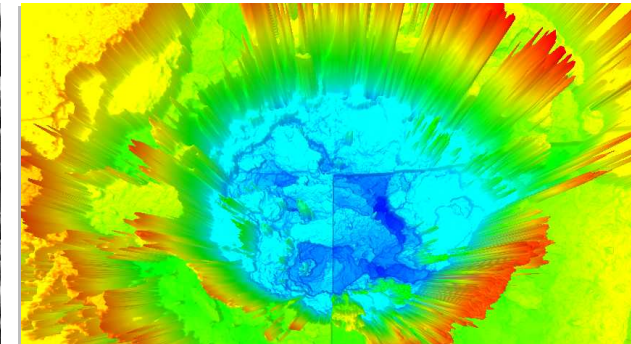
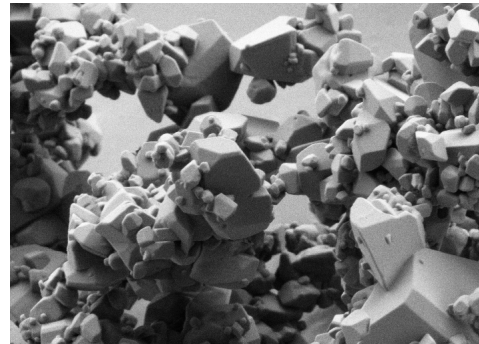


