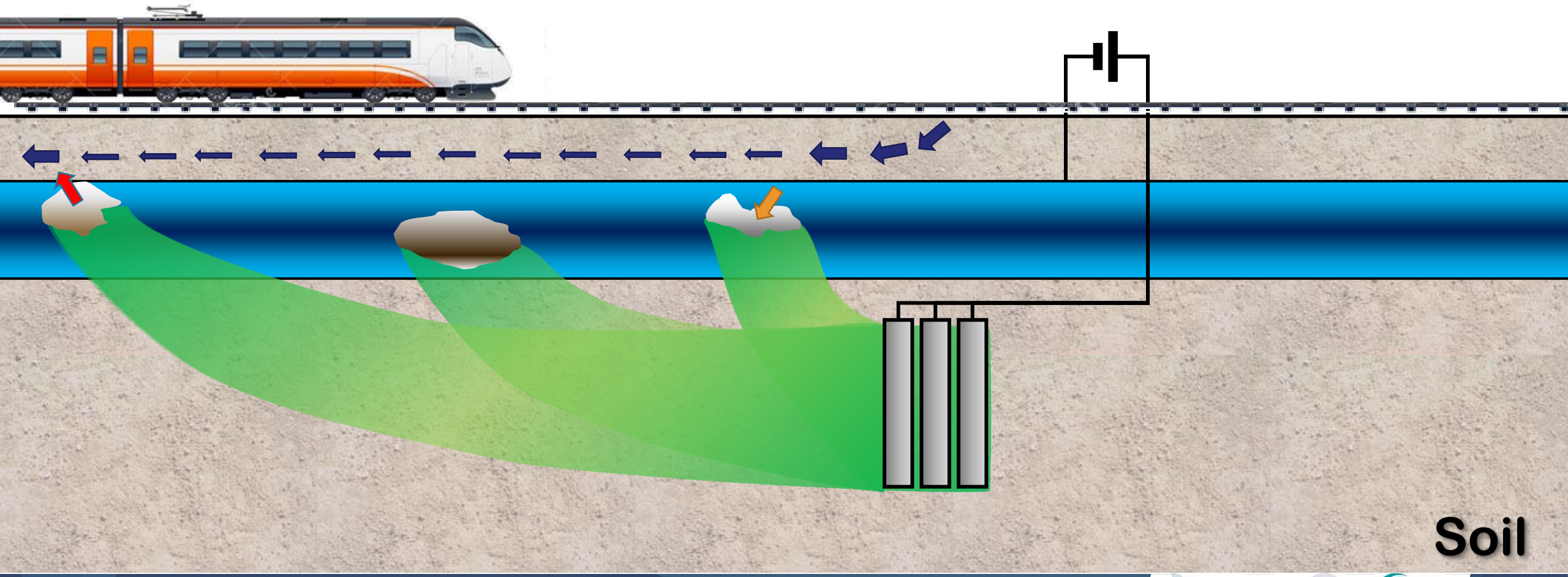
Facundo Bob Varela* and Mike YJ Tan

Deakin University, School of Engineering and Institute for Frontier Materials, Victoria 3216, Australia

