

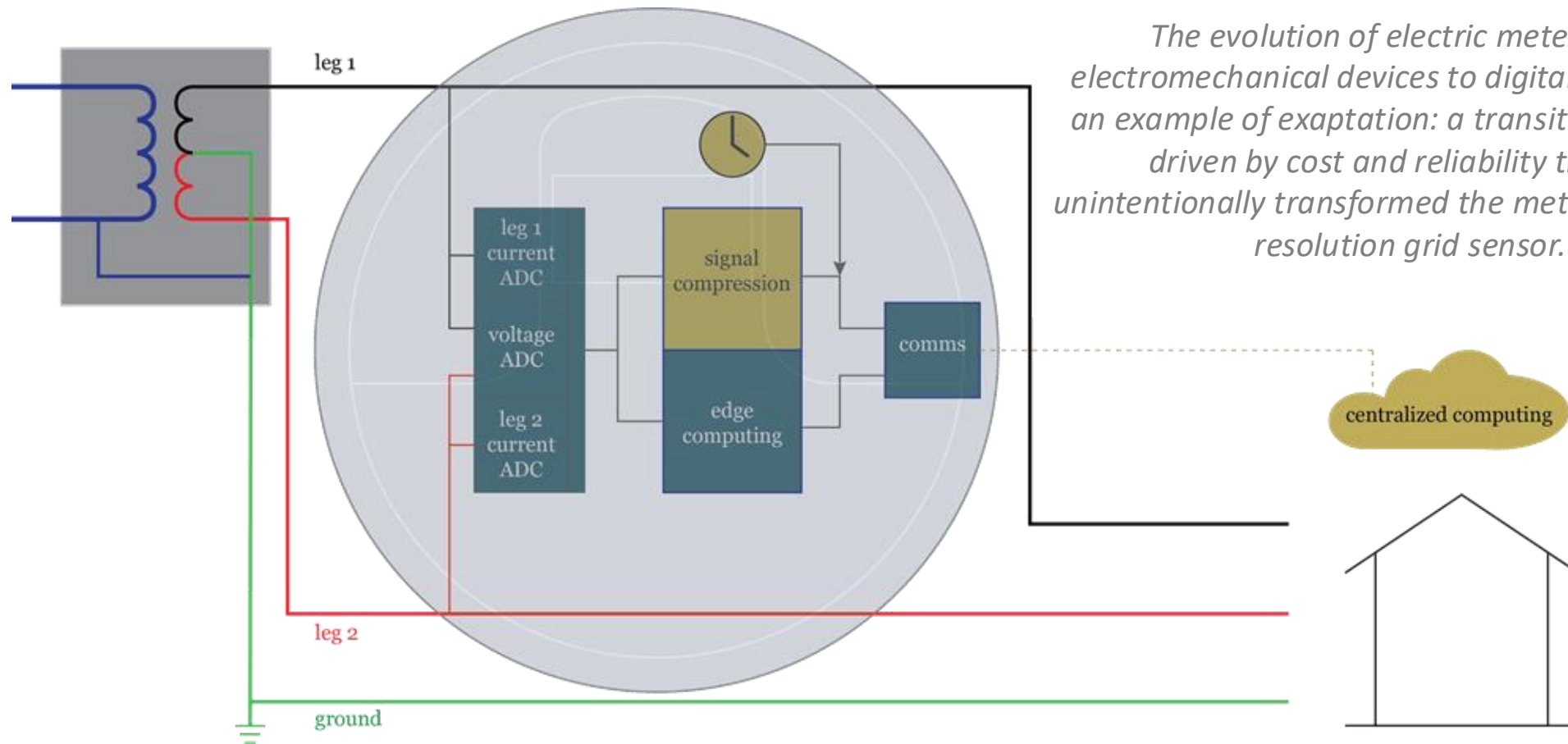


Distribution-Level Synchrophasor Monitoring