Exceptional service in the national interest



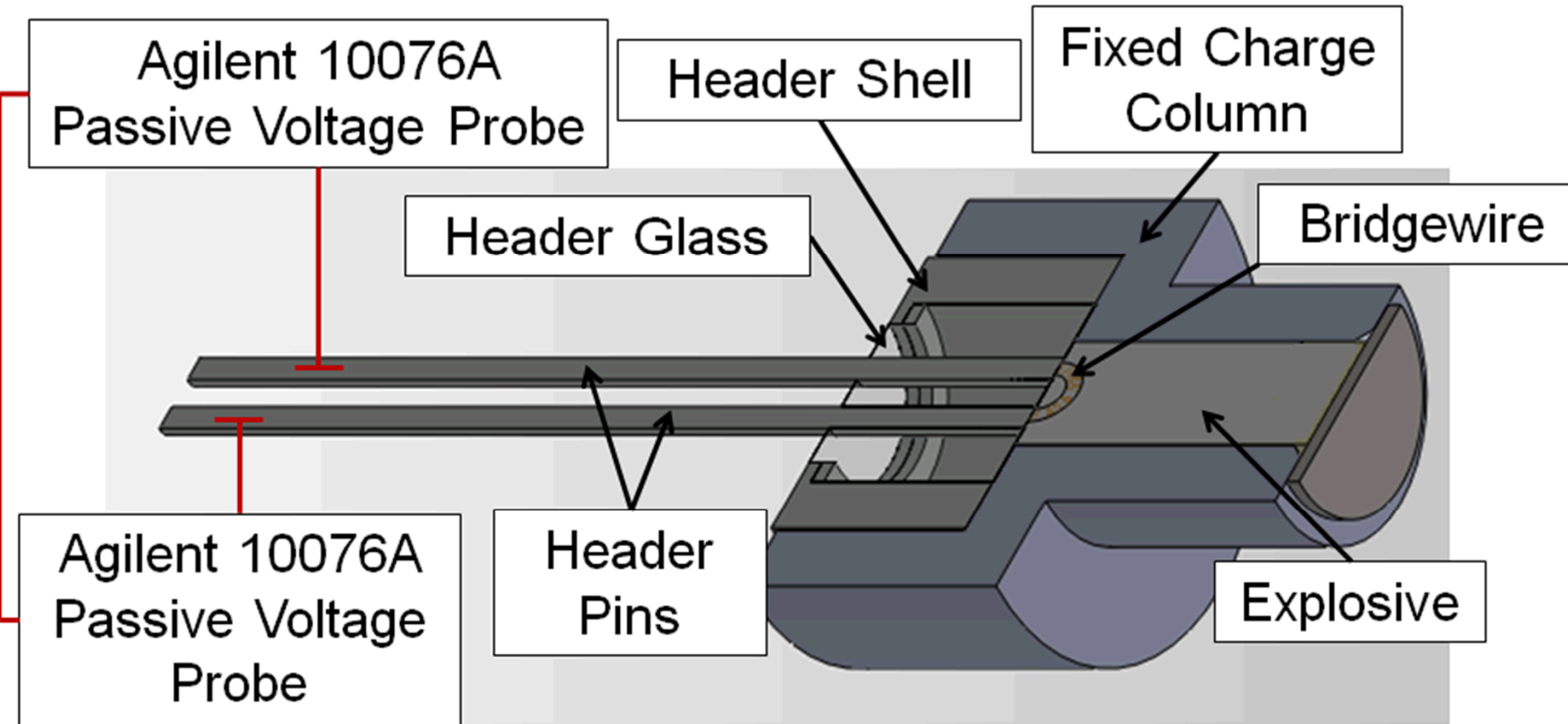
Power and Energy of Exploding Wires

Cole Valancius, Christopher Garasi, Patrick O'Malley

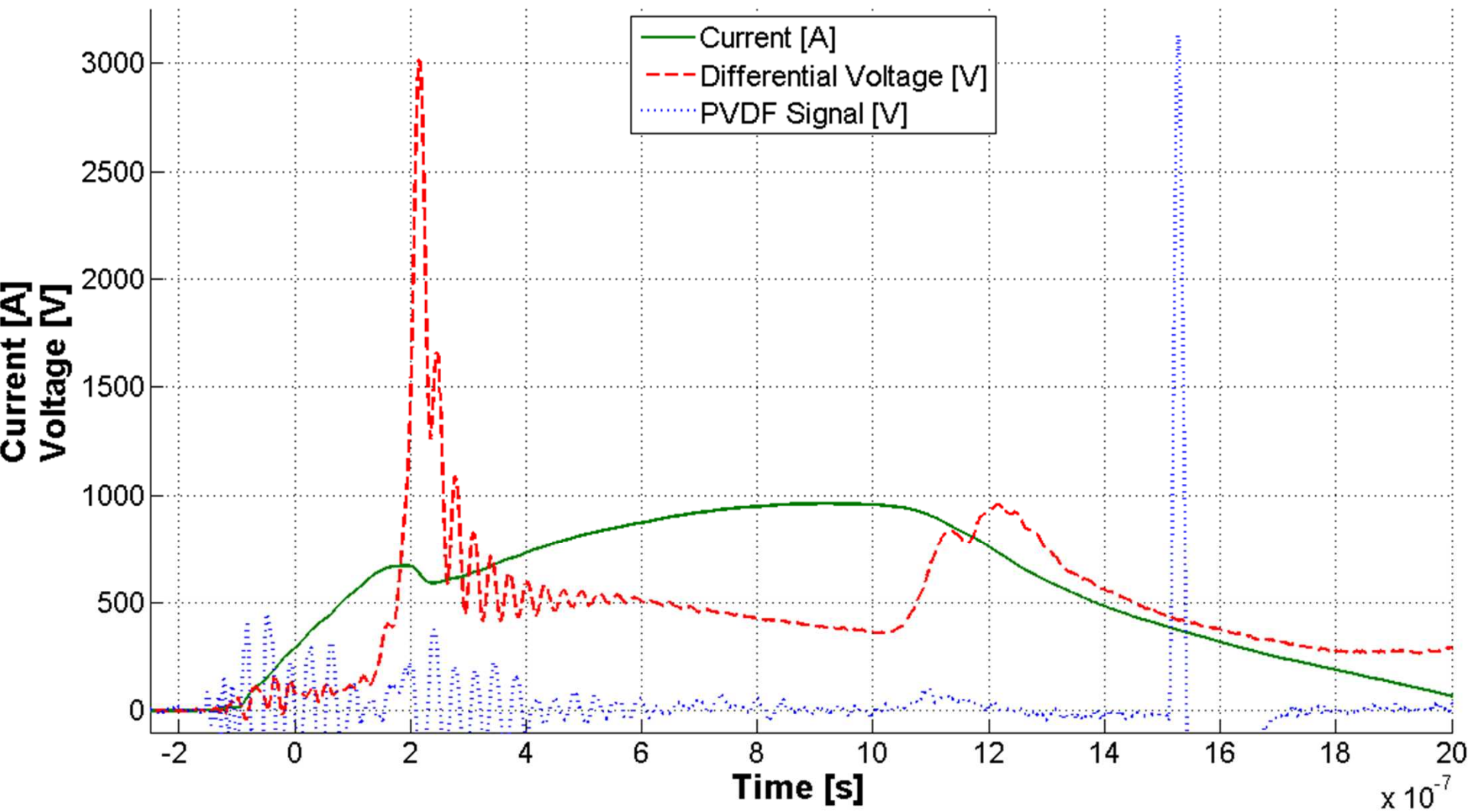
Sandia National Laboratories,

Albuquerque, NM

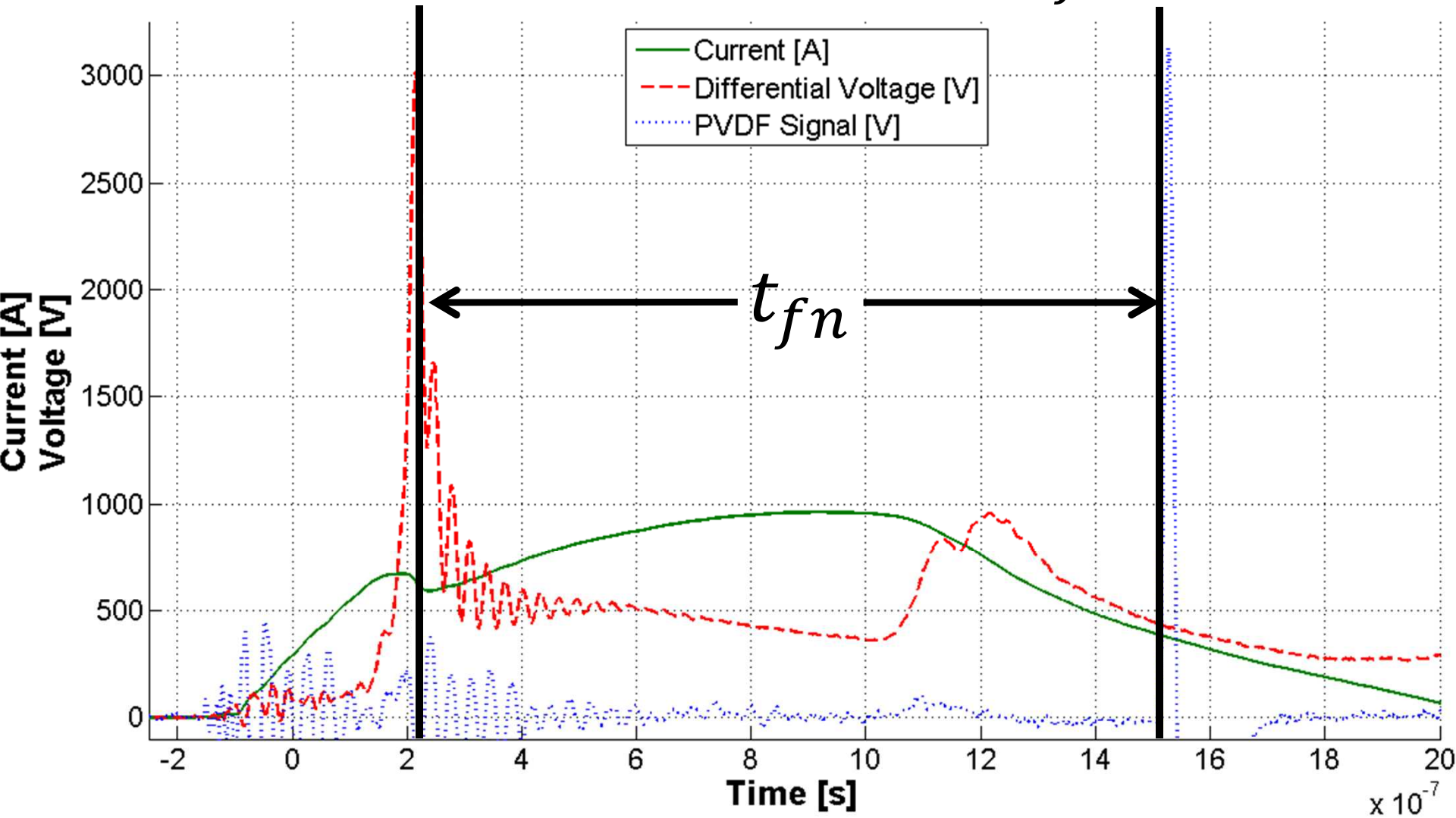
The Test Article



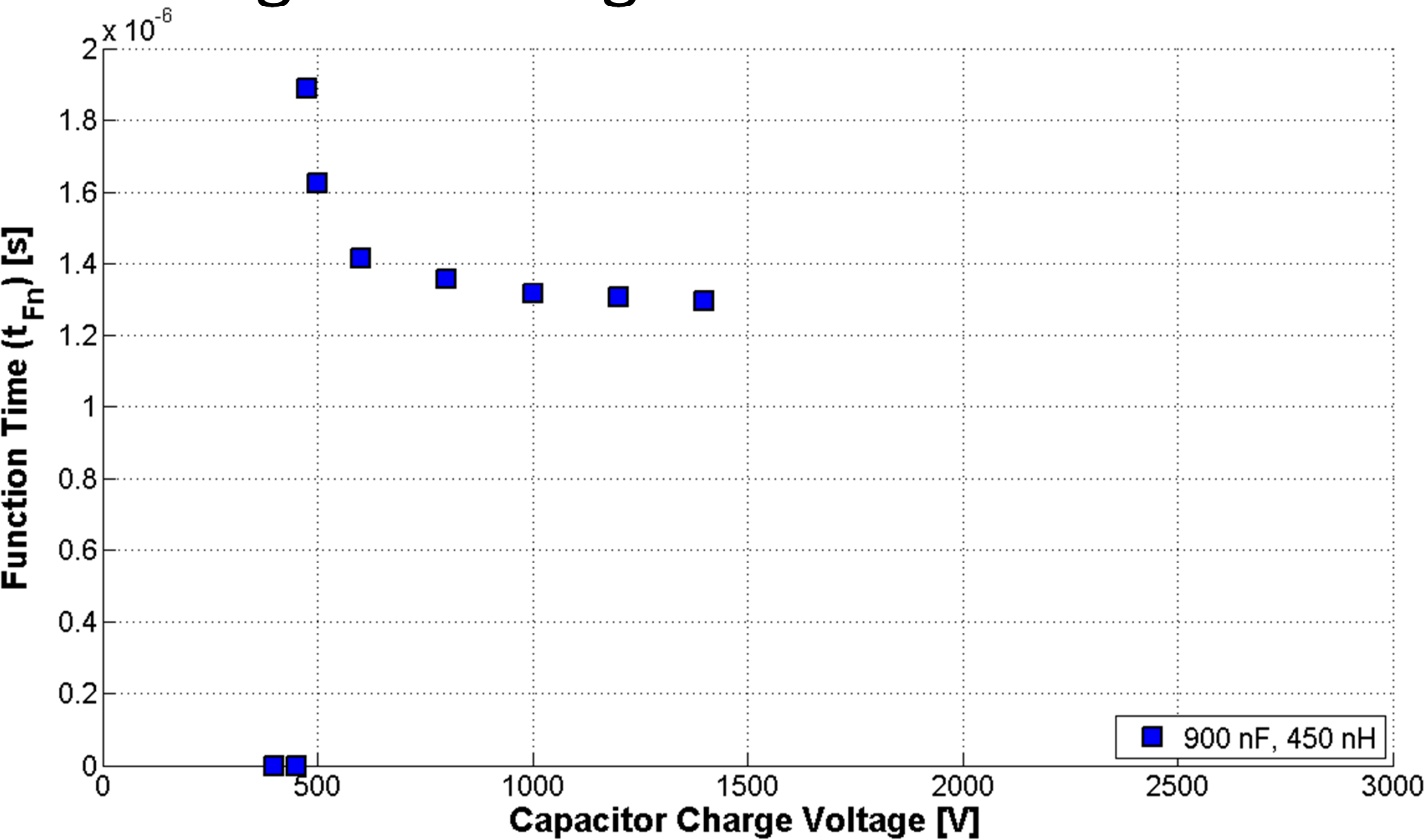
Typical Test Data



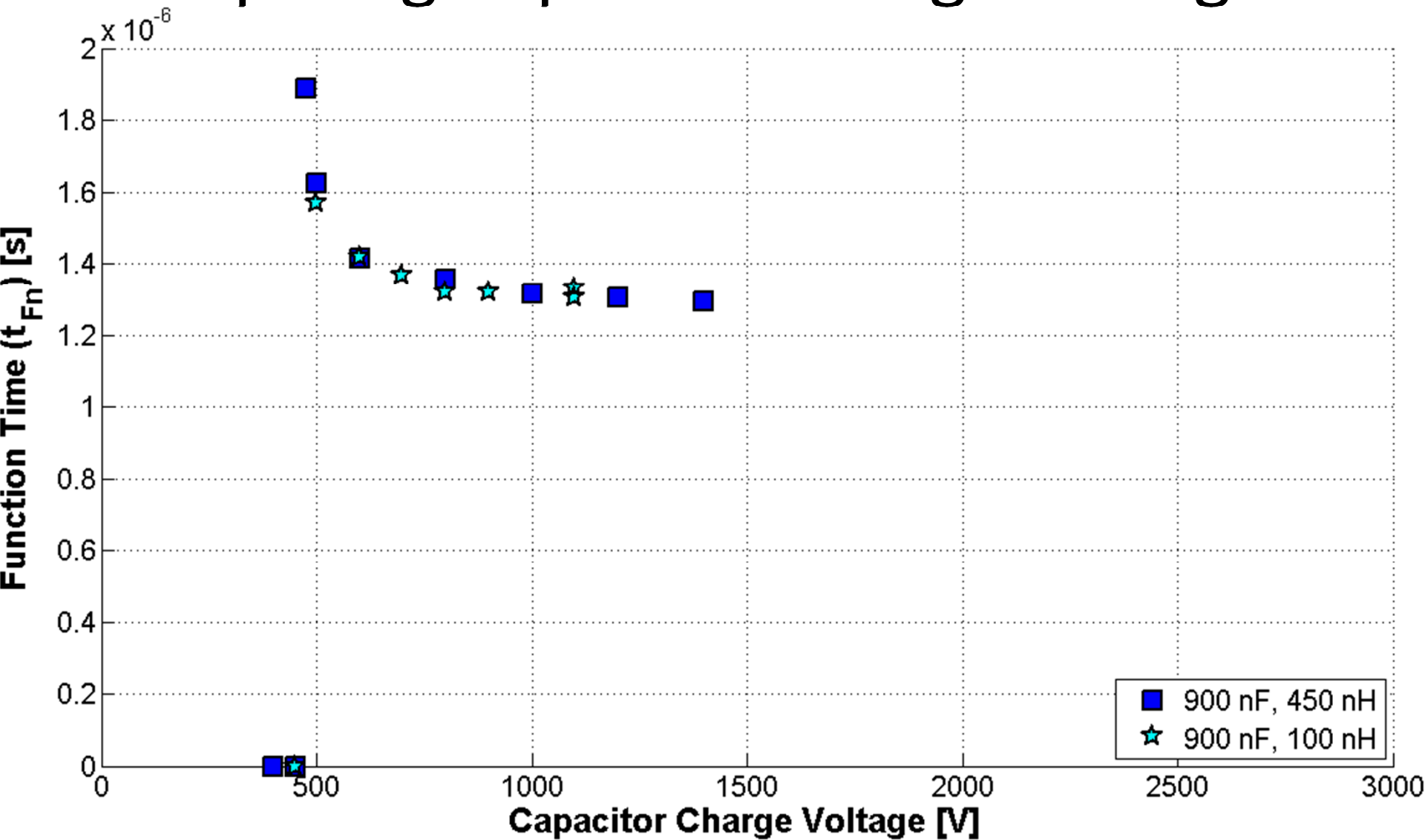
Definition of Function Time (t_{fn})