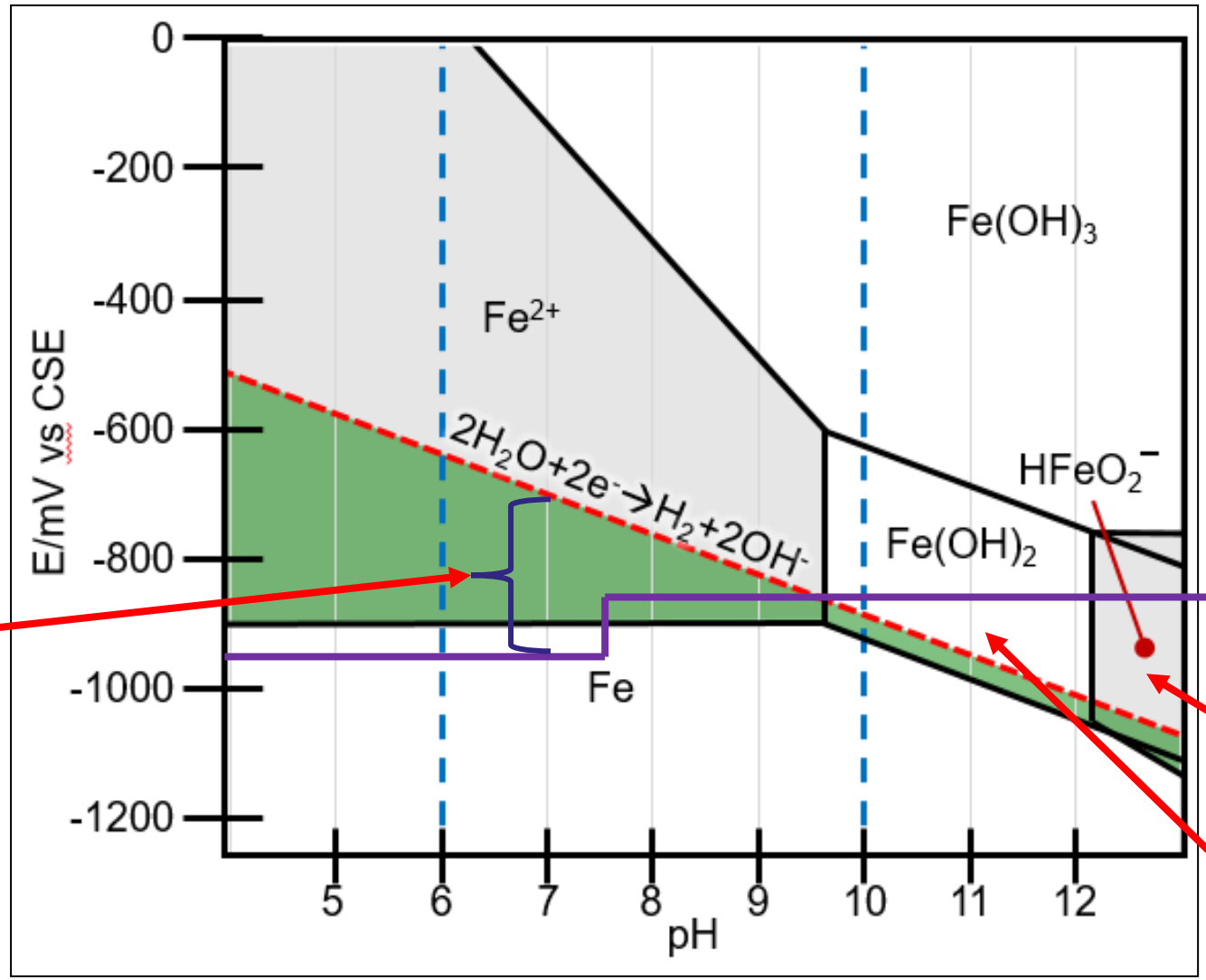
Dynamic environmental conditions



Dynamic environmental conditions



Definition of succesful CP



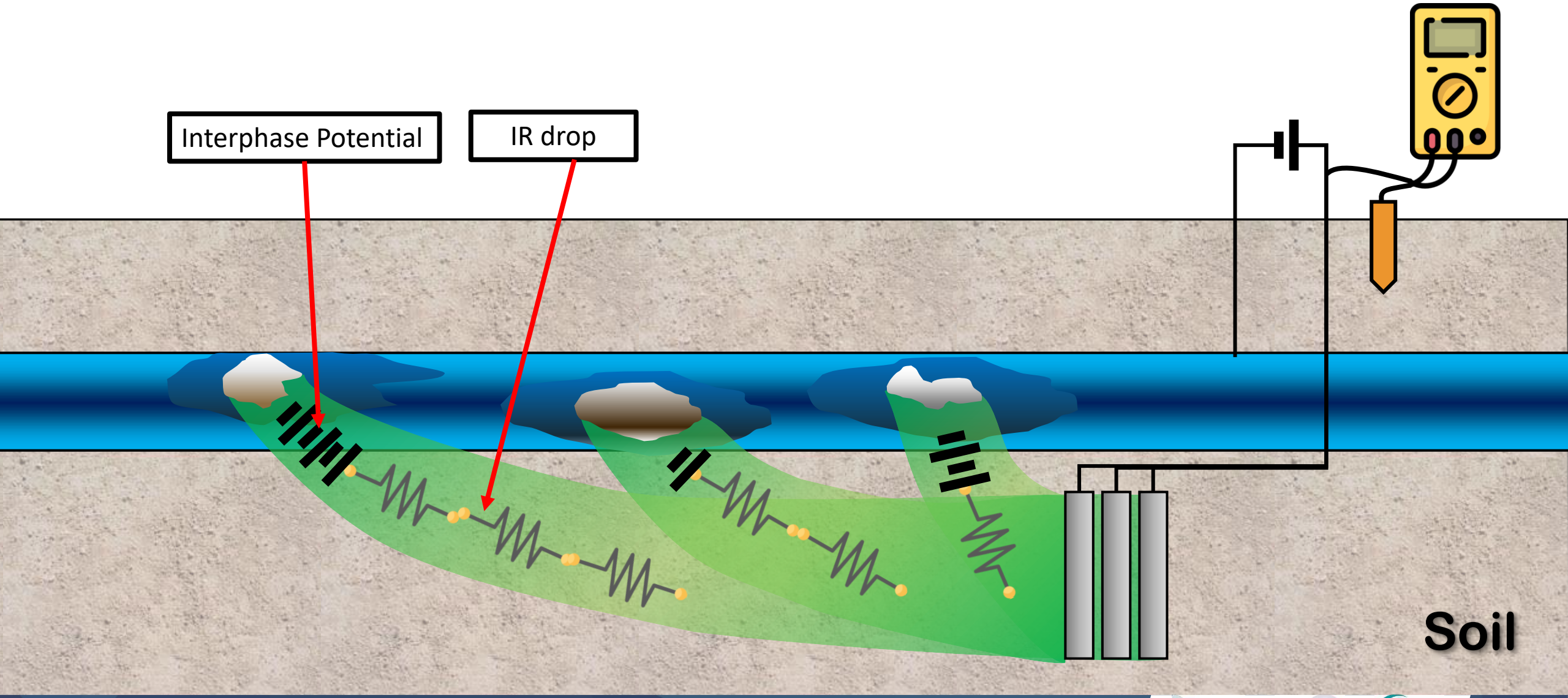
Exponentially greater current densities

Effective CP

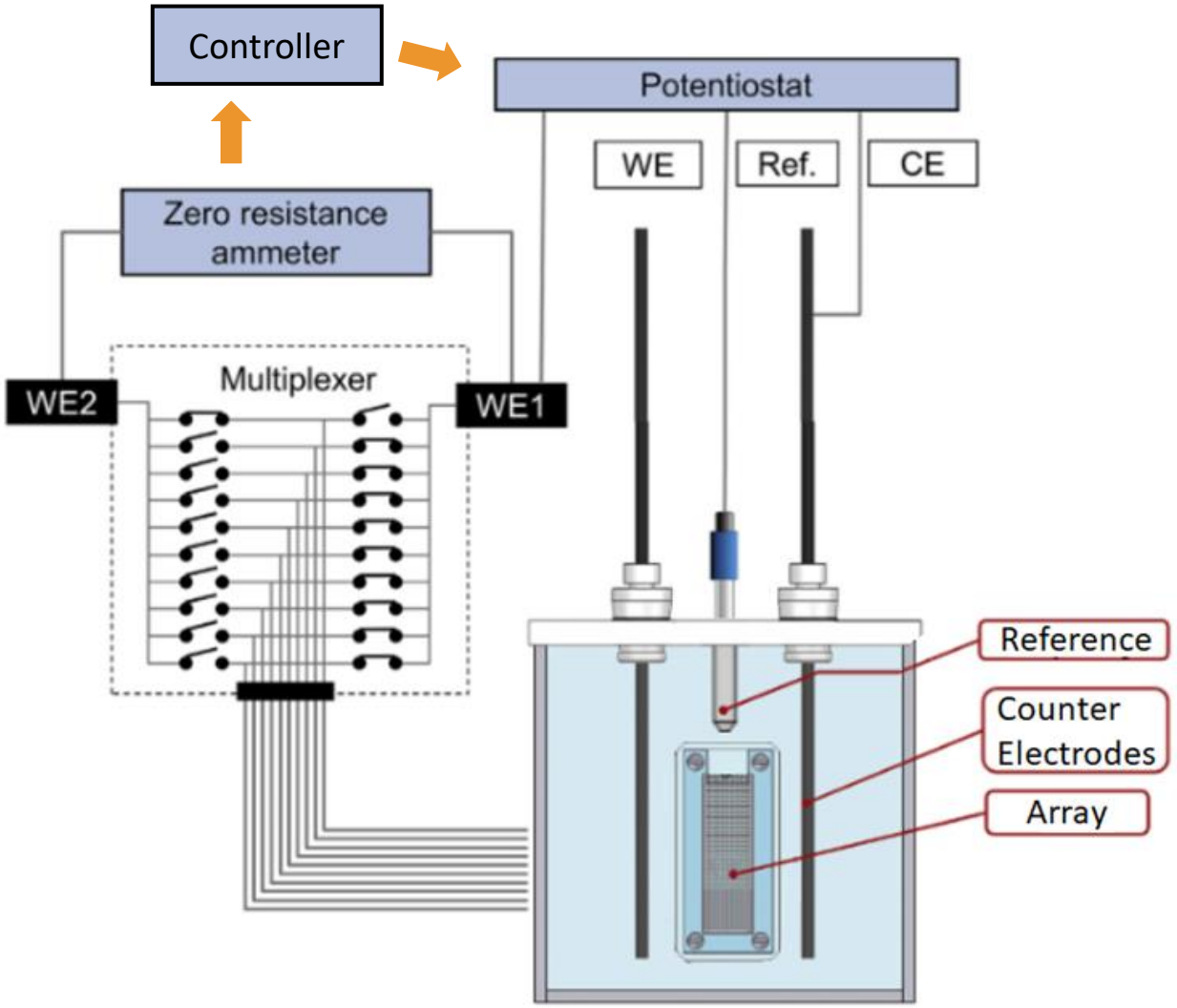
Corrosion

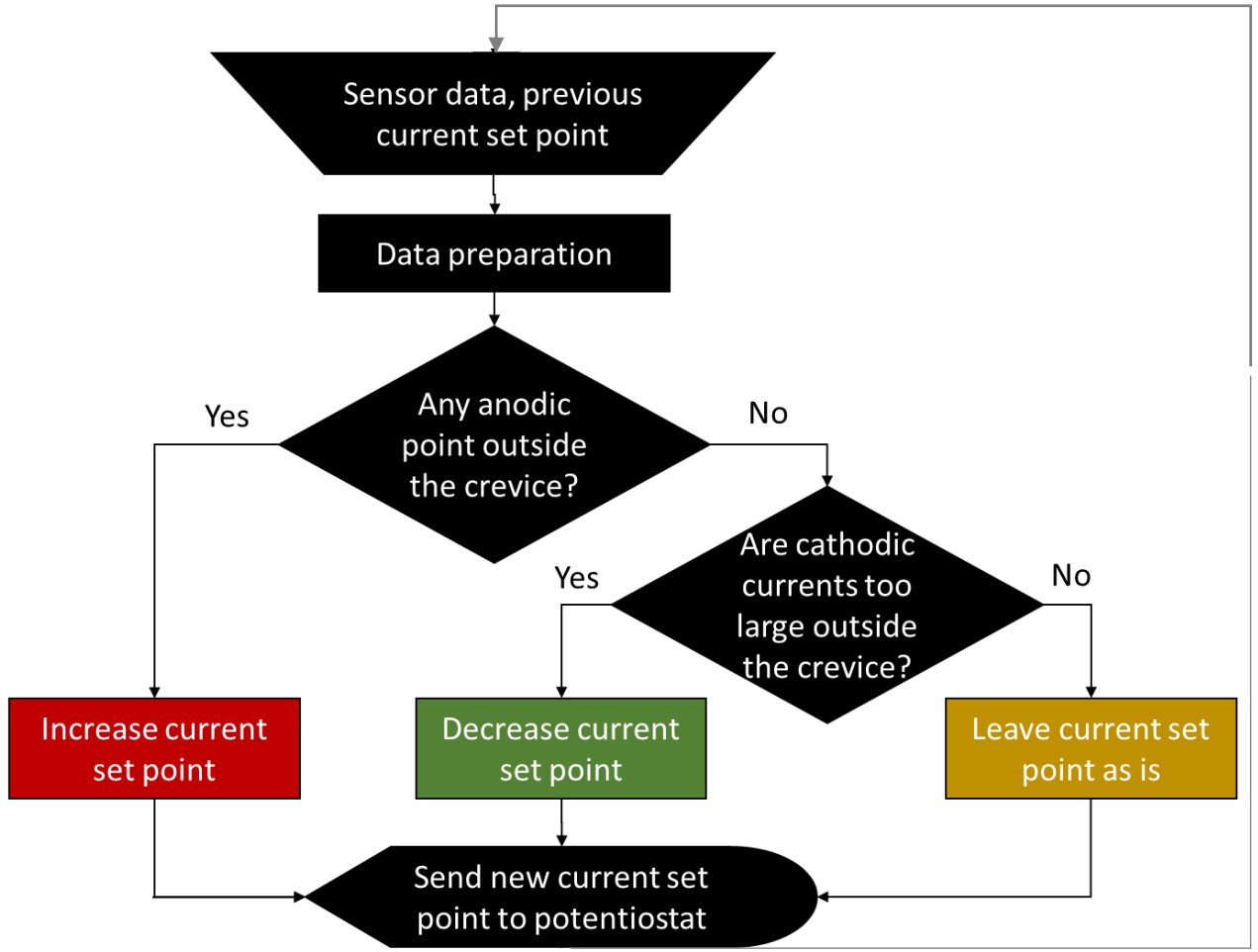
[Cl-]? [O2]?

The potential where?