Using Meters as Sensors

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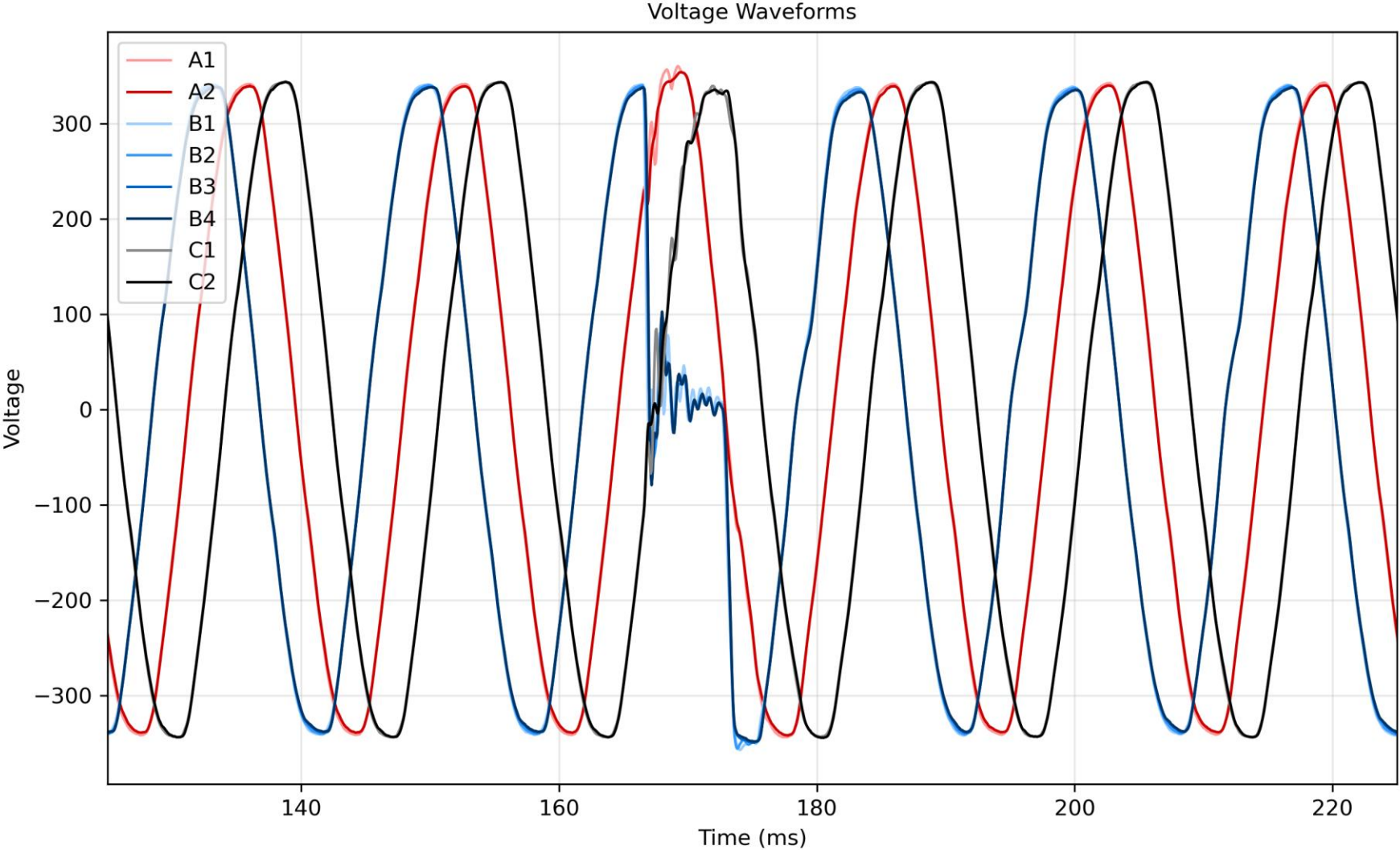
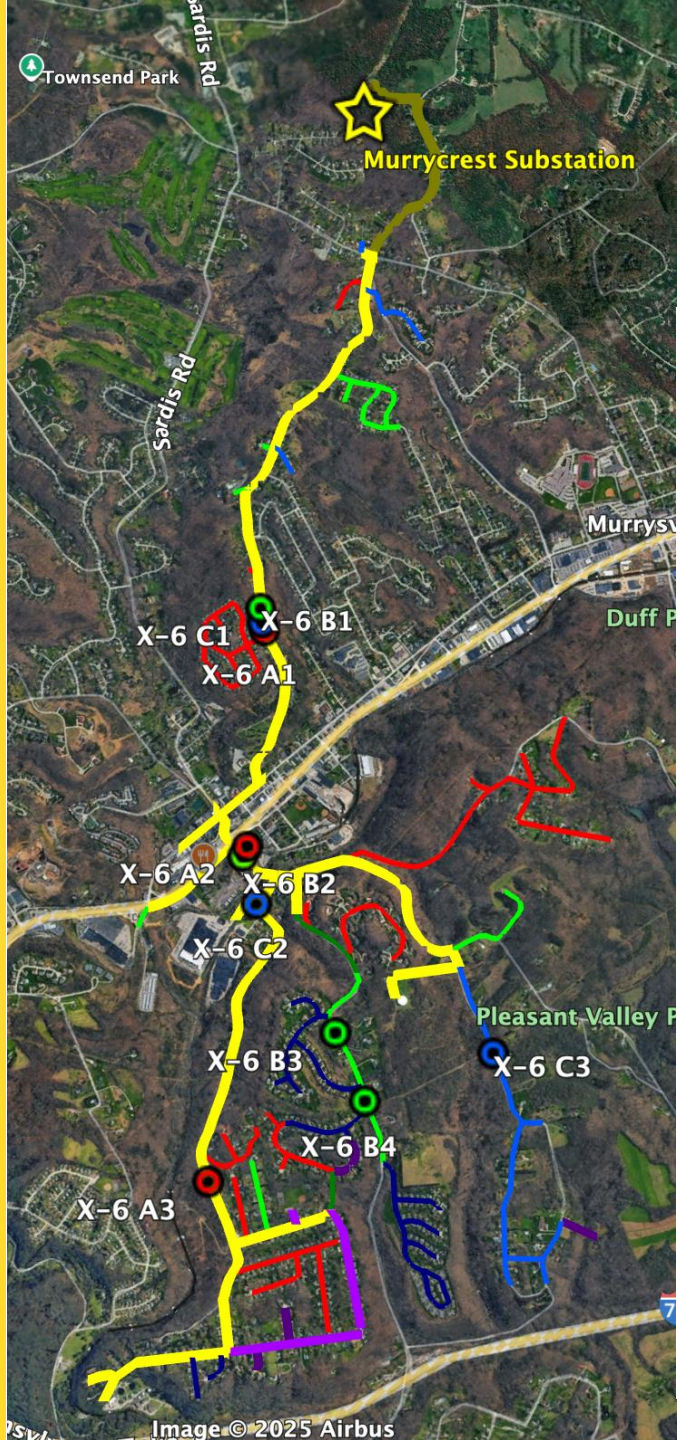