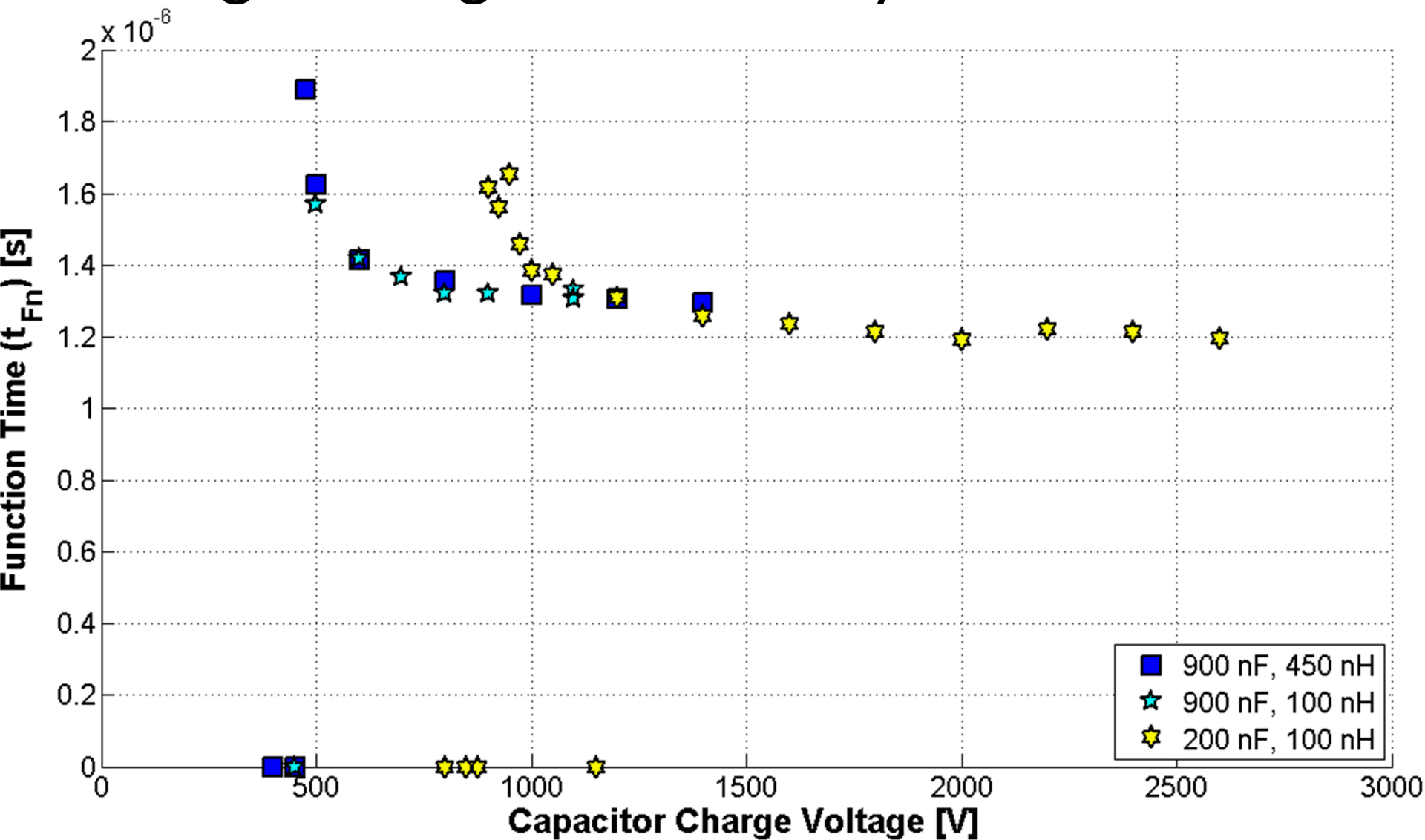
Voltage Scanning



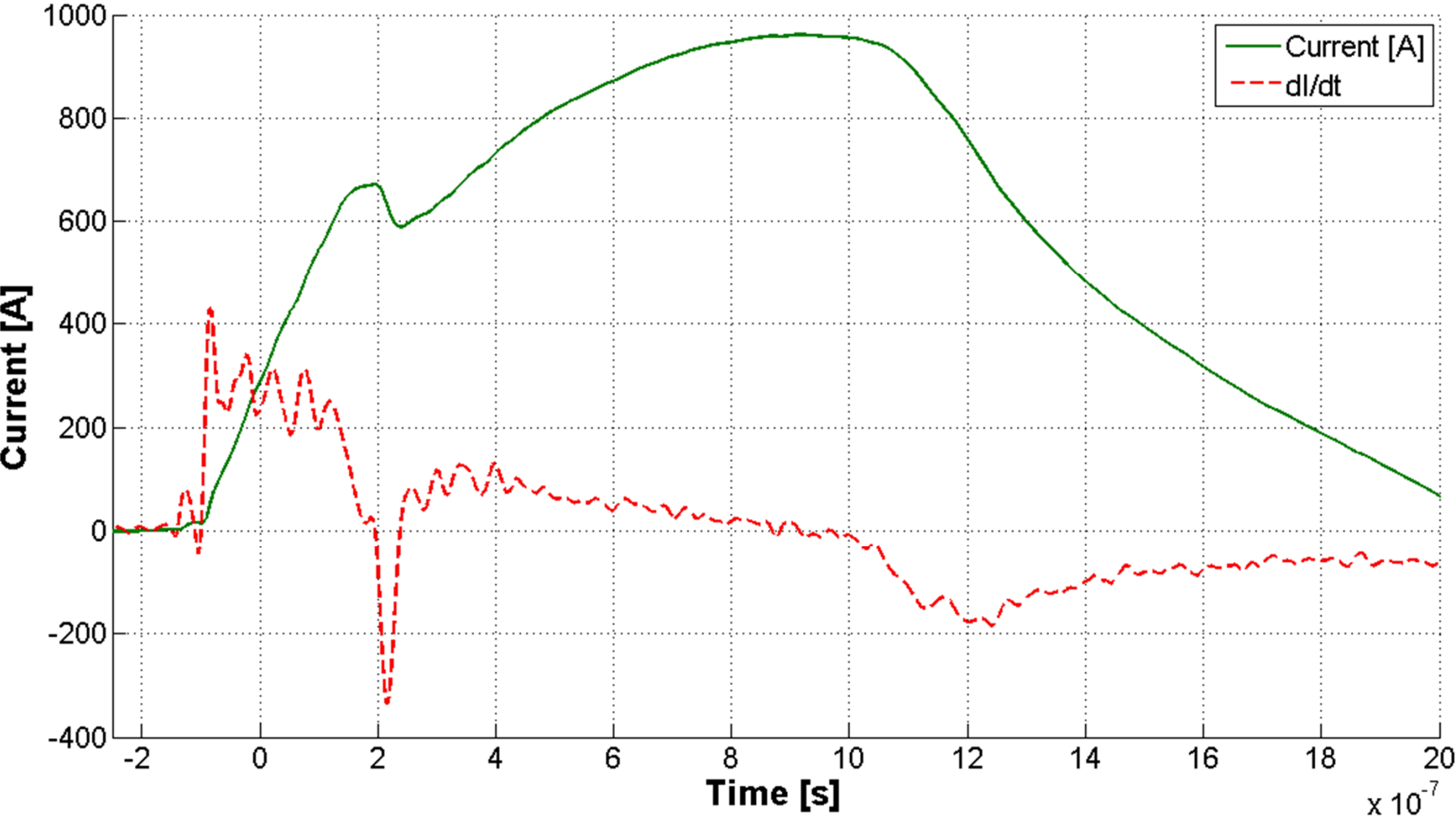
Comparing Capacitor Charge Voltage



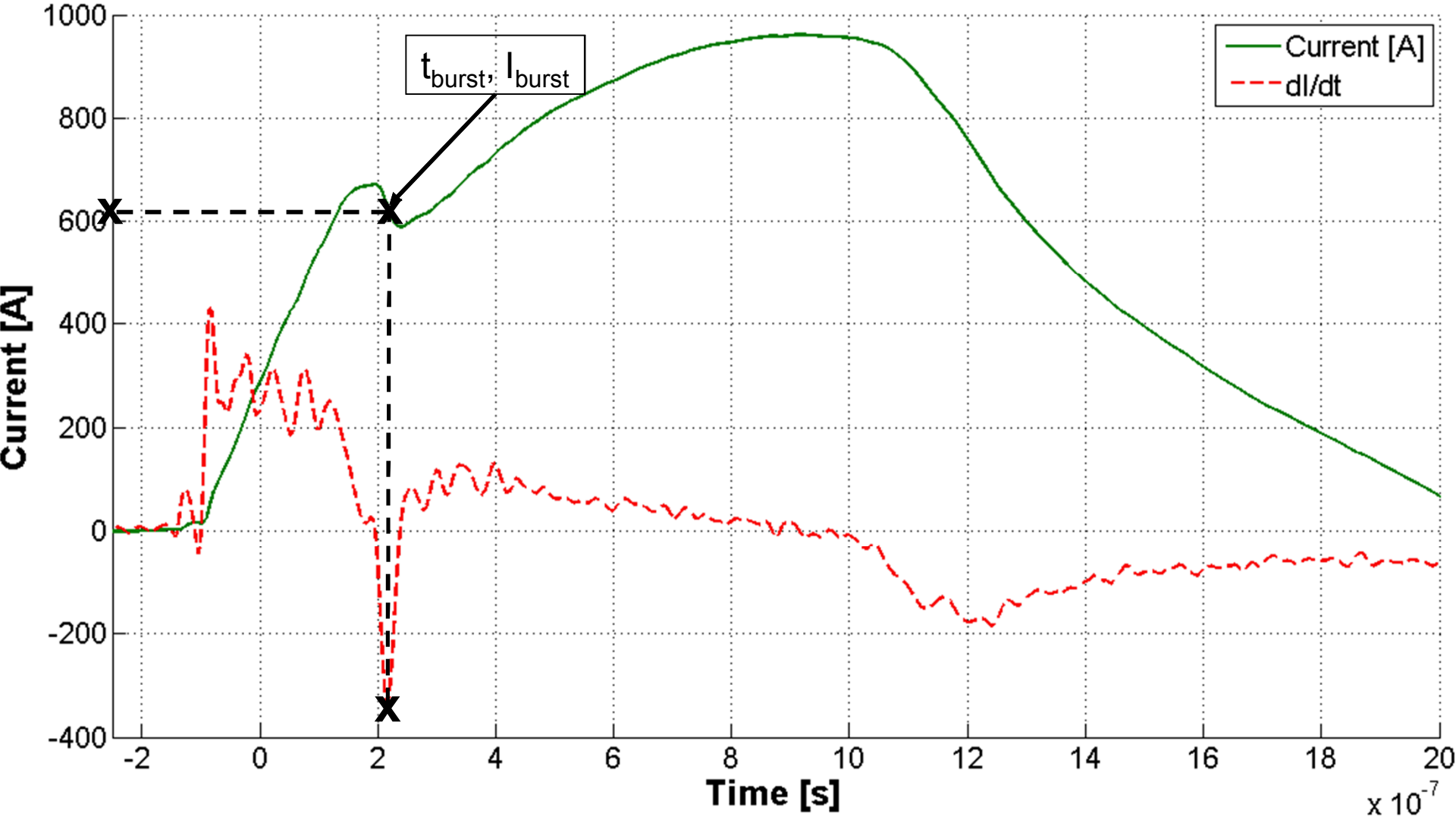
Charge Voltage – Not a Very Reliable Tool