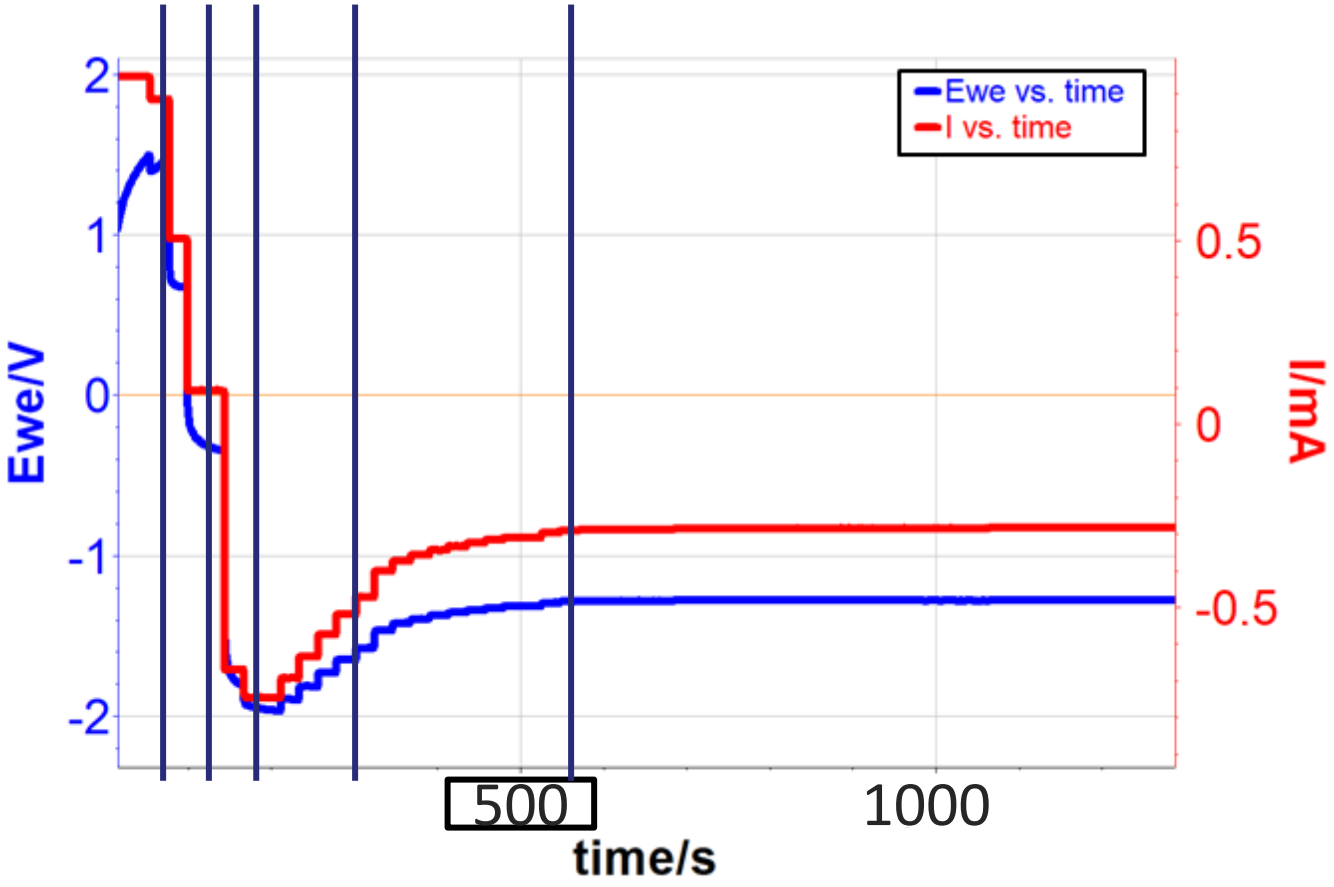


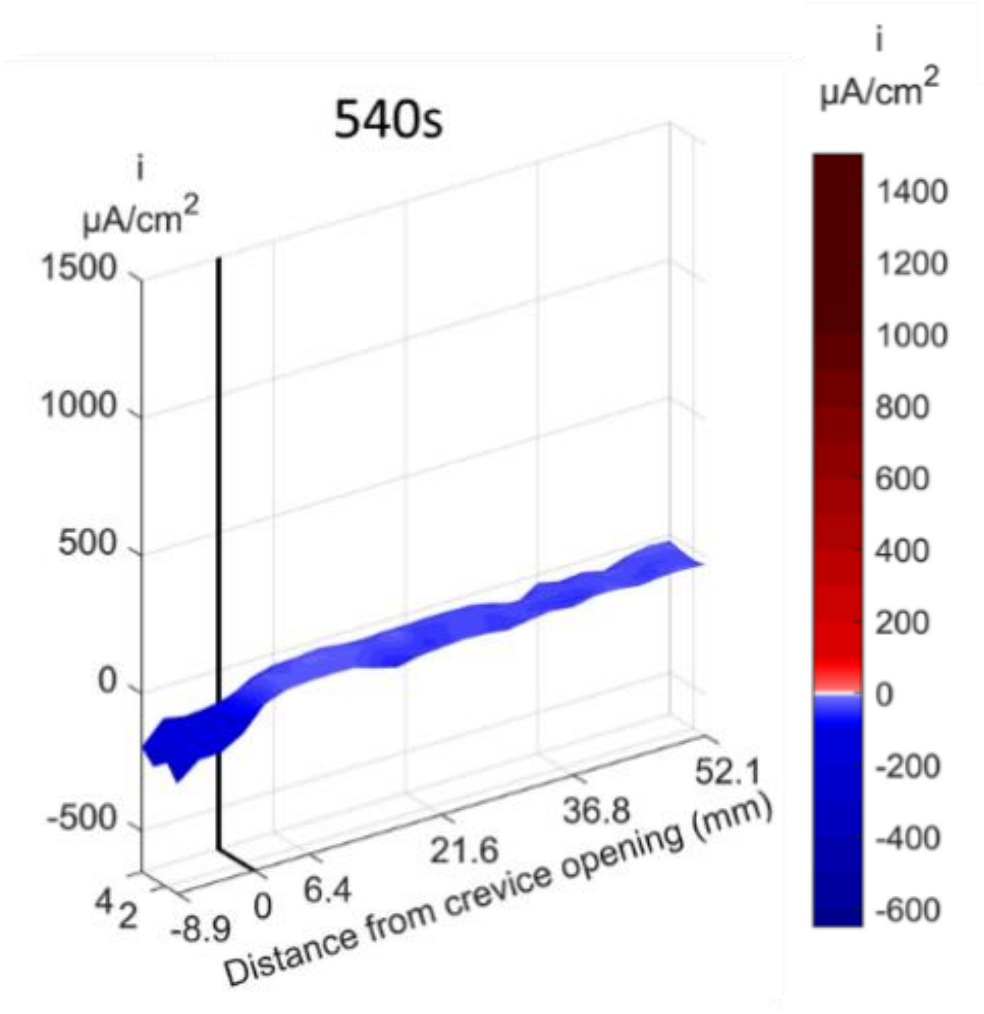
Static and dynamic excursion compensation



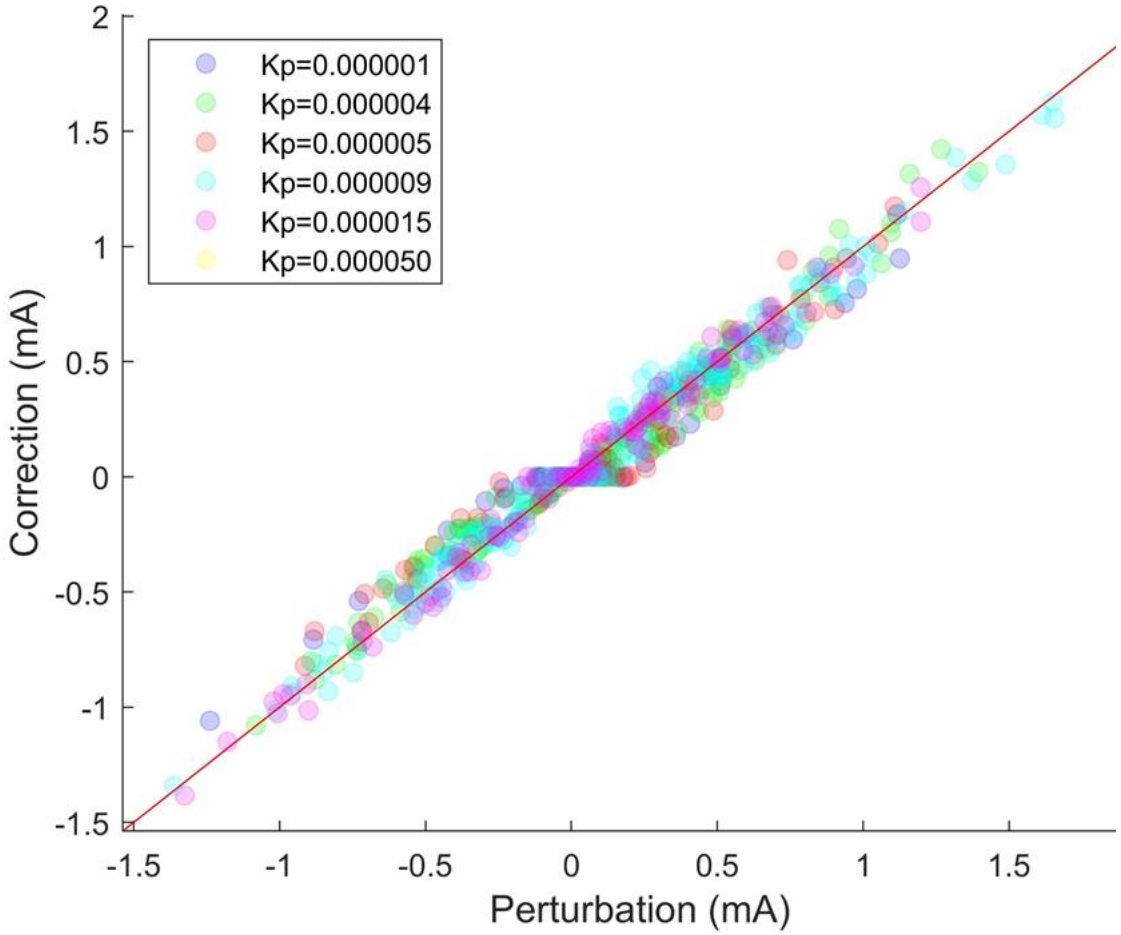


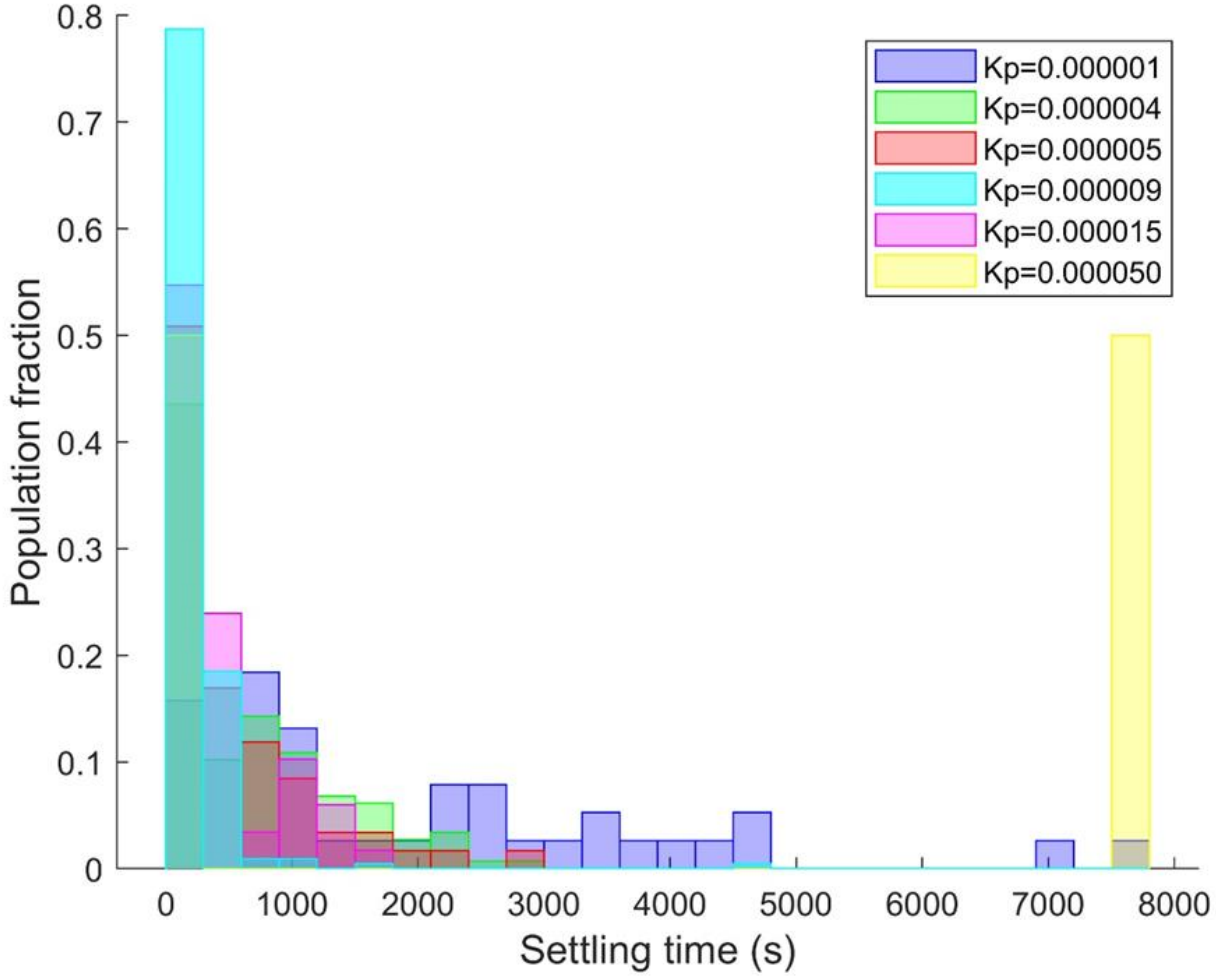
Excursion compensation from static conditions