Digital meters can be sensors

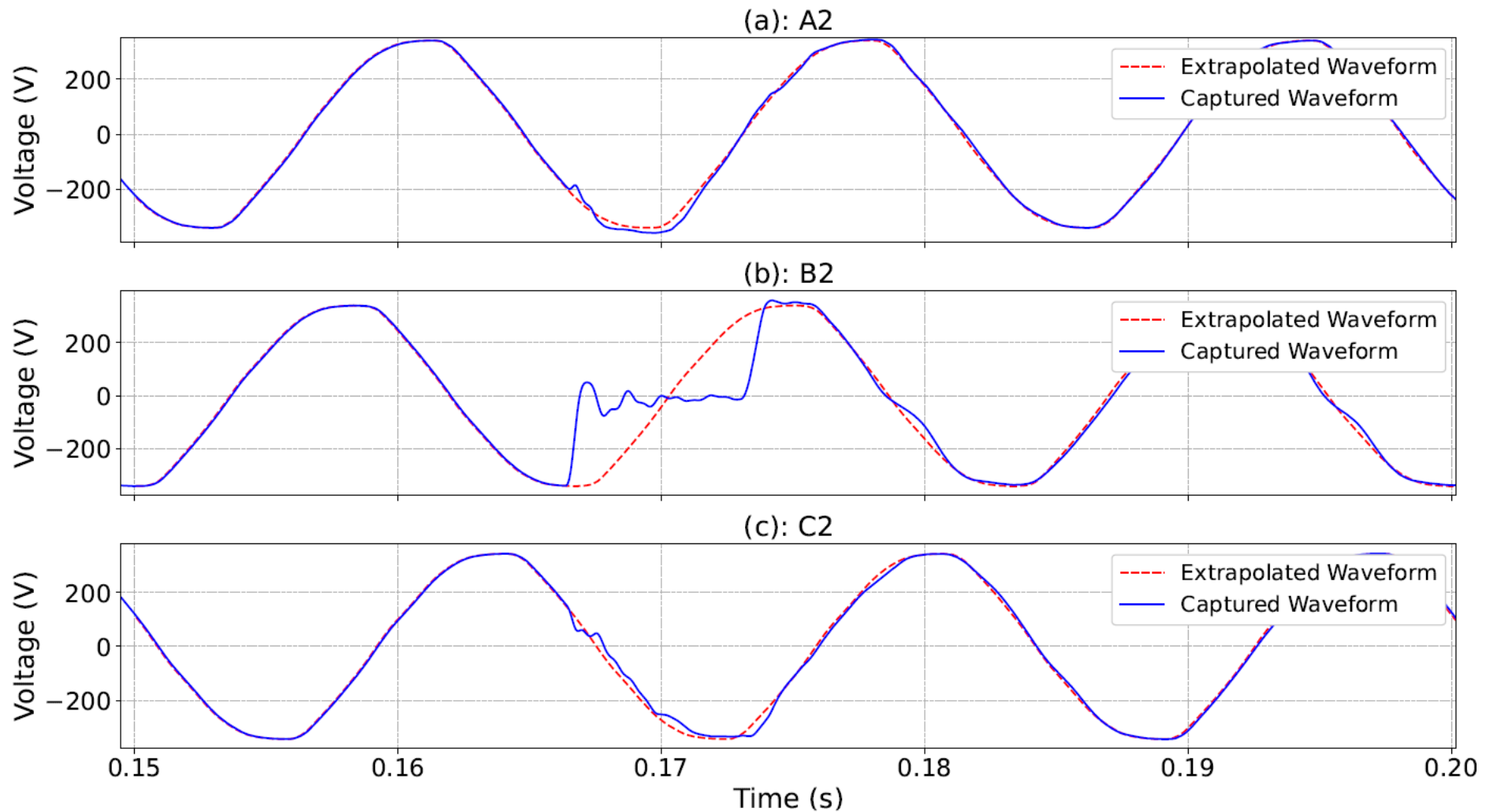


The evolution of electric meters from electromechanical devices to digital platforms is an example of exaptation: a transition originally driven by cost and reliability that has unintentionally transformed the meter into a high-resolution grid sensor.