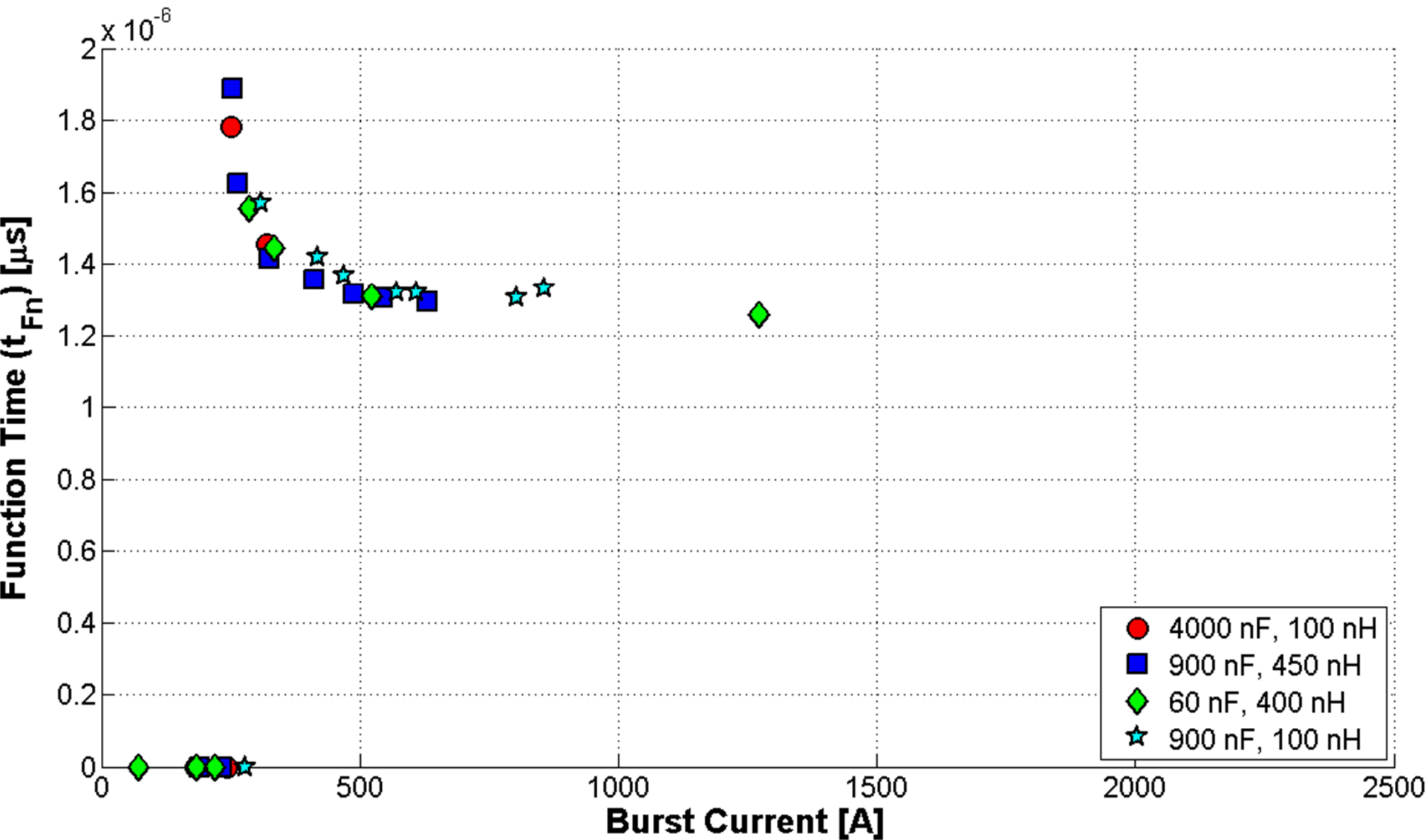
Tucker's Burst Current (1964)



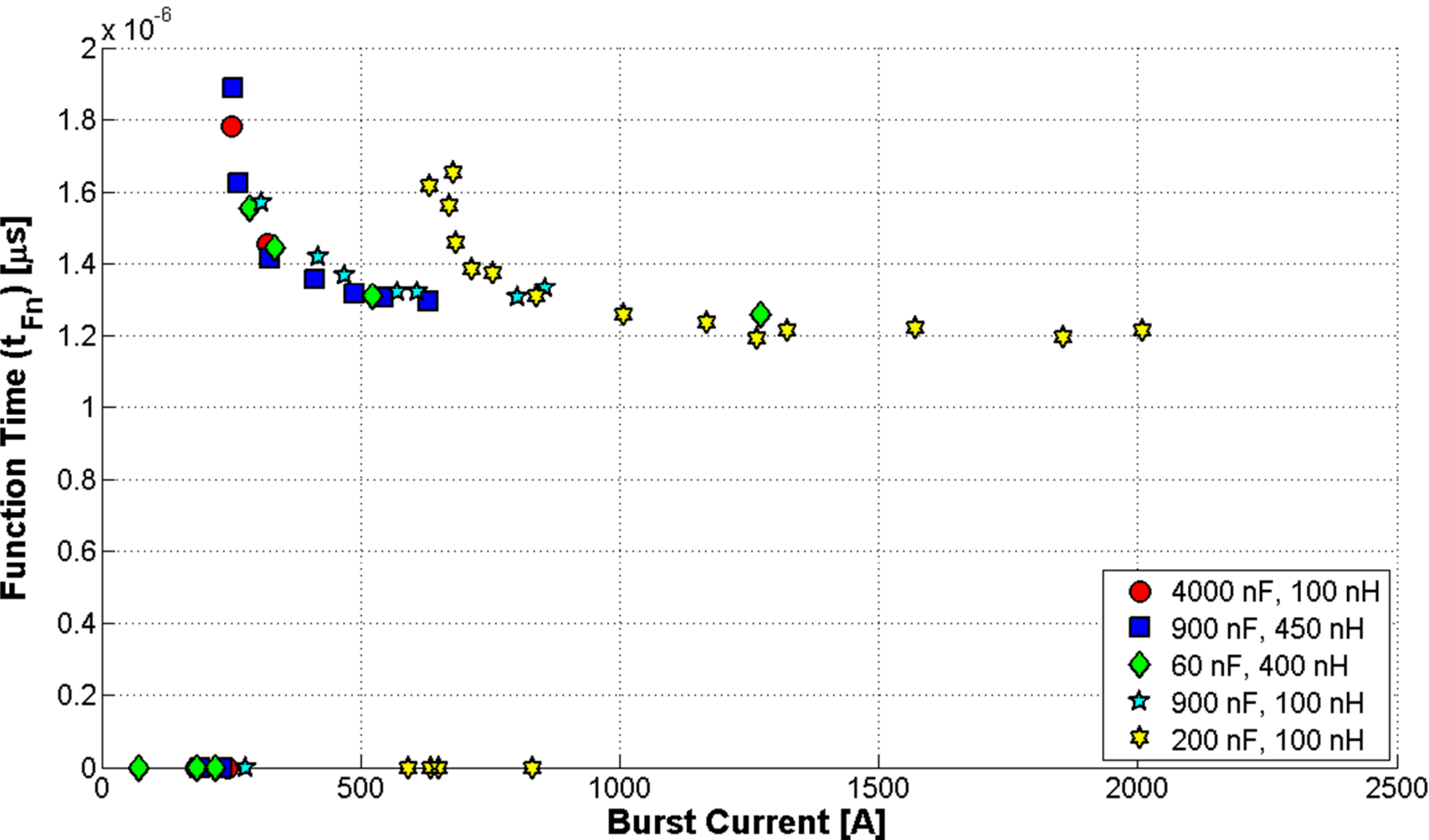
Tucker's Burst Current (1964)