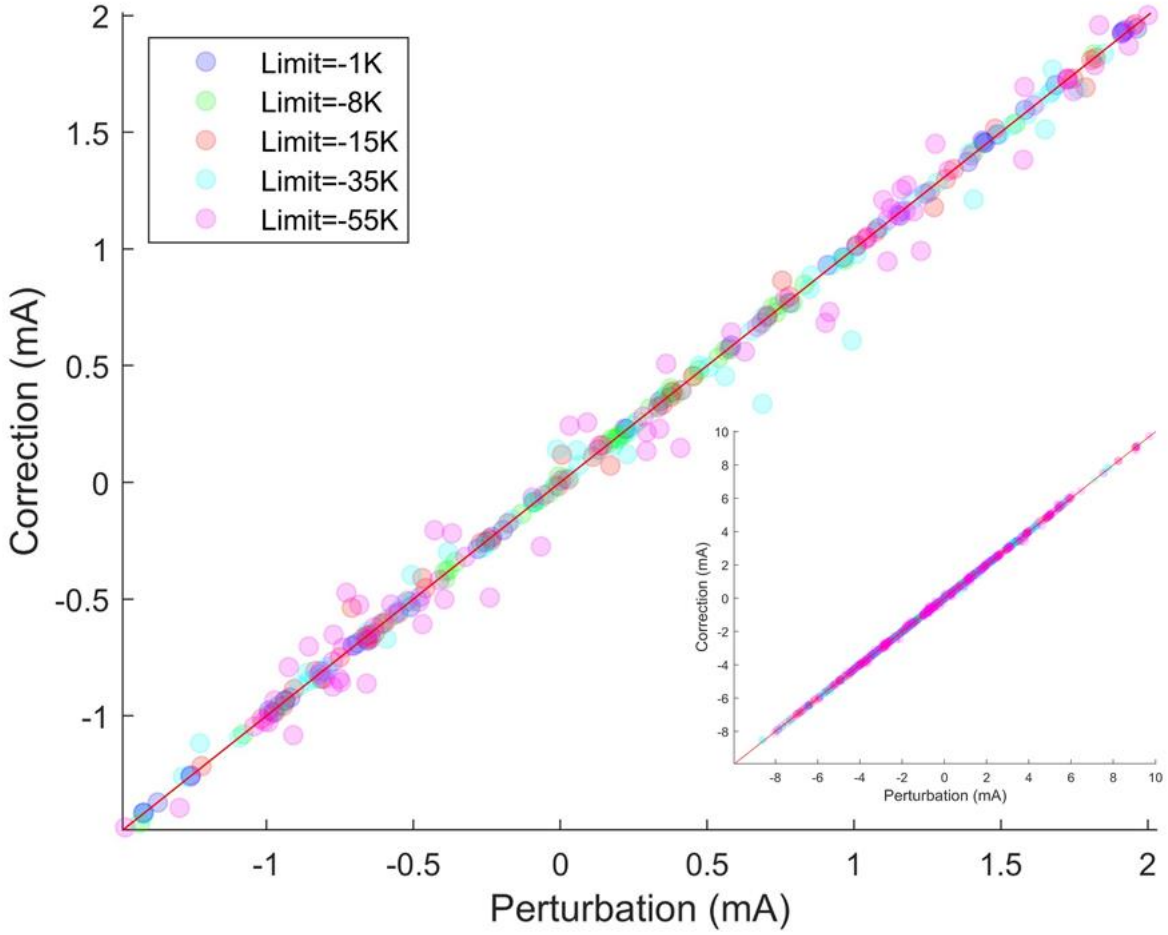


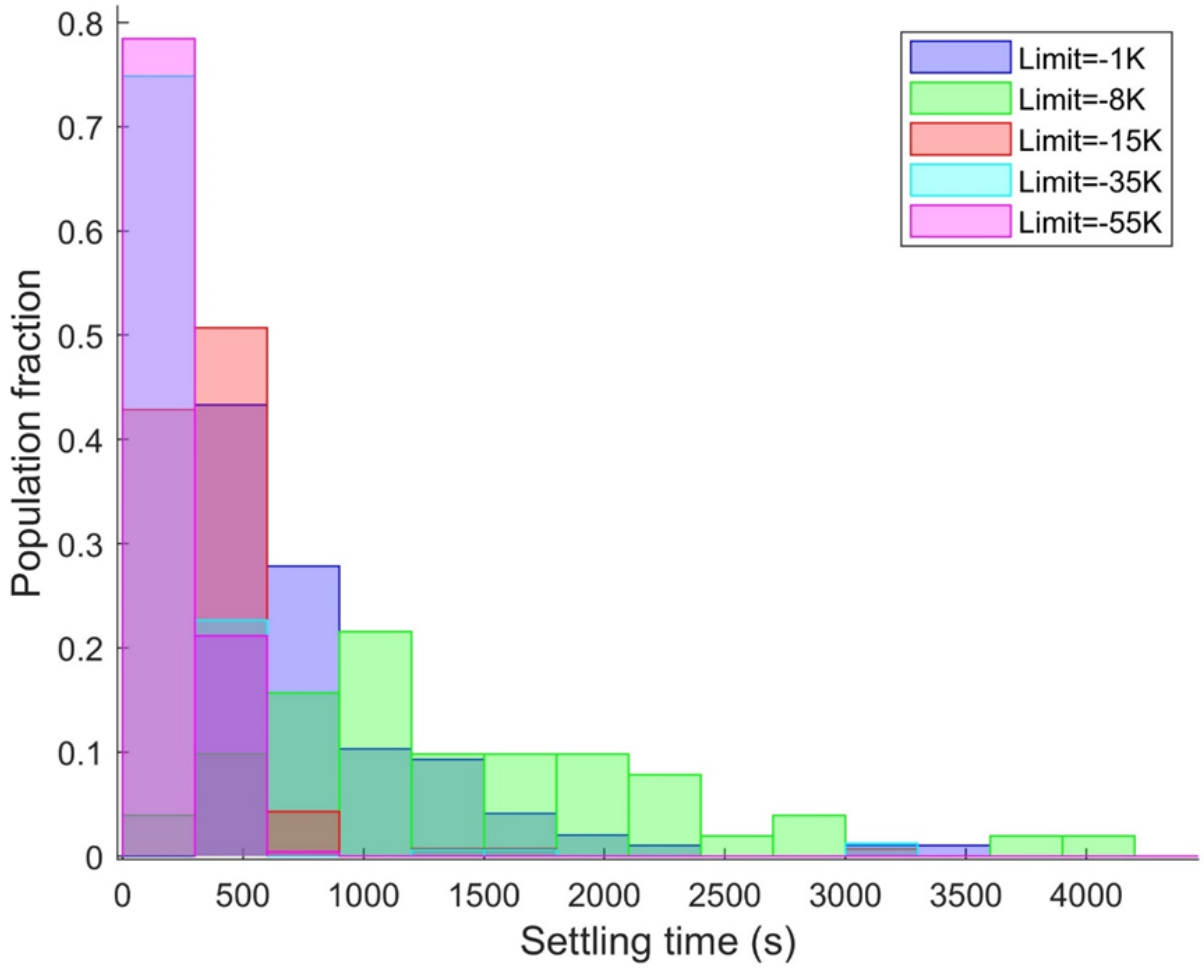
Excursion compensation from static conditions



