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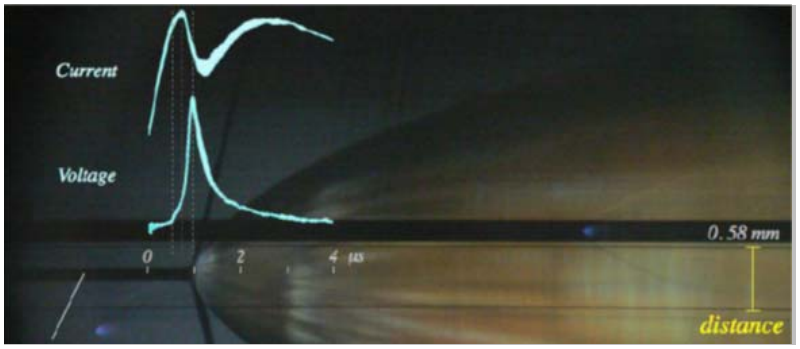

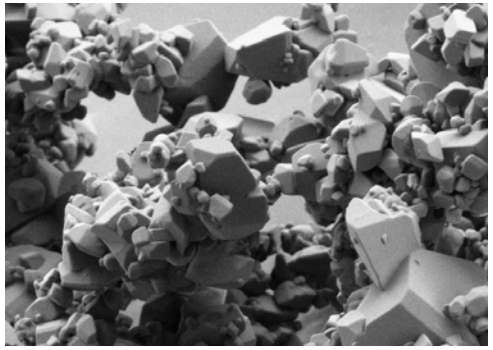

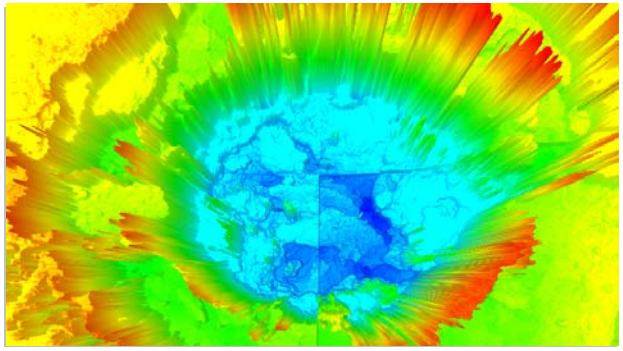

A Common Initiation Criterion for CL-20 EBW Detonators

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U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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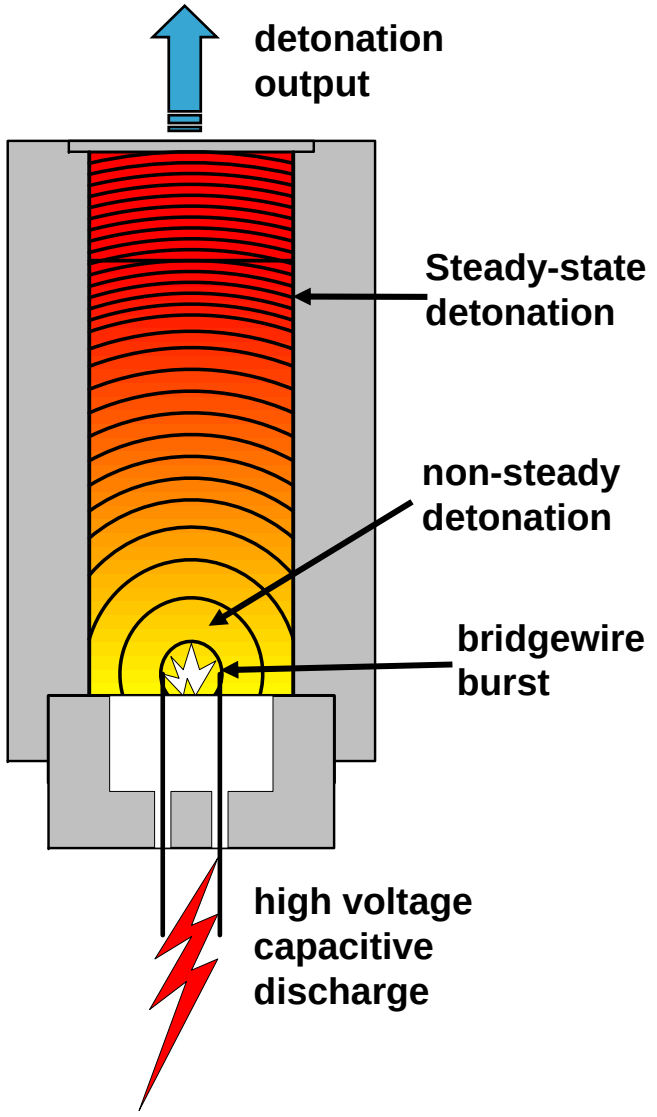
The Basics of EBW Initiation