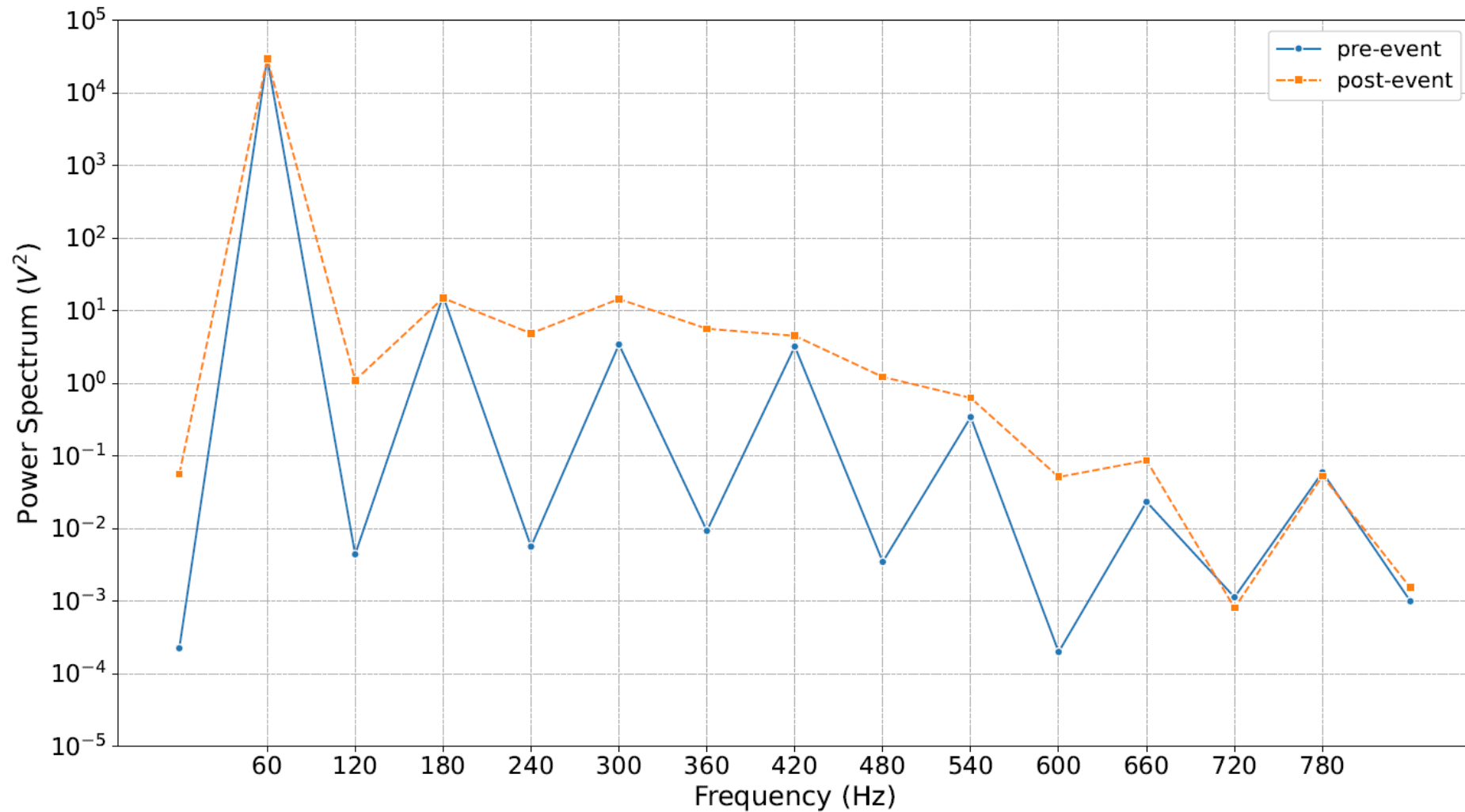
Waveform anomaly capture



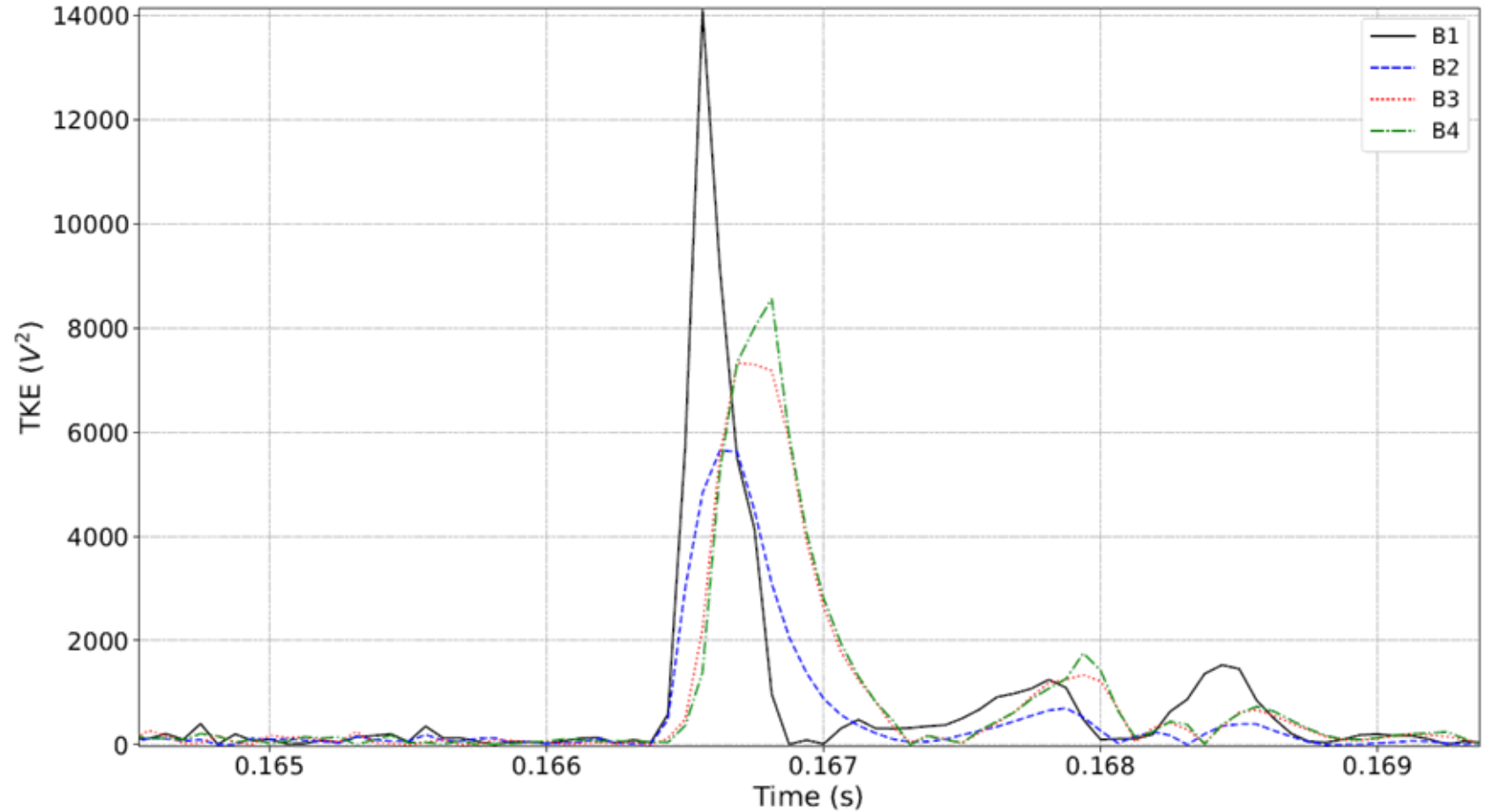