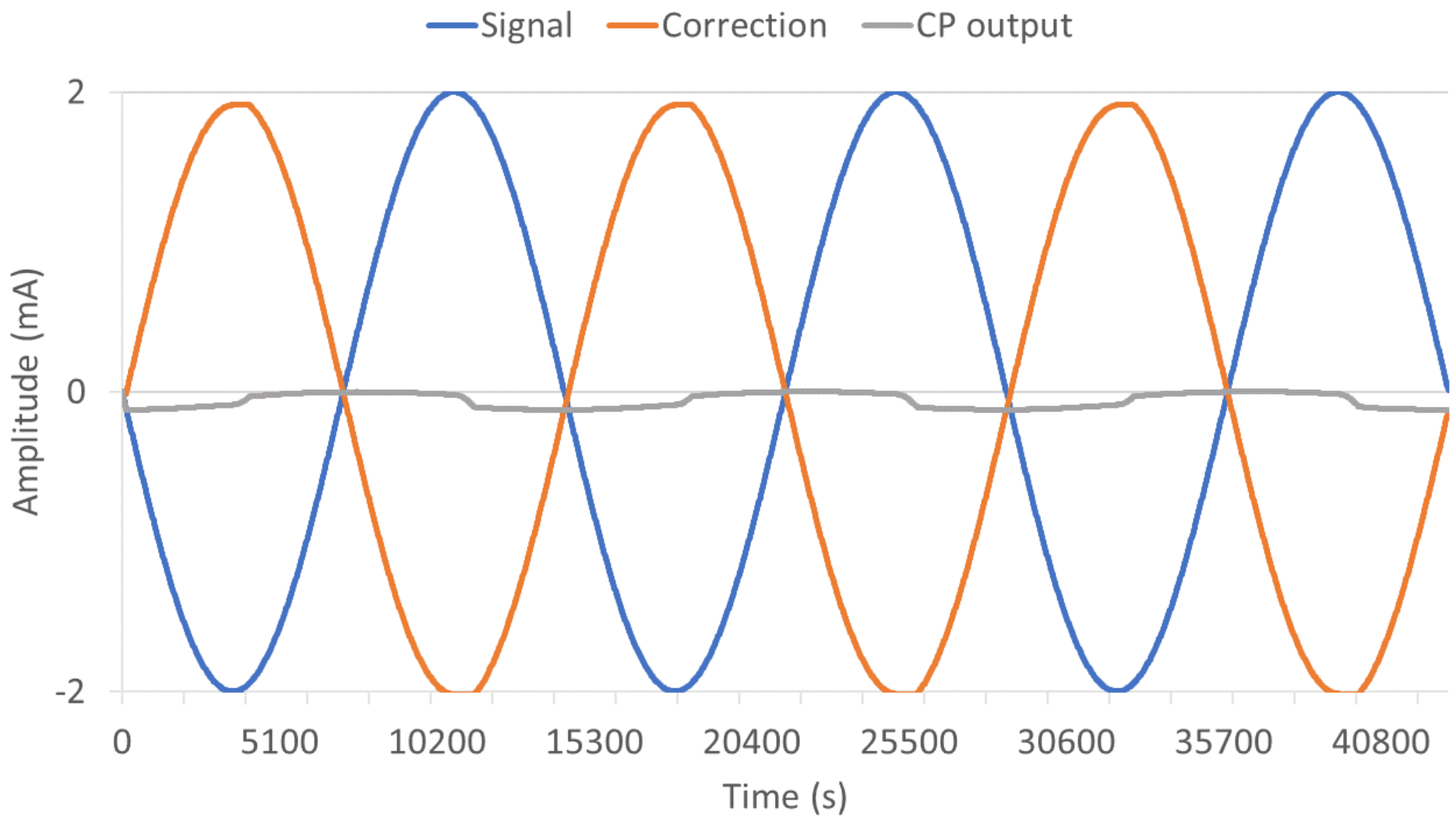


Excursion compensation from static conditions

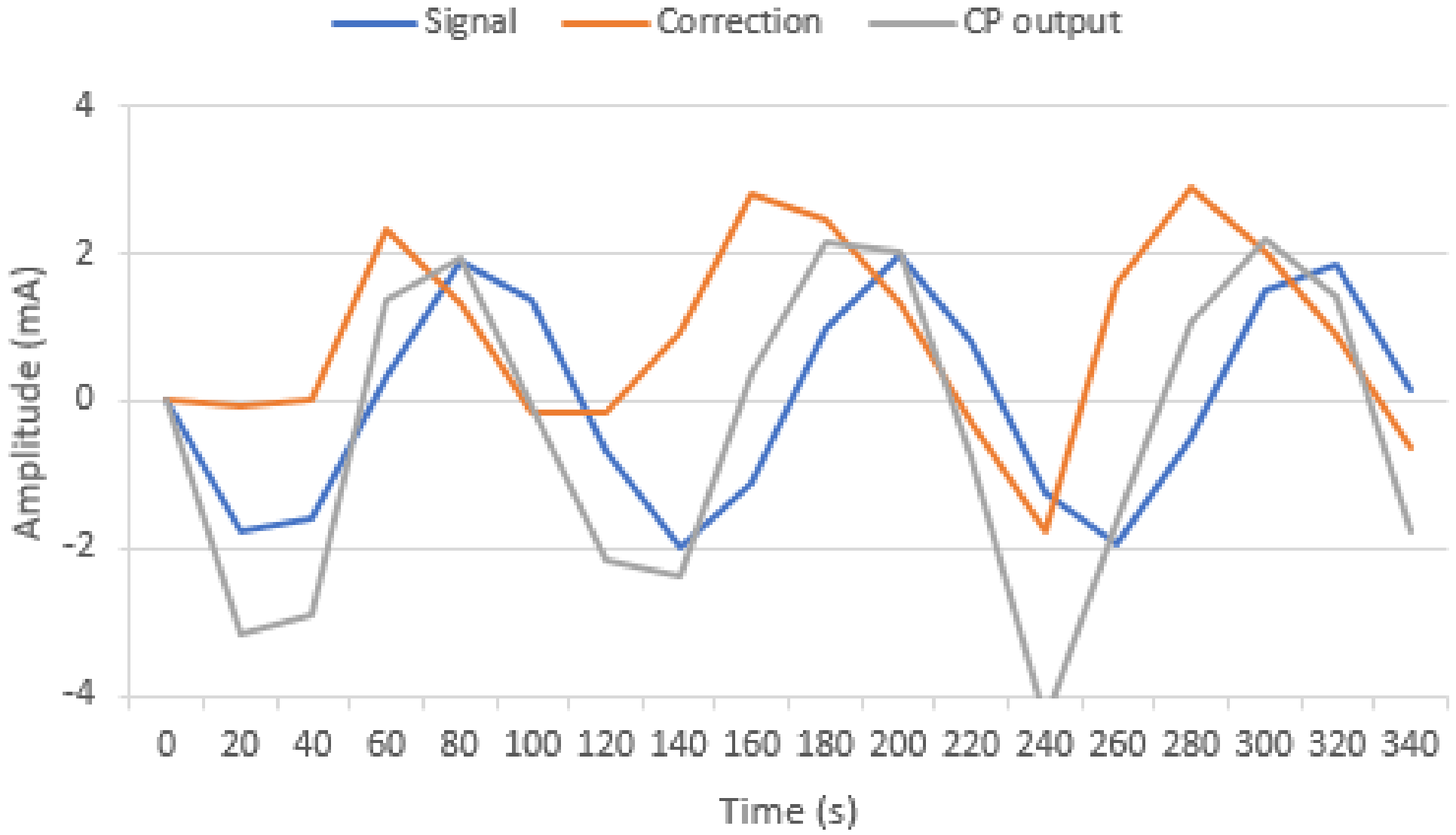




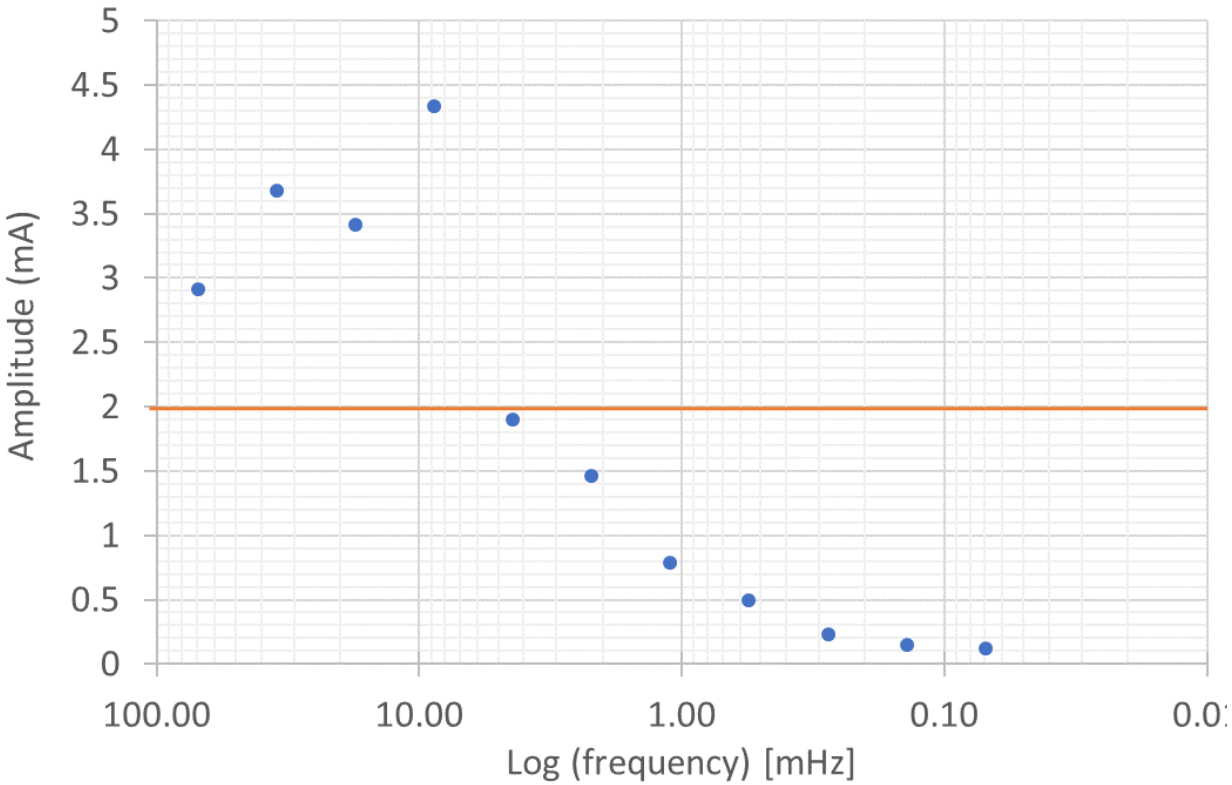
Excursion compensation from Dynamic conditions