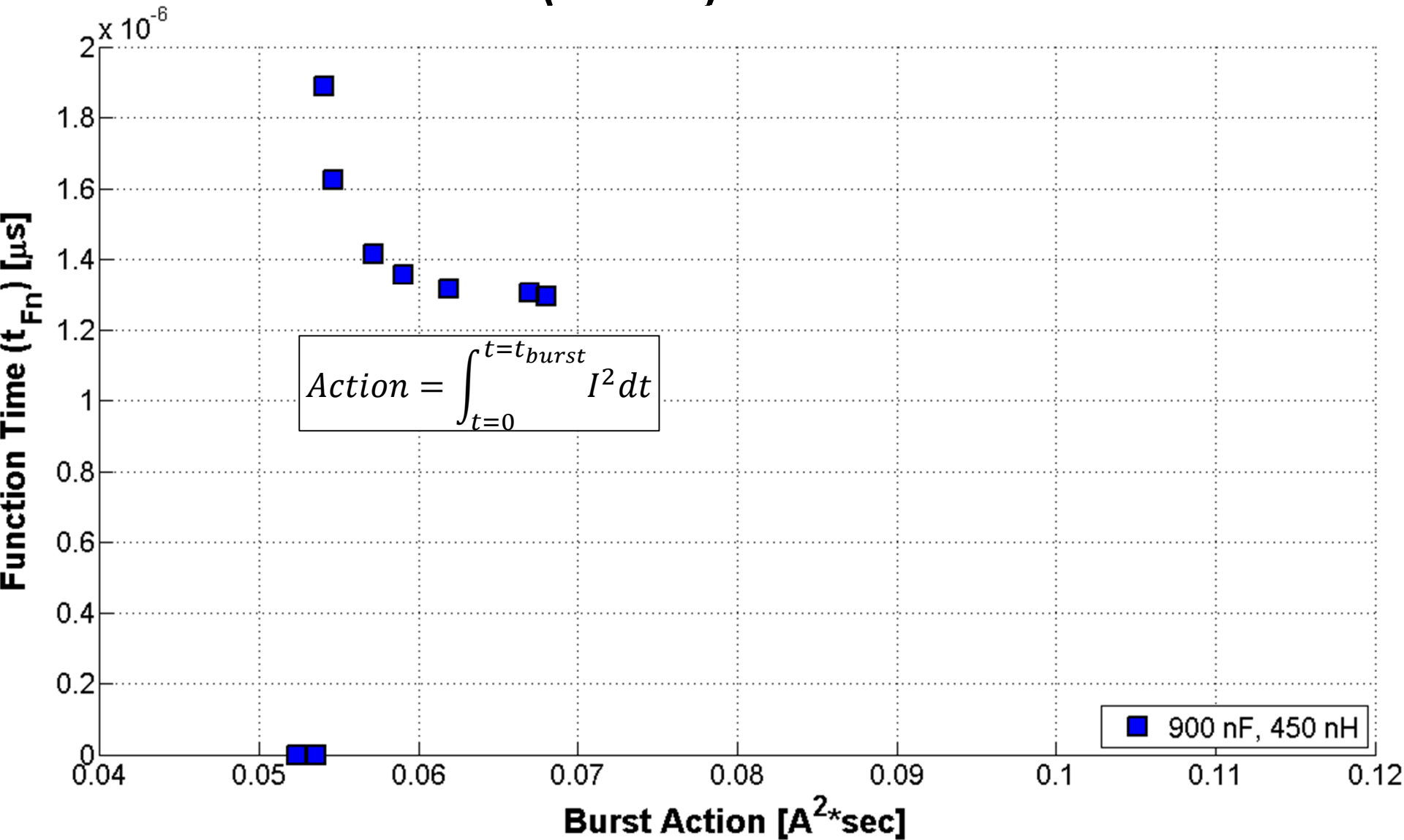
Burst Current Sometimes Works



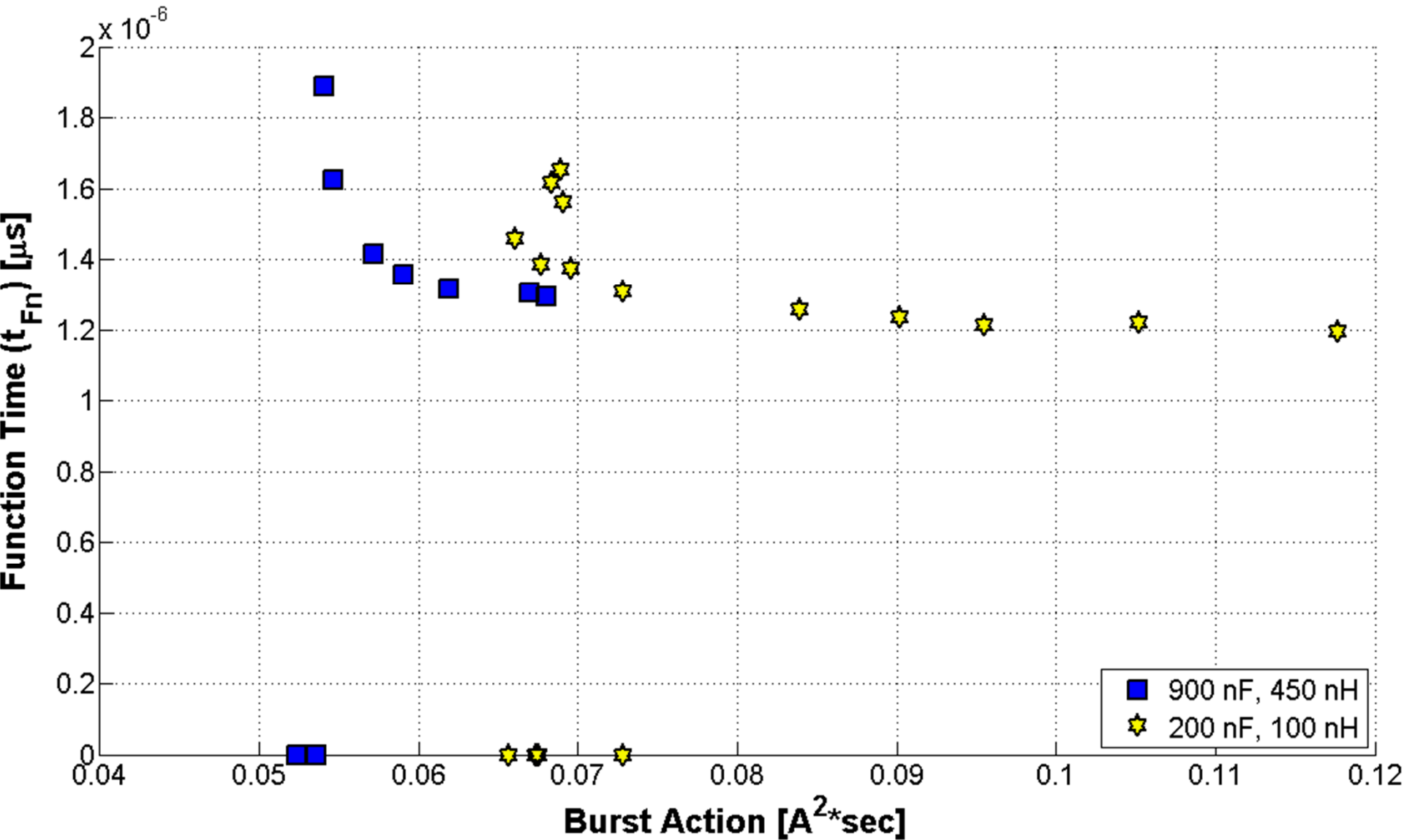
But Burst Current Has Limitations



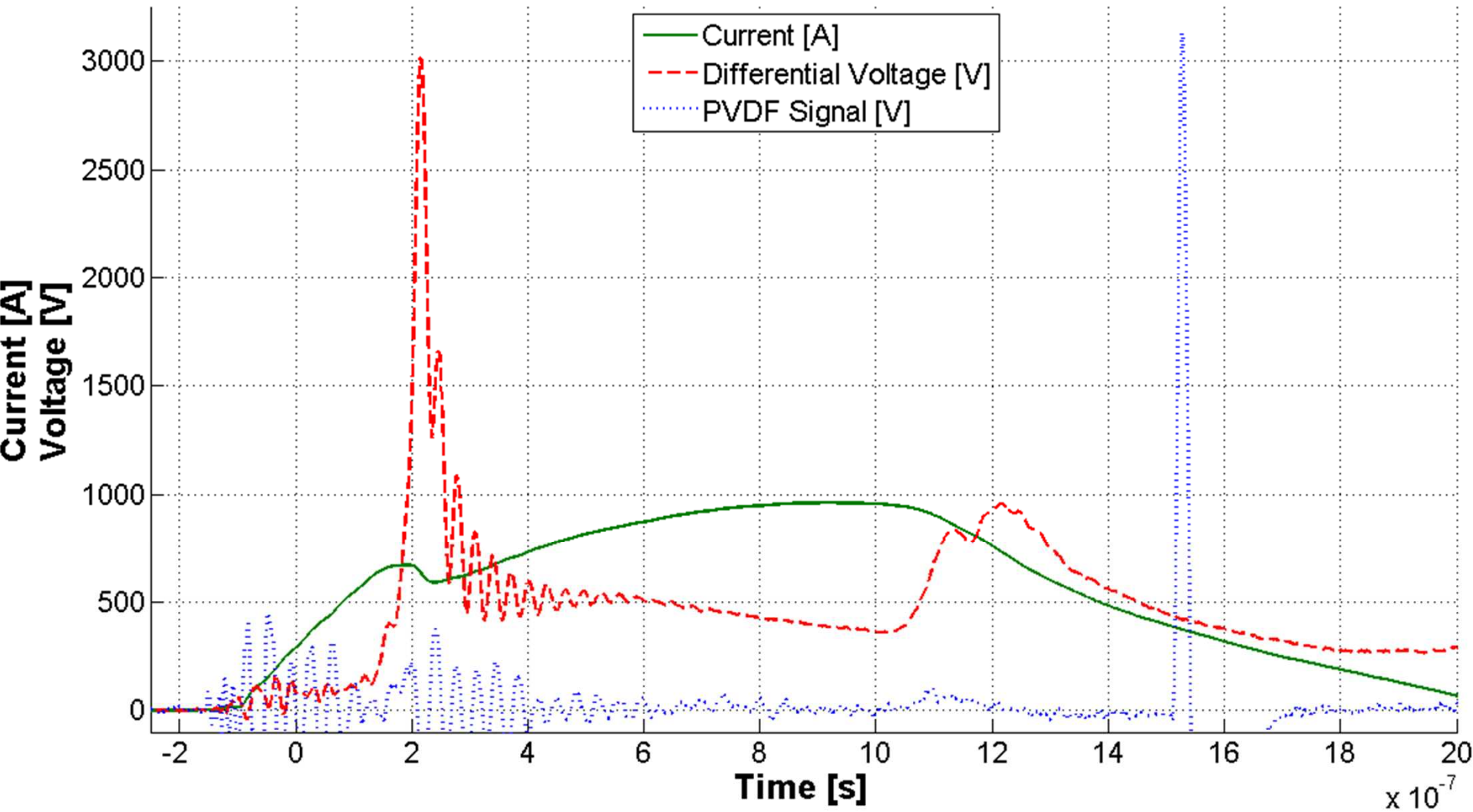
Tucker's Action (1959)