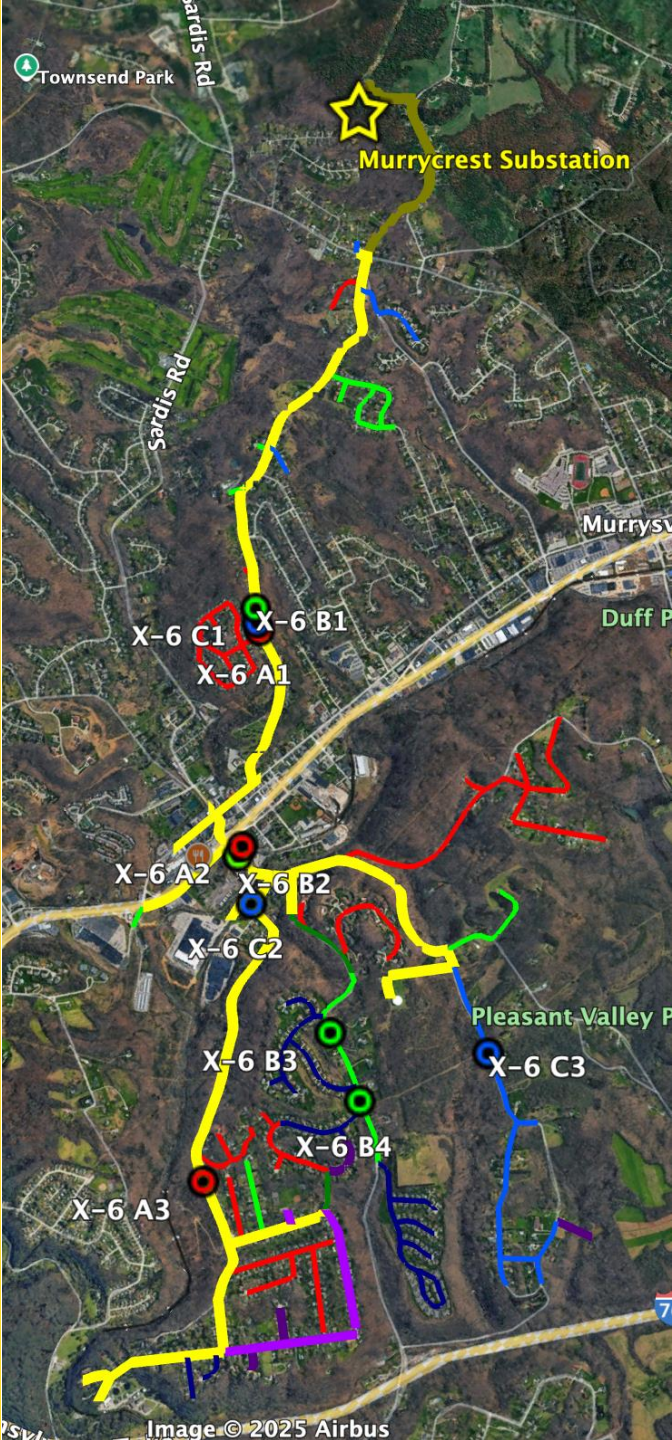
Deviation from steady state