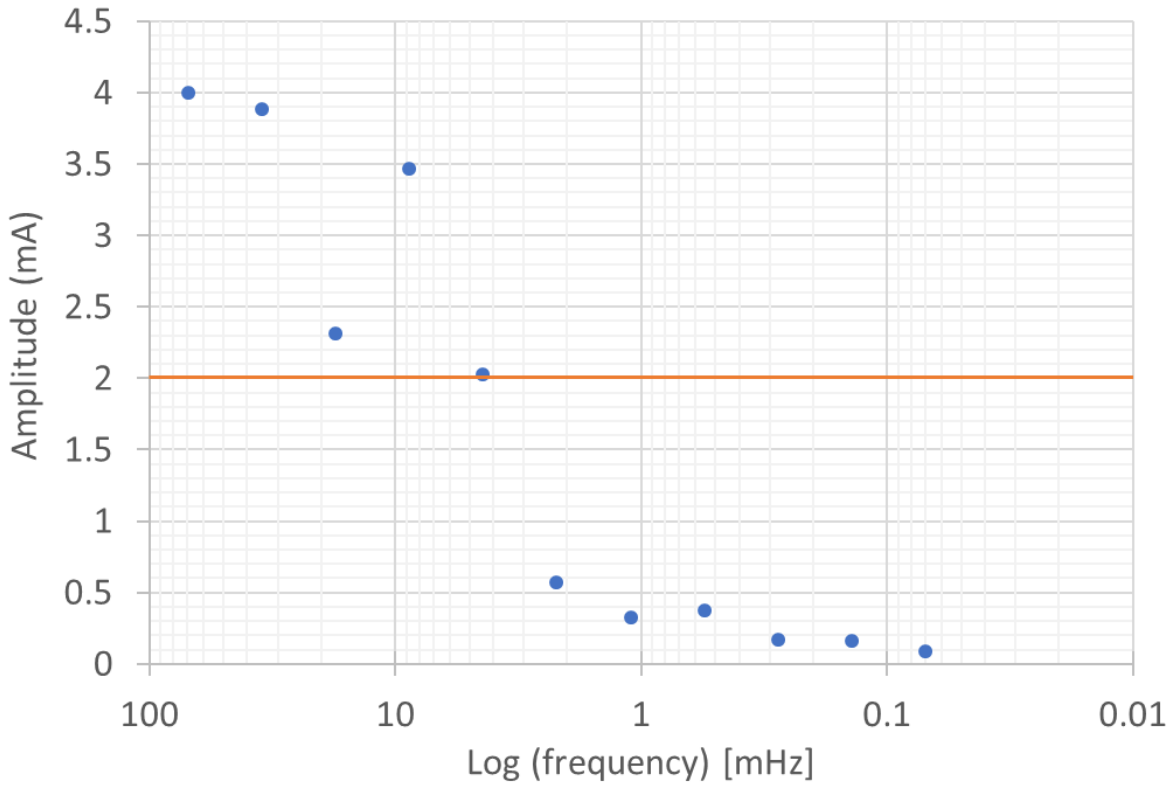


Excursion compensation from Dynamic conditions

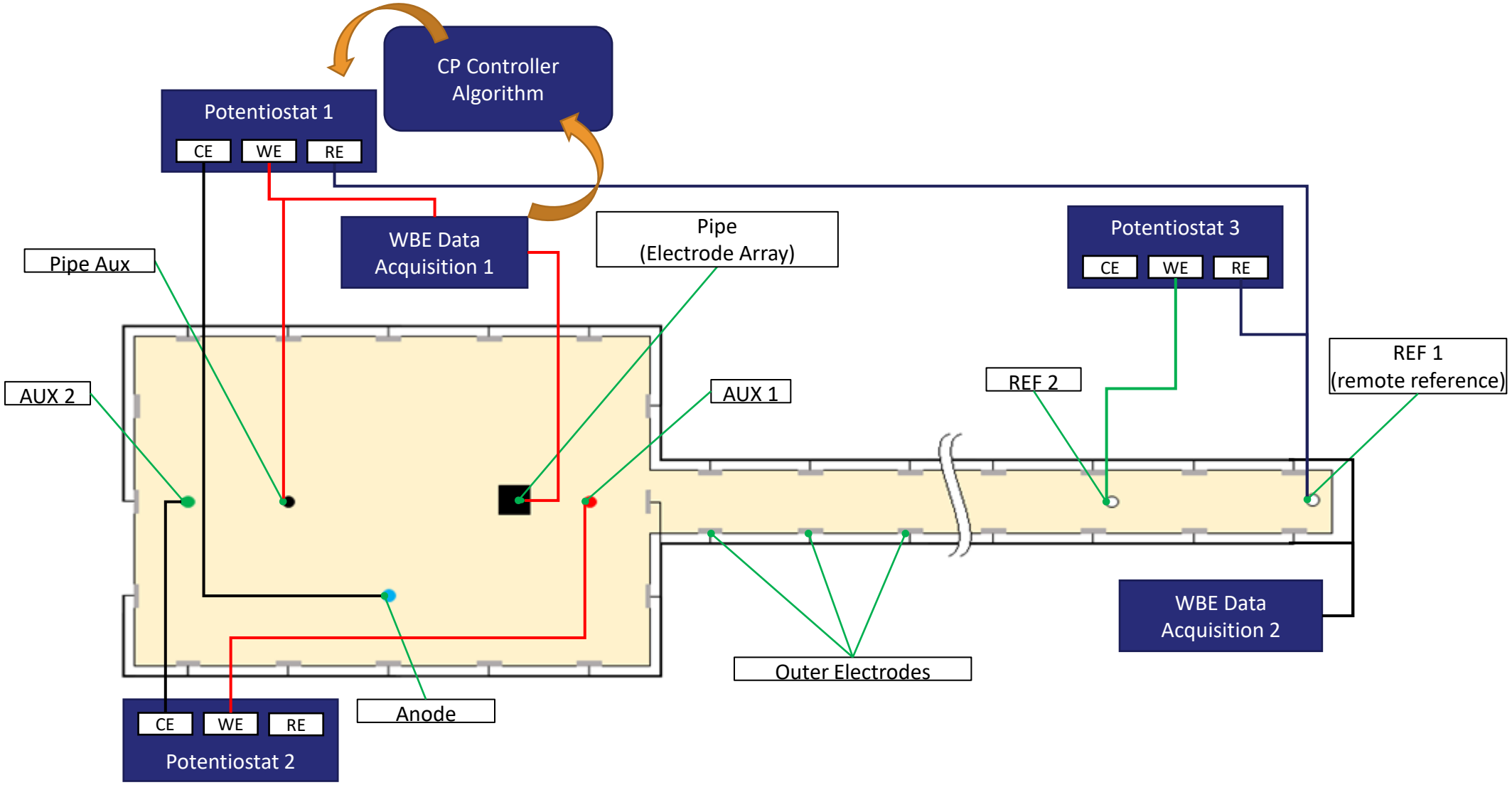


Excursion compensation from Dynamic conditions

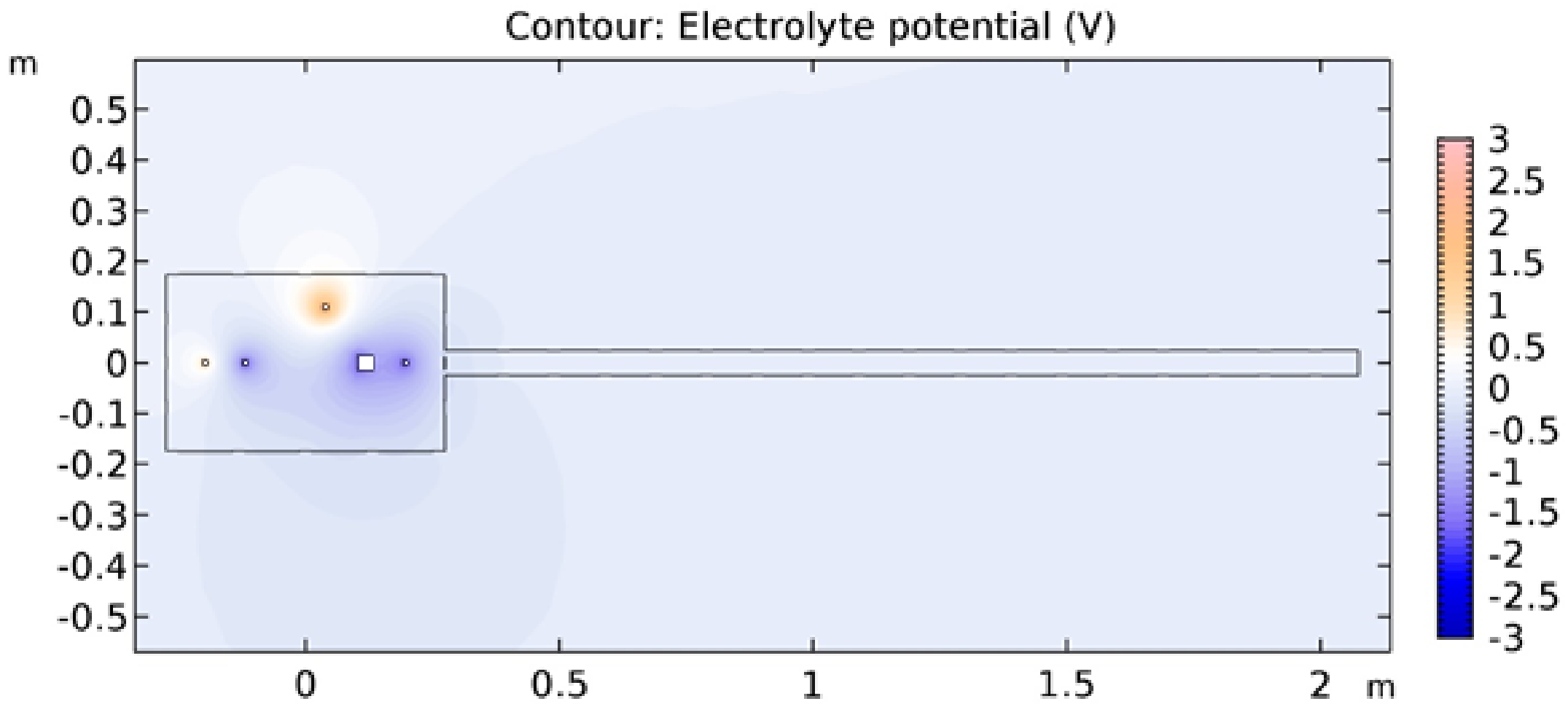




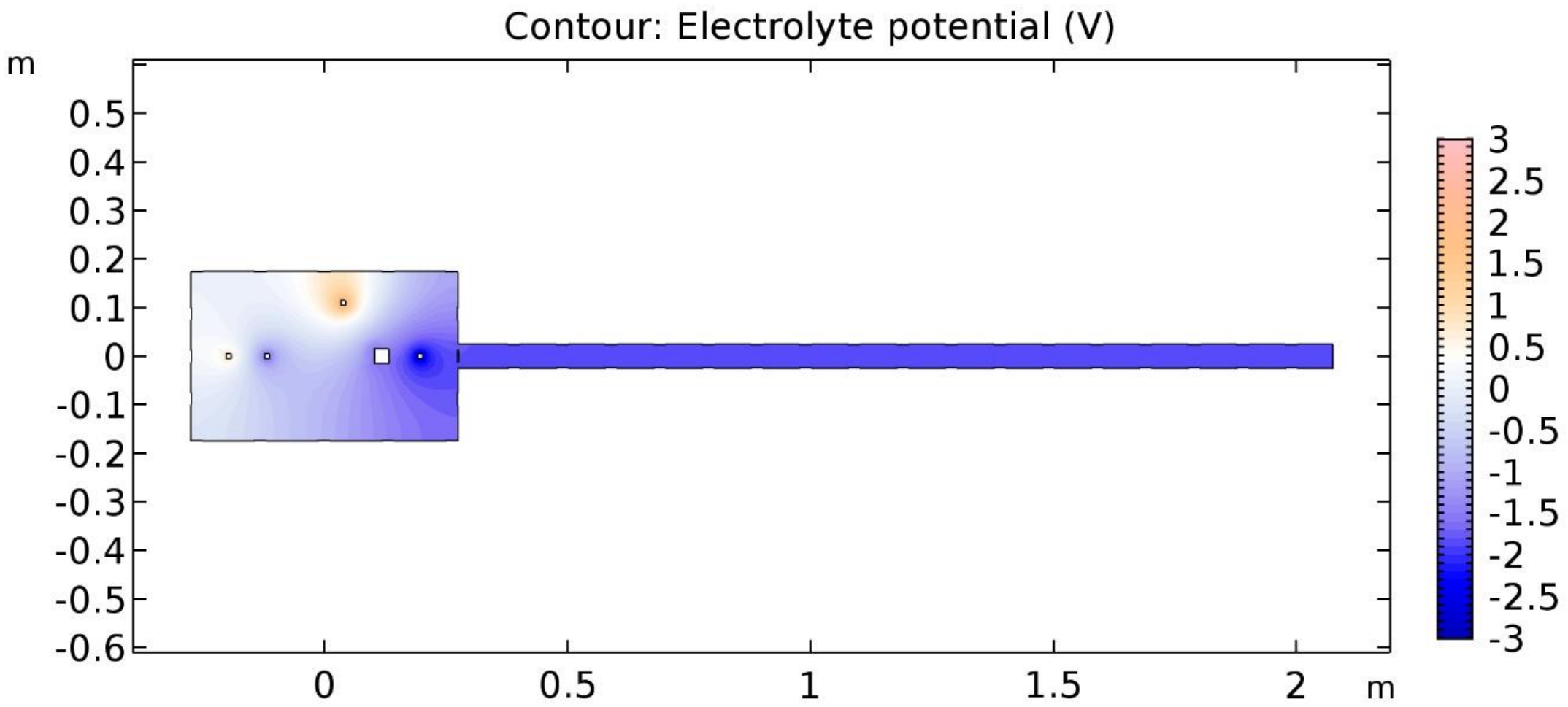
Back to back test against potentiostatic control