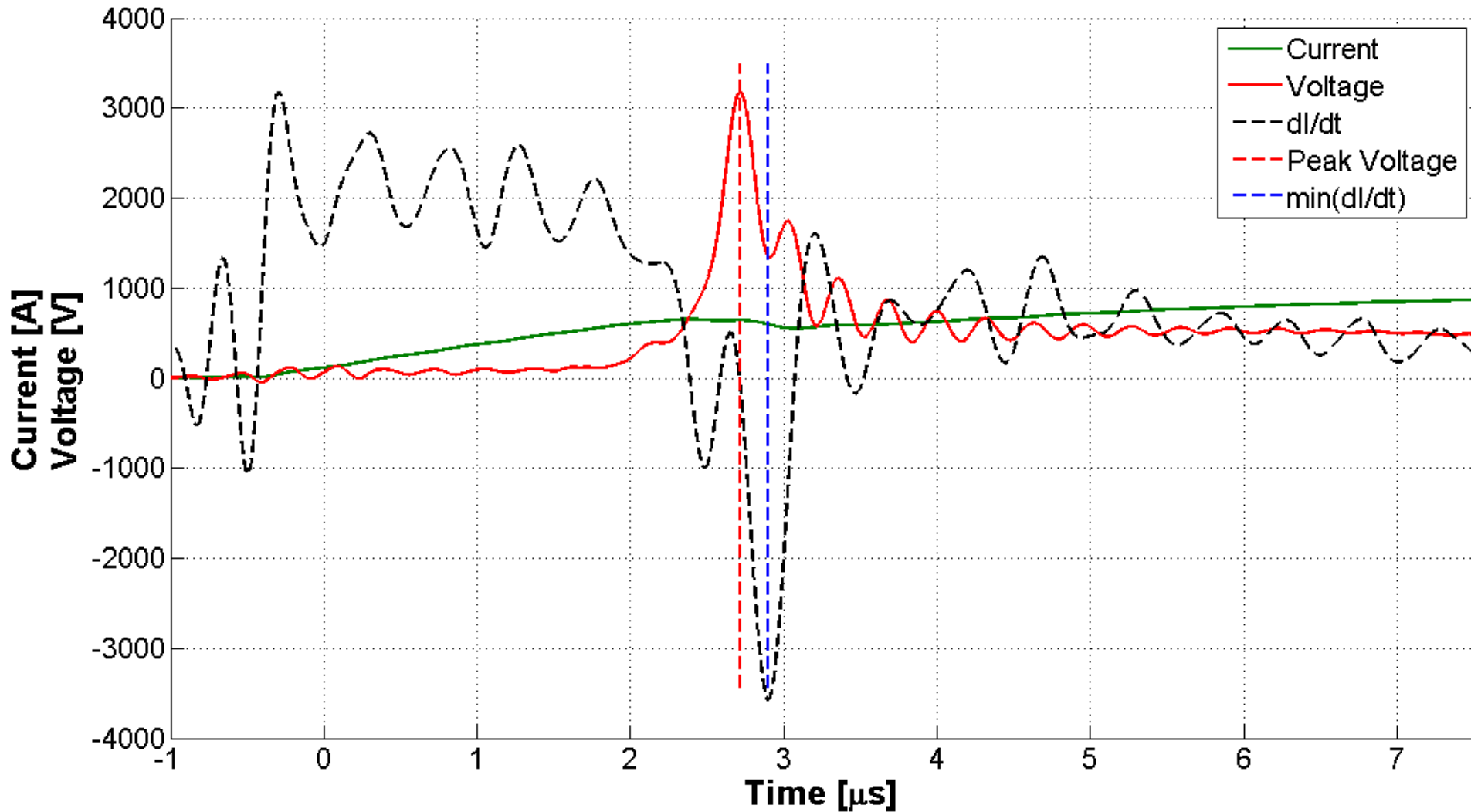
Action is also Limited in Use



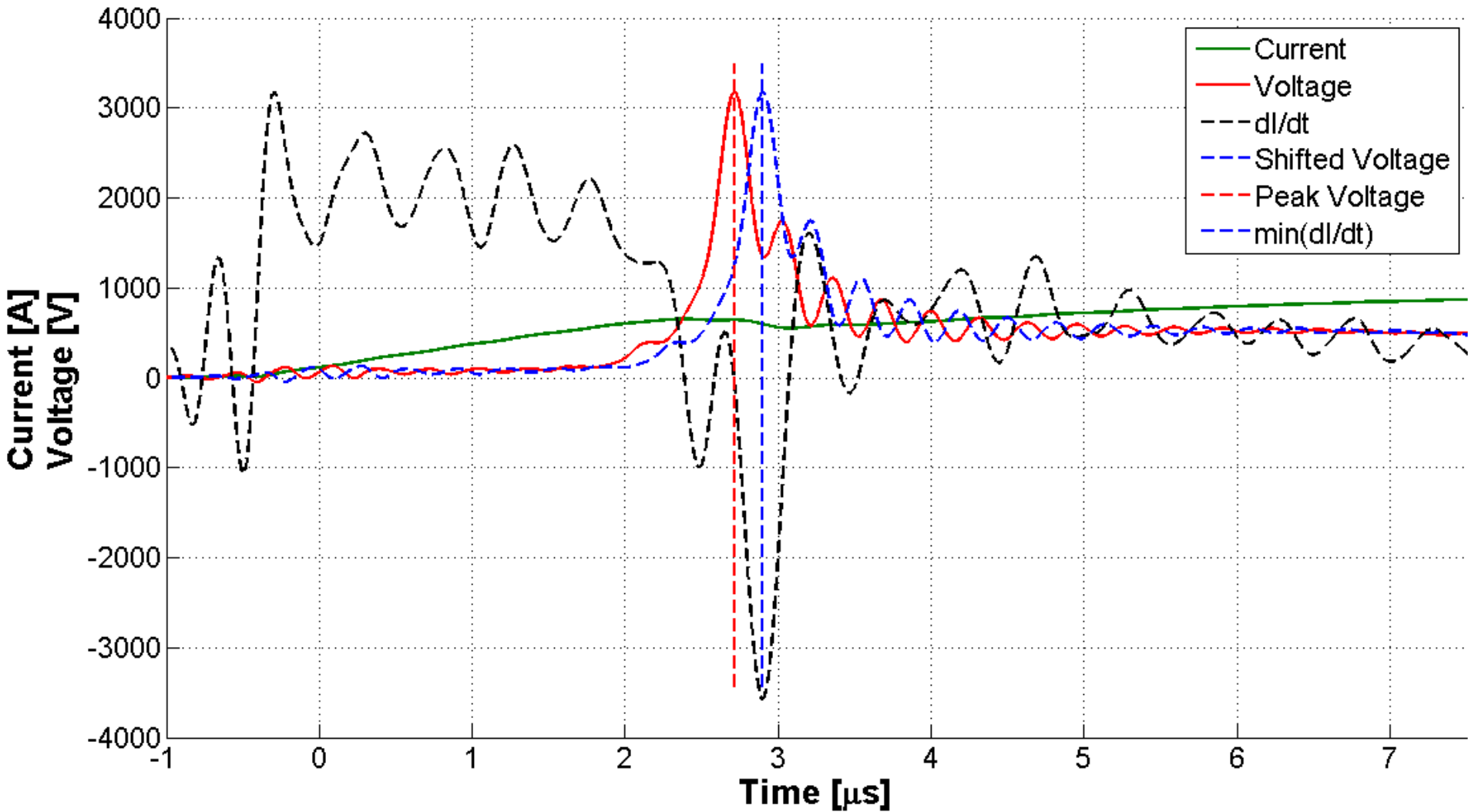
Maybe We Should Incorporate Voltage



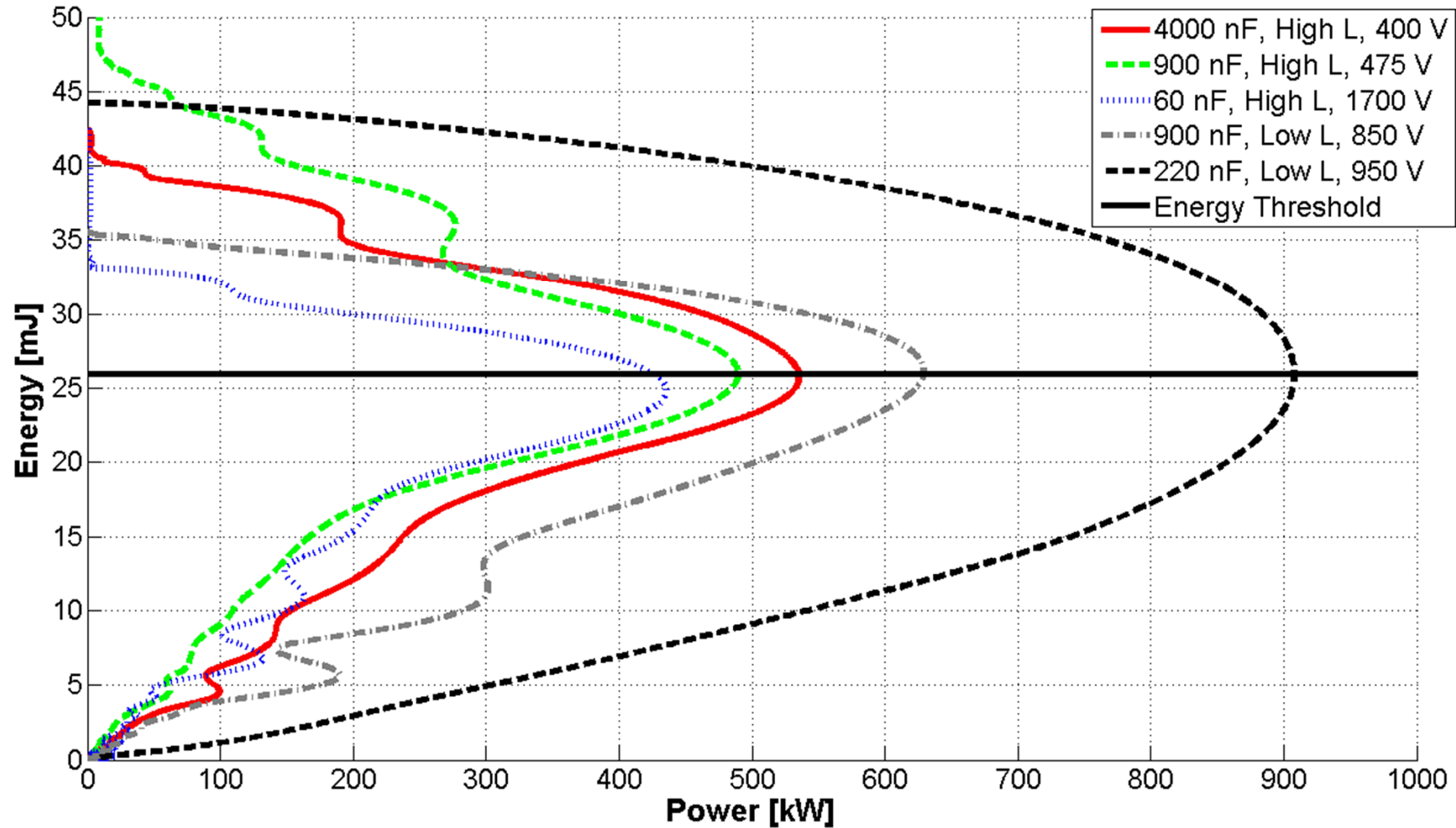
Where Does the Voltage Peak Go?