Harmonic analysis

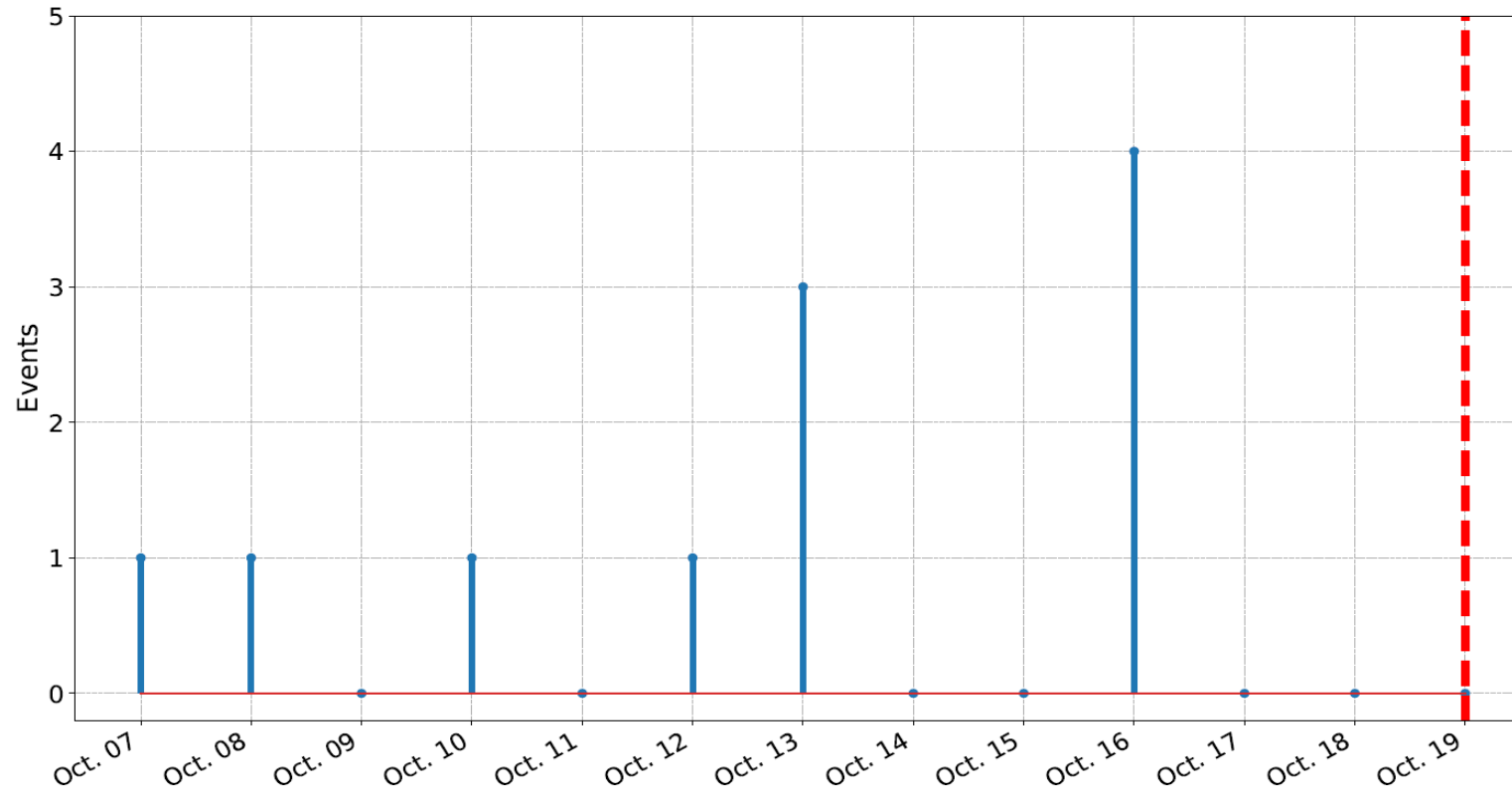


Teager Kaiser Energy (TKE)





Event Detection over Time



Conclusion

We detected an arcing underground cable as it was failing

- 1 arc persists past zero crossing:: underground dielectric conduction
- 2 even harmonics:: residual rectification
- 3 TKE direction-of-arrival:: localizes underground segment
- 4 increasing event frequency:: insulation degradation

Hypothesis confirmed when cable failed permanently on Oct 19



Now imagine synchronized waveforms from every meter on the feeder