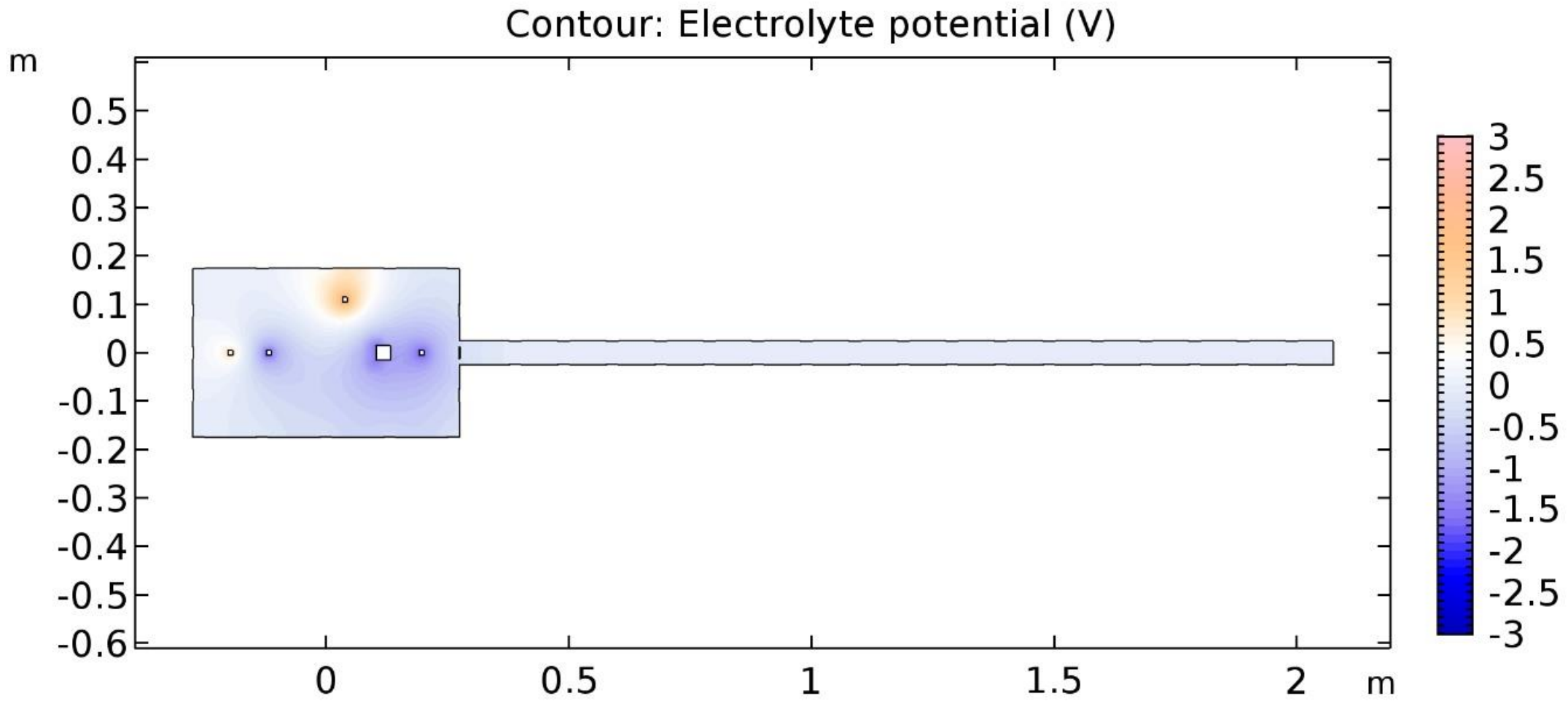
Simulation of a semi-infinite media



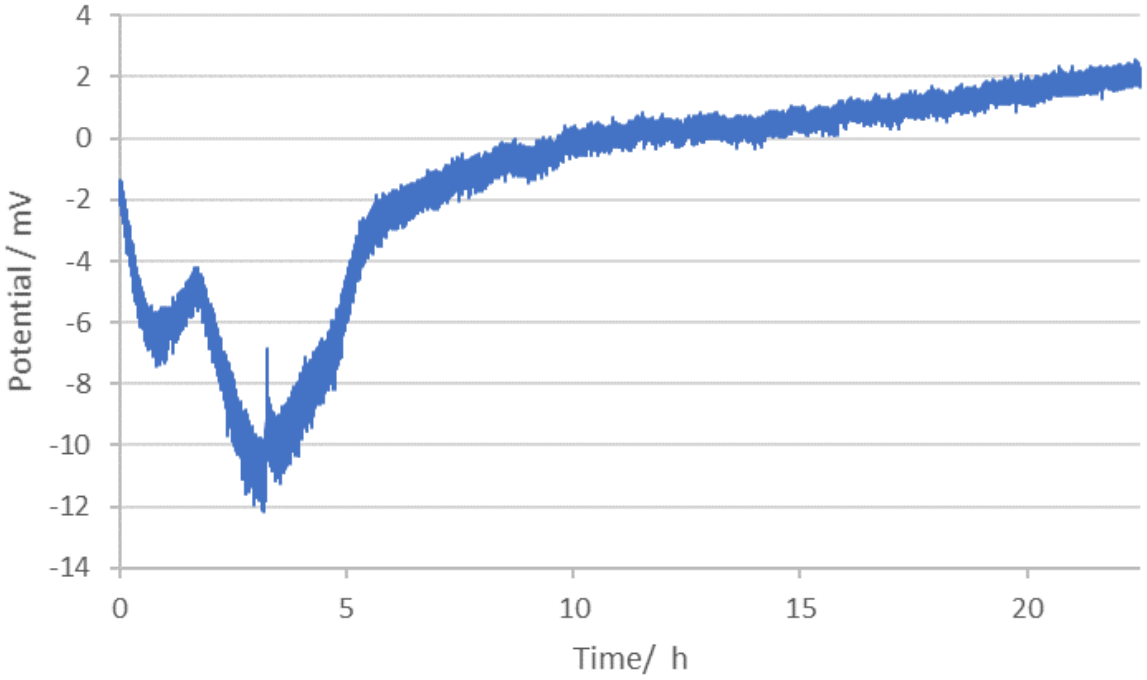
Simulation of a semi-infinite media

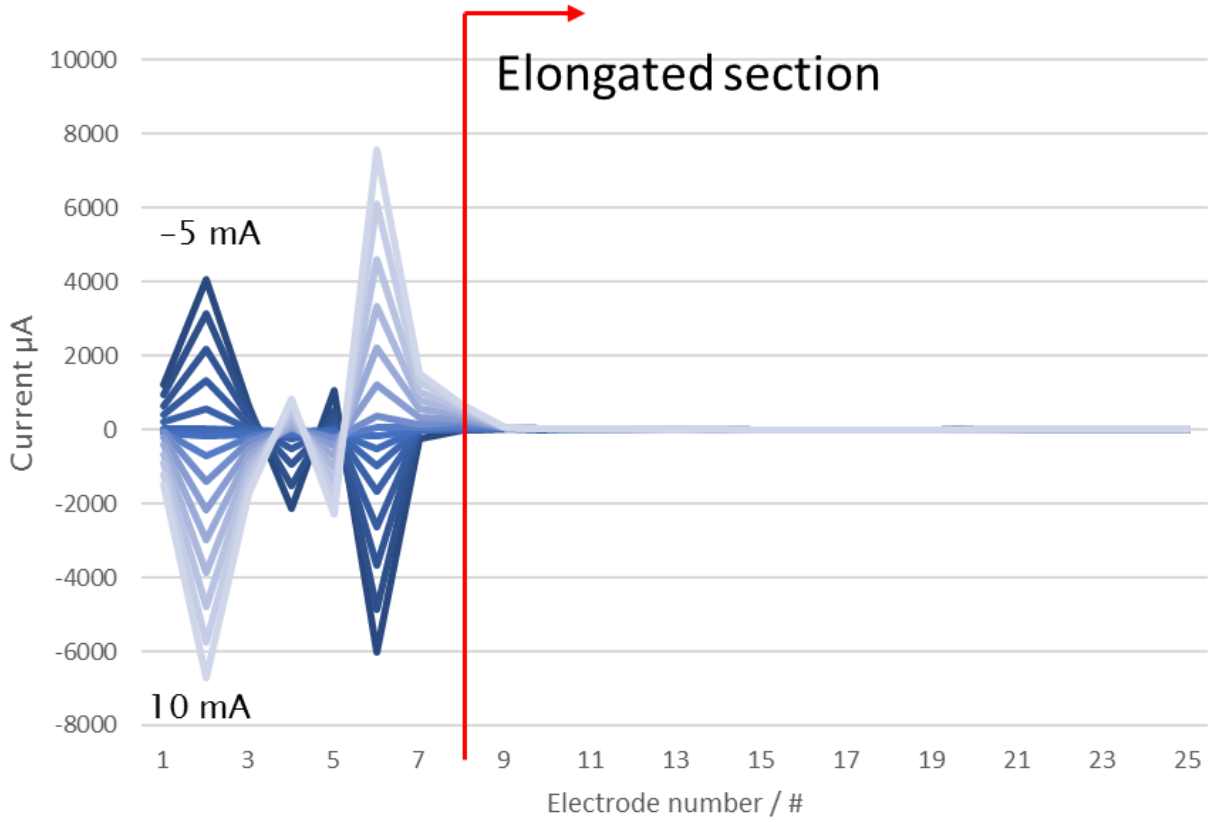


Simulation of a semi-infinite media



Simulation of a semi-infinite media

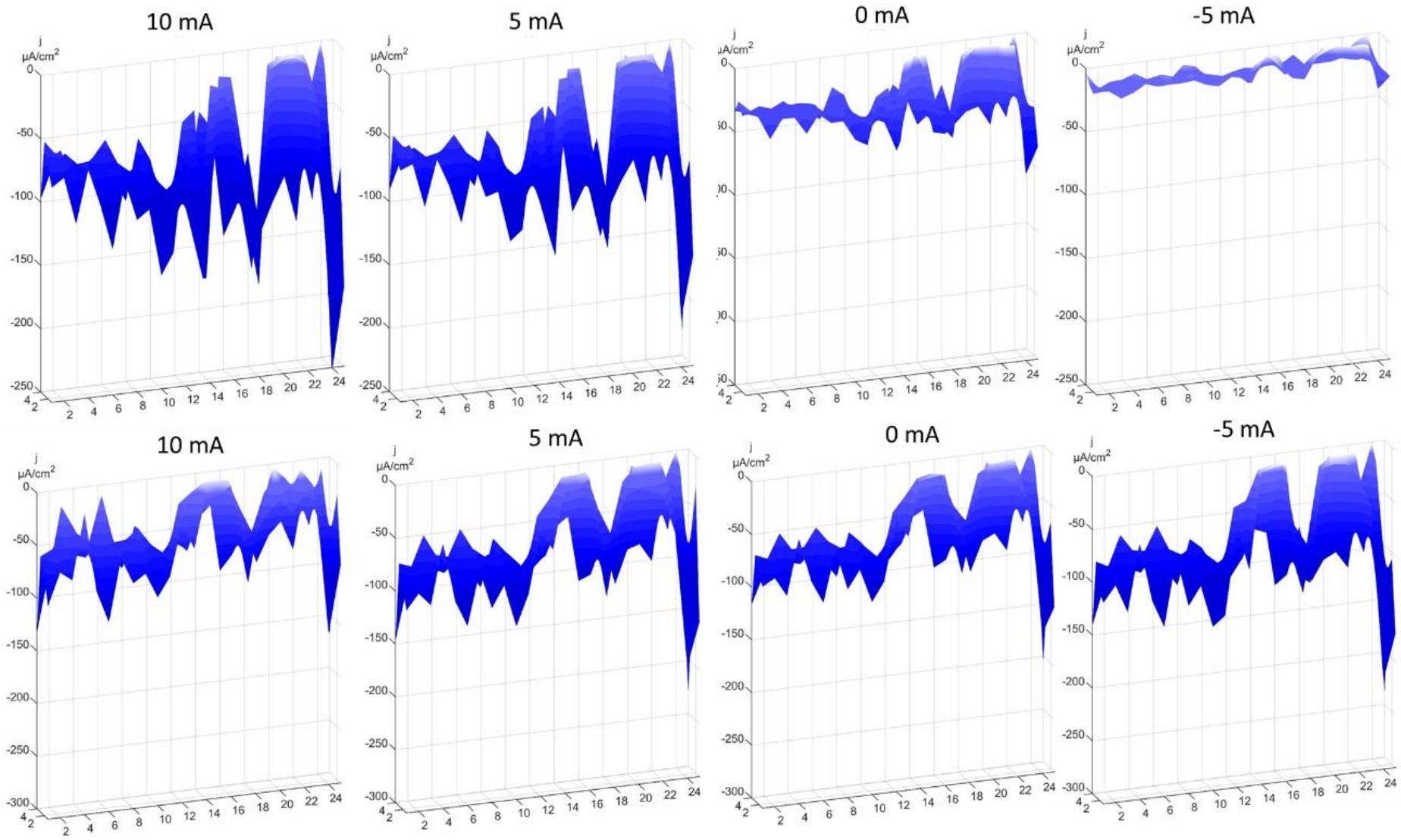




Comparison: sand and test solution at 90% WHC

Potentiostatic closed loop

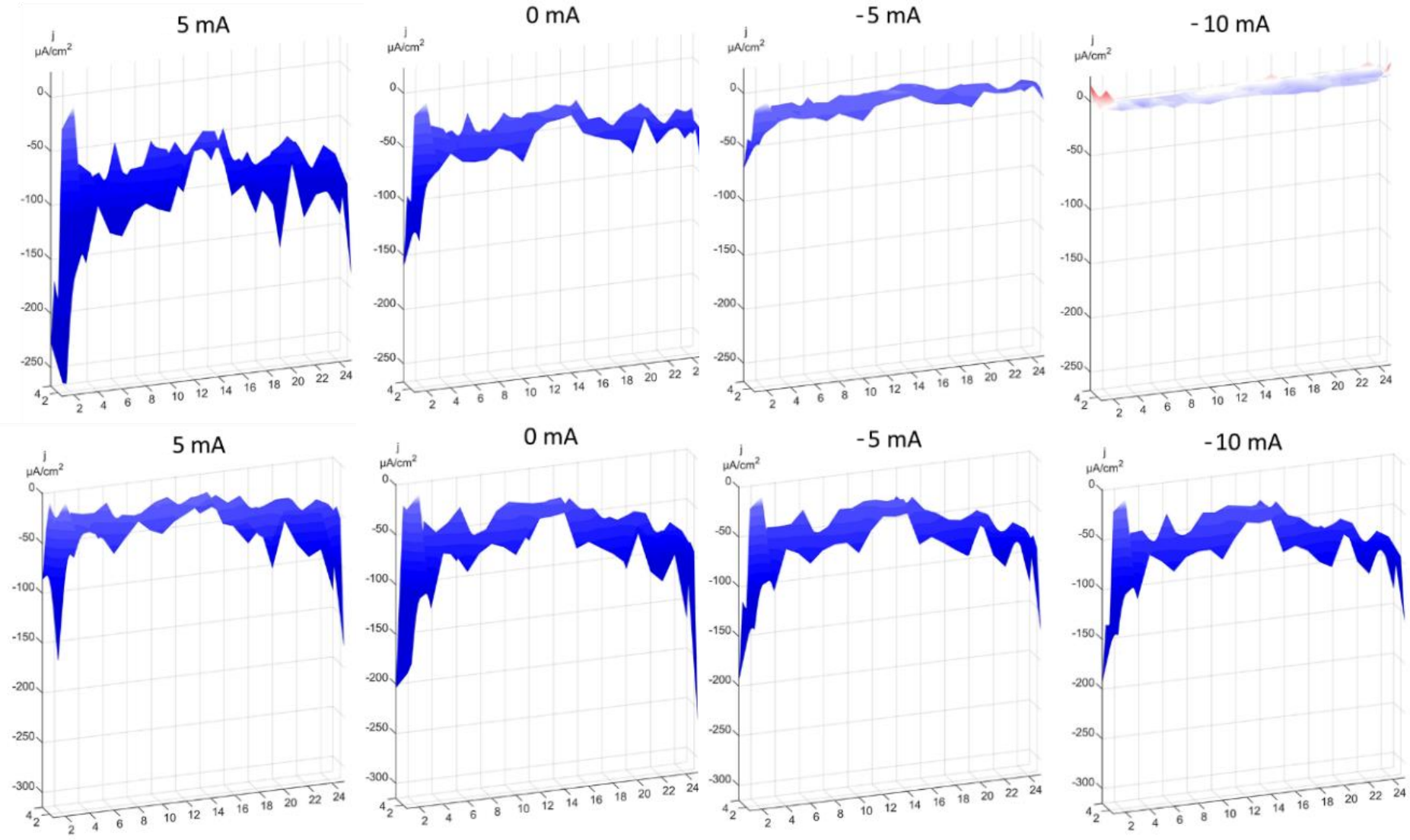
Corrosion rate closed loop



Comparison: sand and test solution at 60% WHC

Potentiostatic closed loop

Corrosion rate closed loop



Conclusions:

- The proof of concept was successful
- Excursion in CP can be compensated using proportional controllers
- Controller parameters must balance accuracy of compensations with settling time
- Under dynamic conditions, the bandwidth of the controller was limited by the sampling rate of the prototype
- The new control loop remained unmuted in stray current scenarios
- In same stray current scenario, potentiostatic control led to overprotection or underproduction

FUTURE FUELS CRC

Future Fuels CRC is supported through the Australian Government's Cooperative Research Centres Program. We gratefully acknowledge the cash and in-kind support from all our research, government and industry participants.

Australian Government
Department of Industry, Science, Energy and Resources

AusIndustry
Cooperative Research Centres Program

Thank you for your attention.