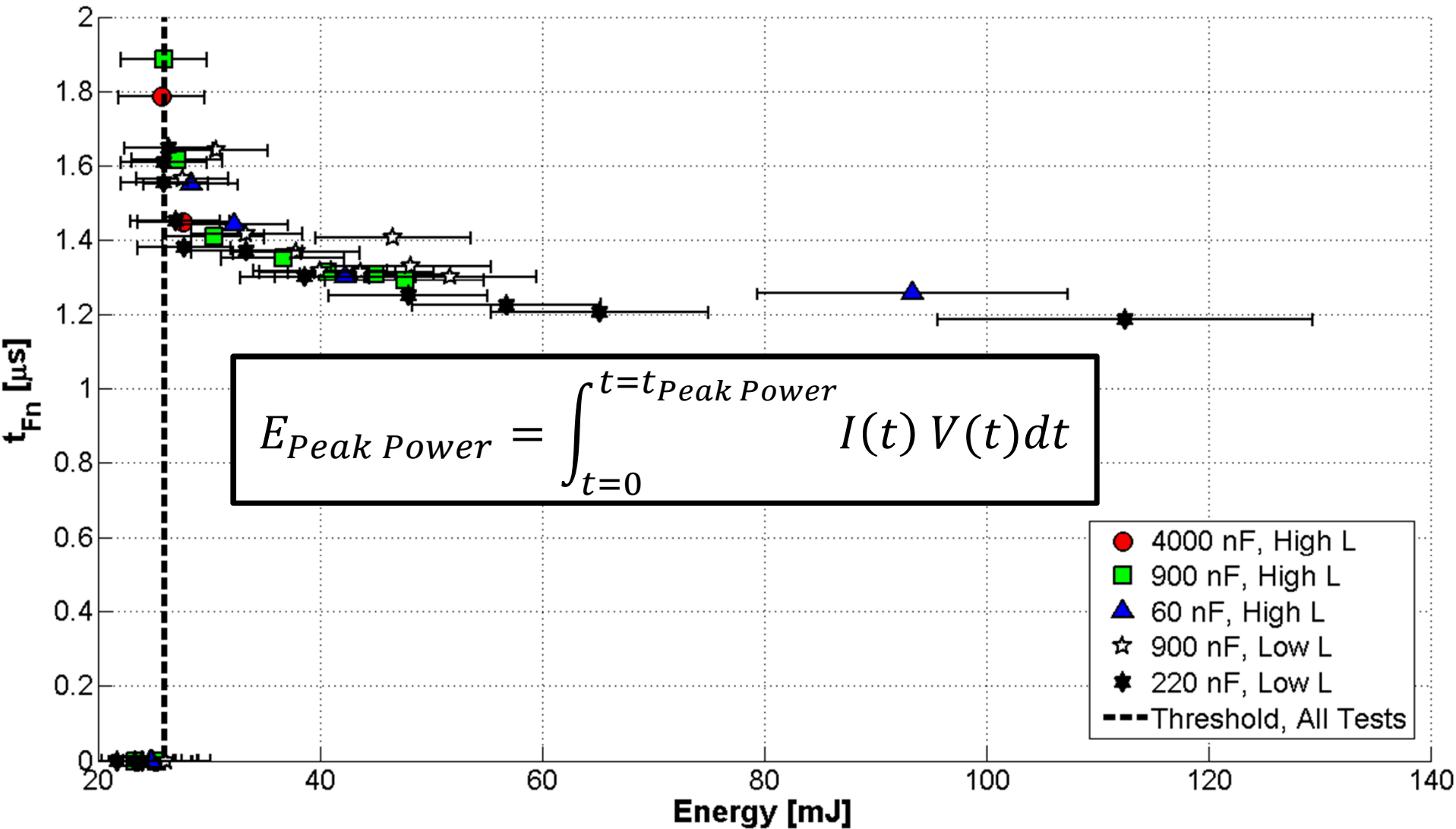
Shifting Peak Voltage to Current Inflection Point



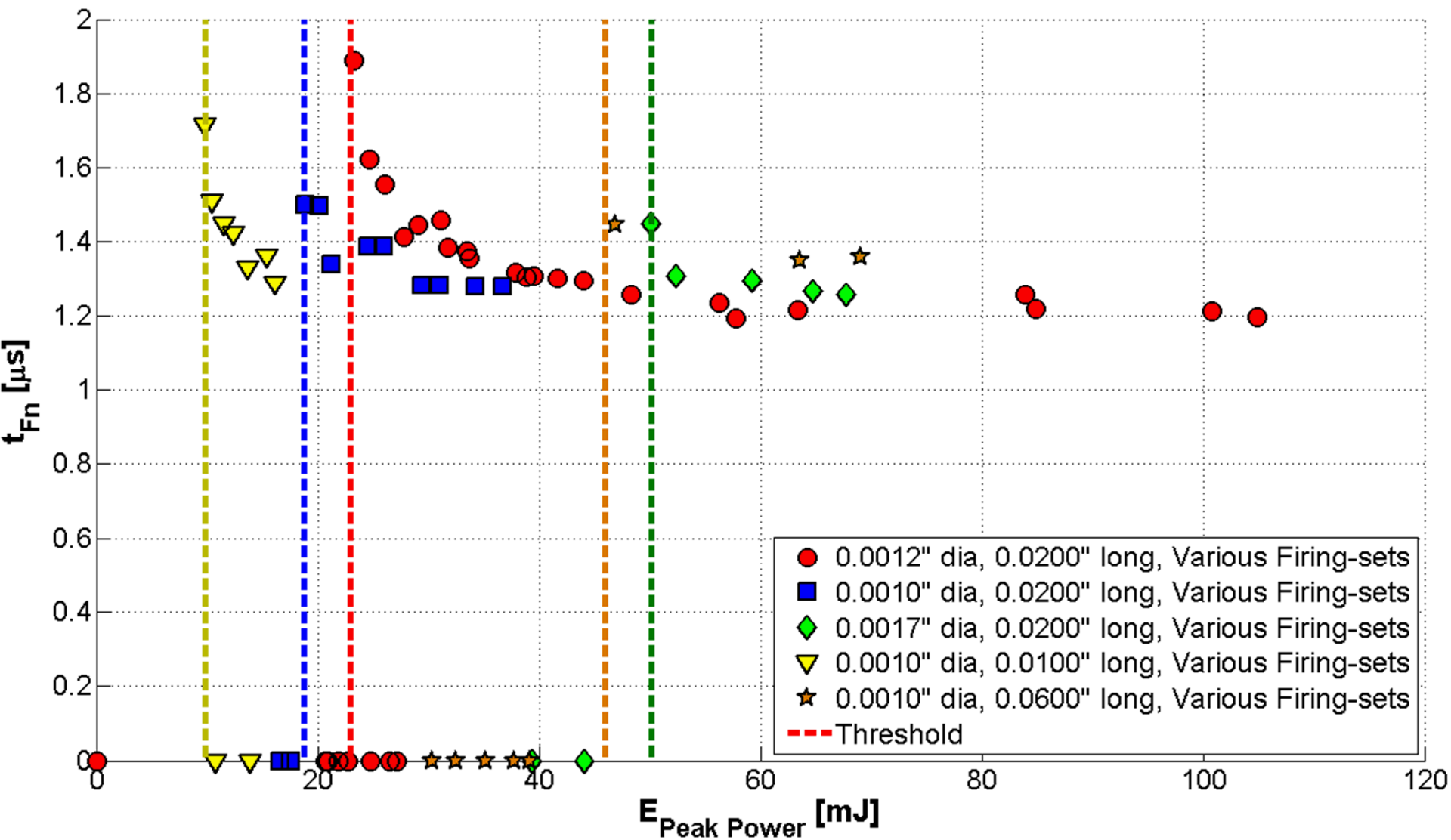
Detonators Near Threshold in P-E Space



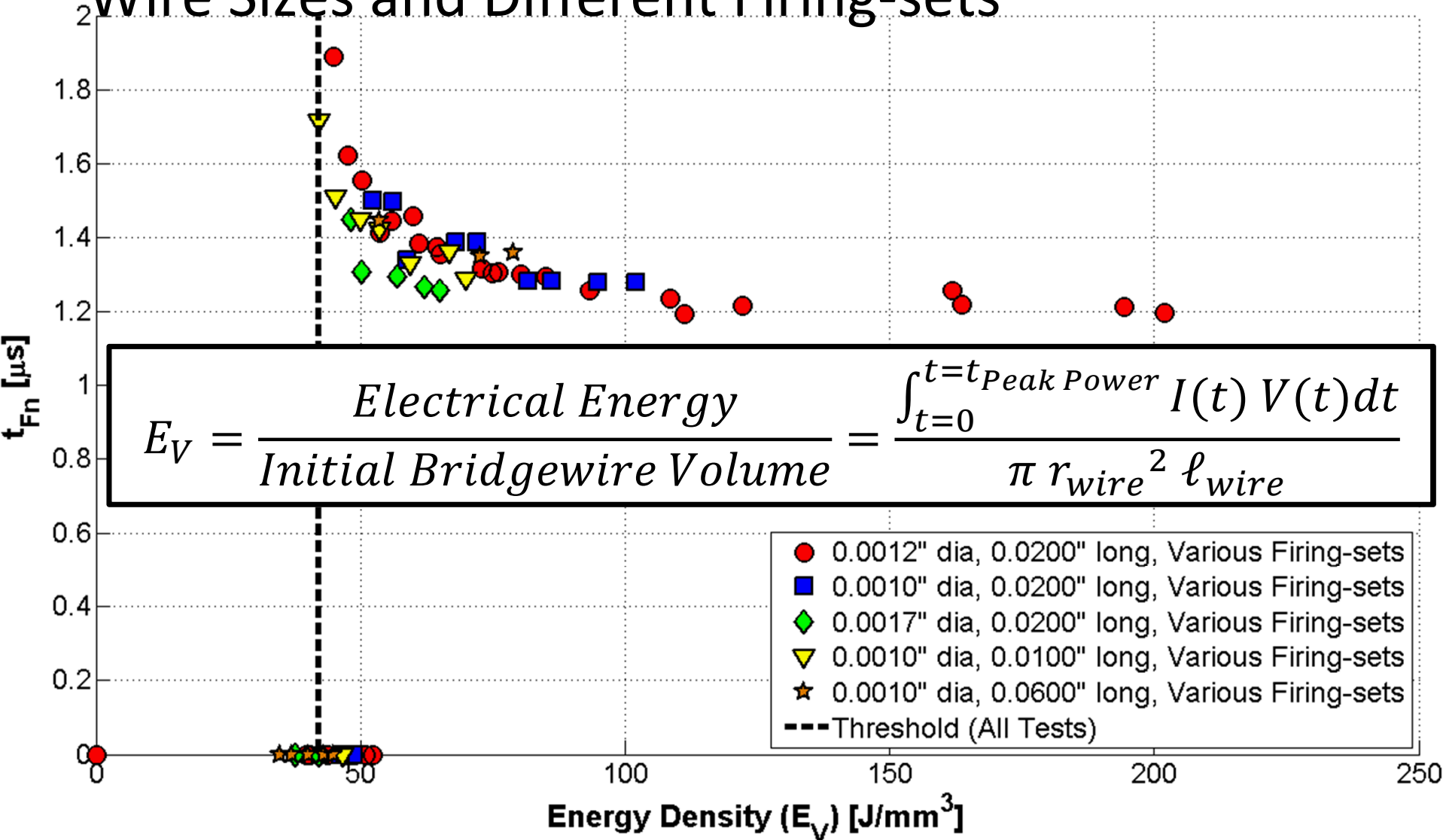
Energy at Peak Power Appears to Work



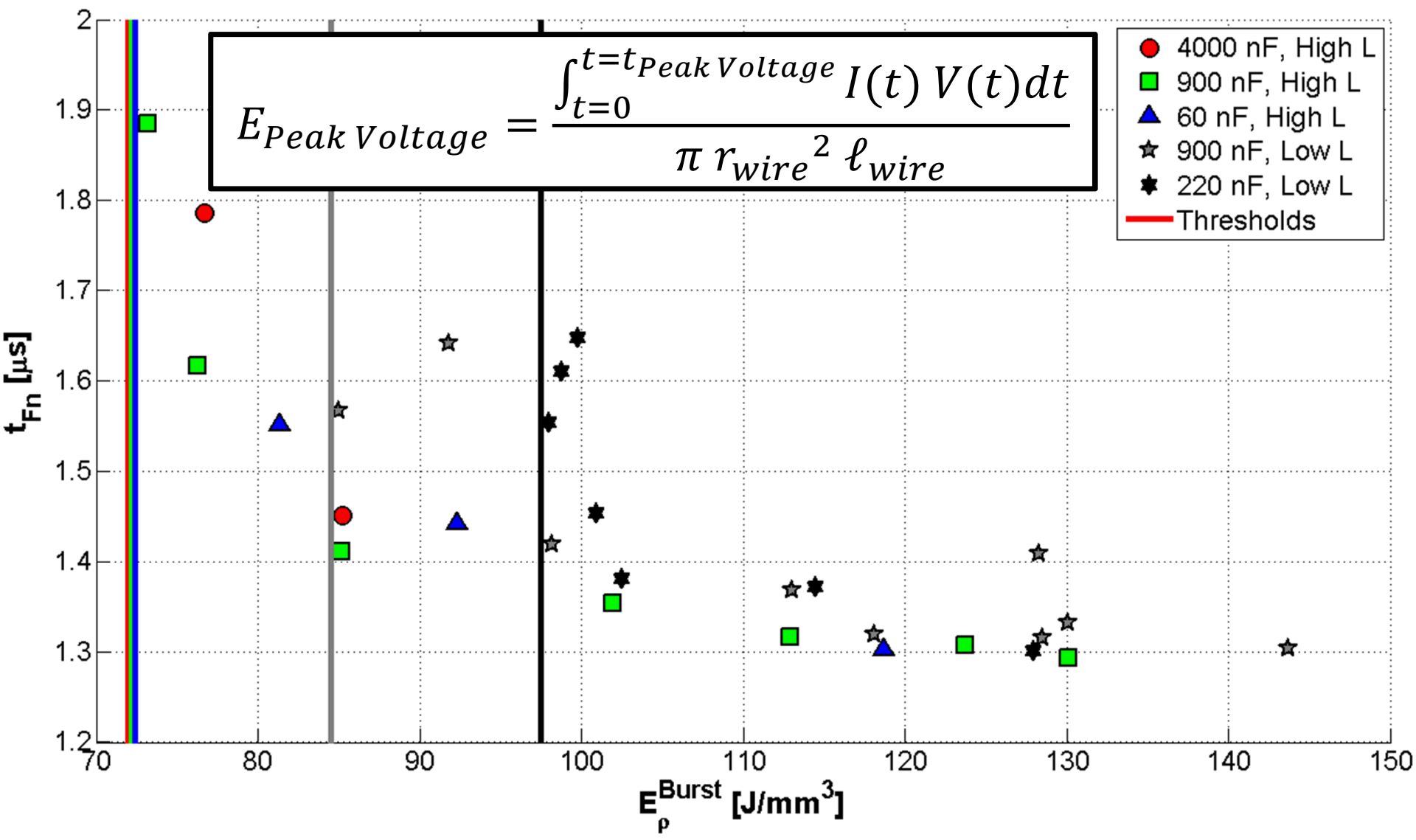
Energy at Peak Power of Different Wire Sizes



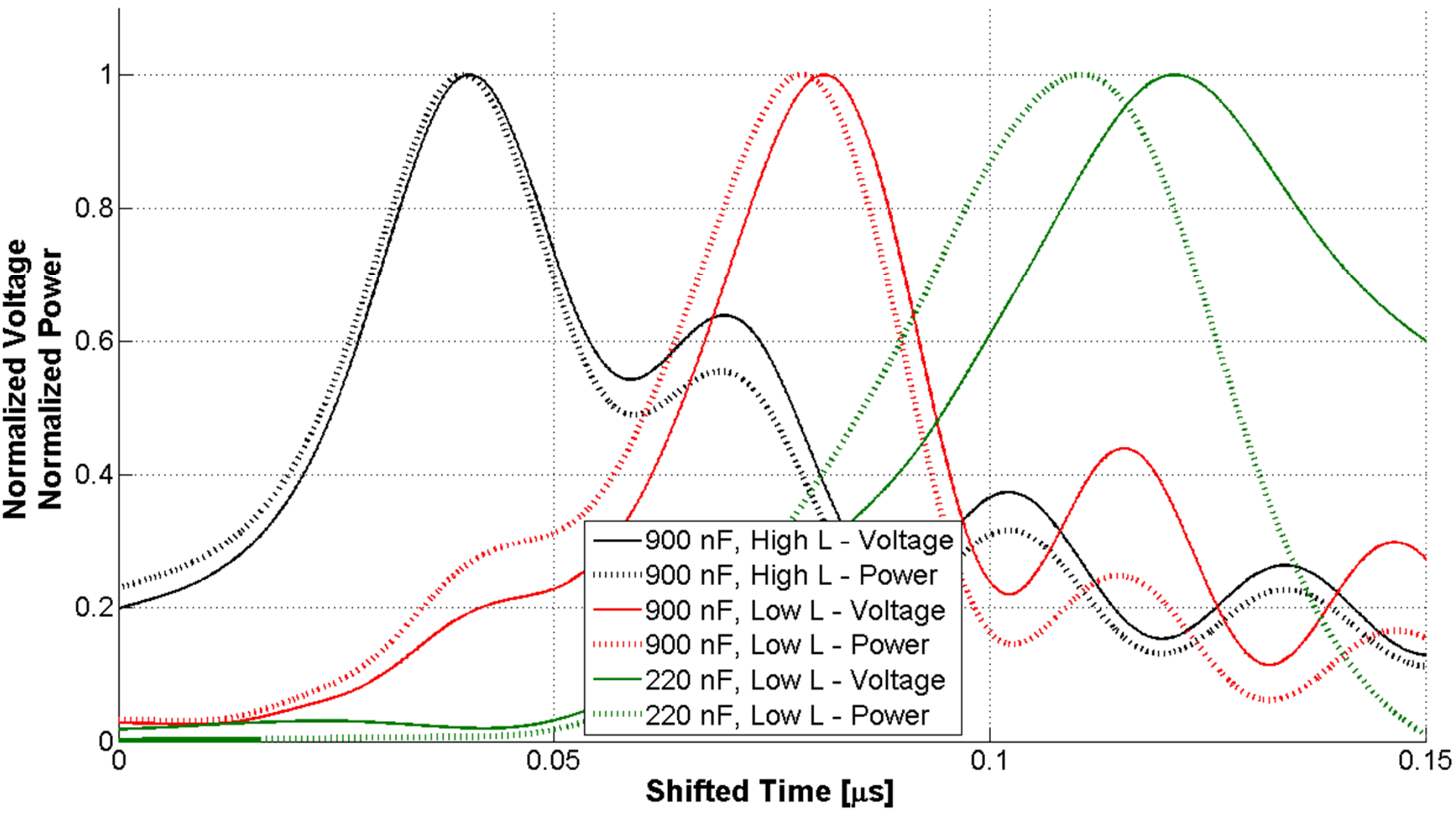
Energy Density at Peak Power Relates Different Wire Sizes and Different Firing-sets



Energy Density at Peak Voltage Does Not Collapse Data



Peak Power versus Peak Voltage



Conclusions

- Current measurements alone are not sufficient to determine exploding wire and detonator performance.
- Peak voltage must be aligned to the inflection point in the current prior to analysis.
- The energy deposited until peak power divided by the bridgewire volume (Energy Density) collapses detonator performance.
- The energy deposited until peak voltage does not correlate to detonator performance.
- “Burst” appears to occur at peak power, not peak voltage.

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