Initiation and DDT

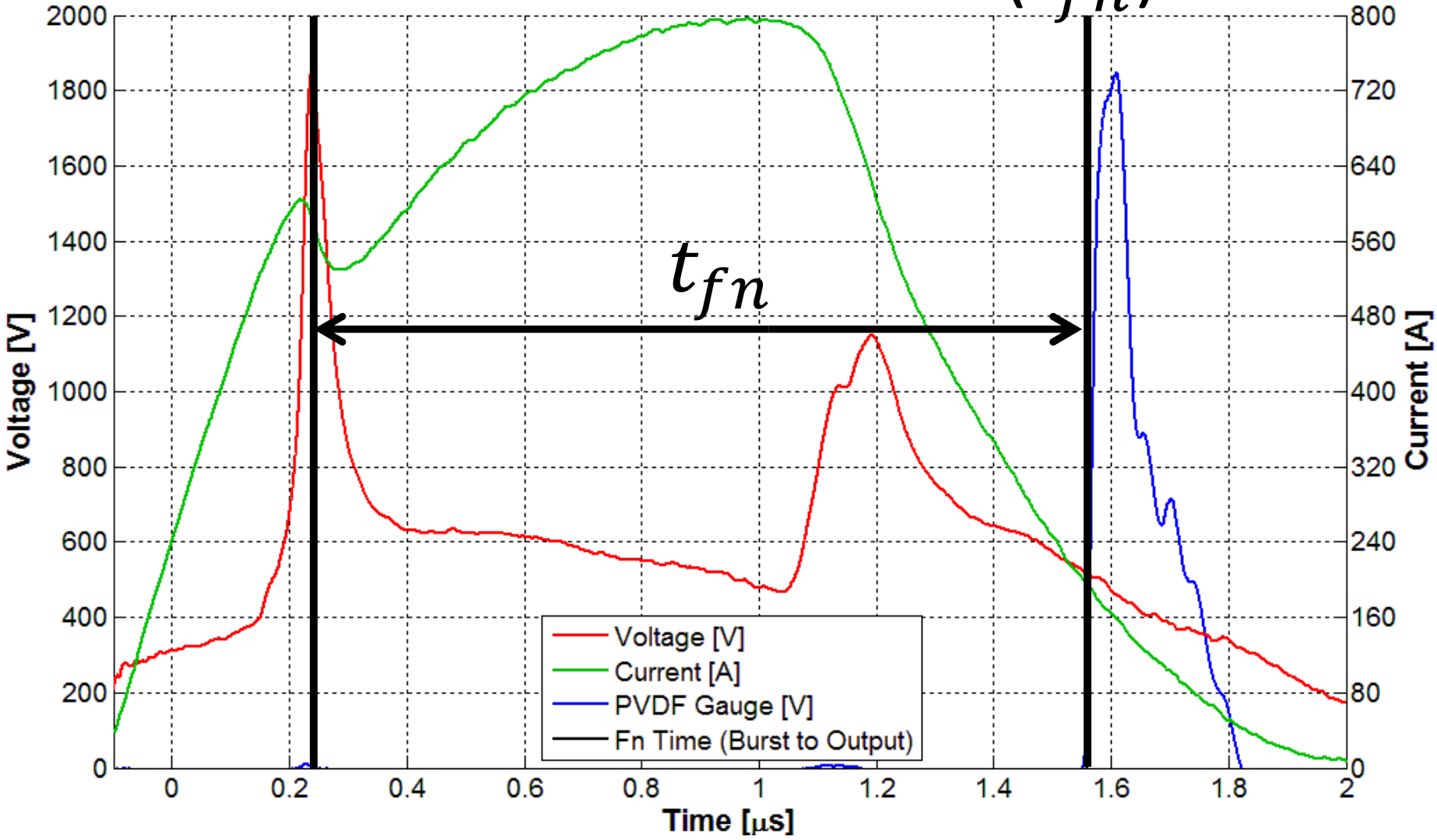
- Initial pressing (IP) typically contains explosive at ~50% TMD.
- Physical mechanism of initiation is not understood.
- Bridge burst initiates “low-order” detonation in the IP, which transitions to steady state detonation.

Output

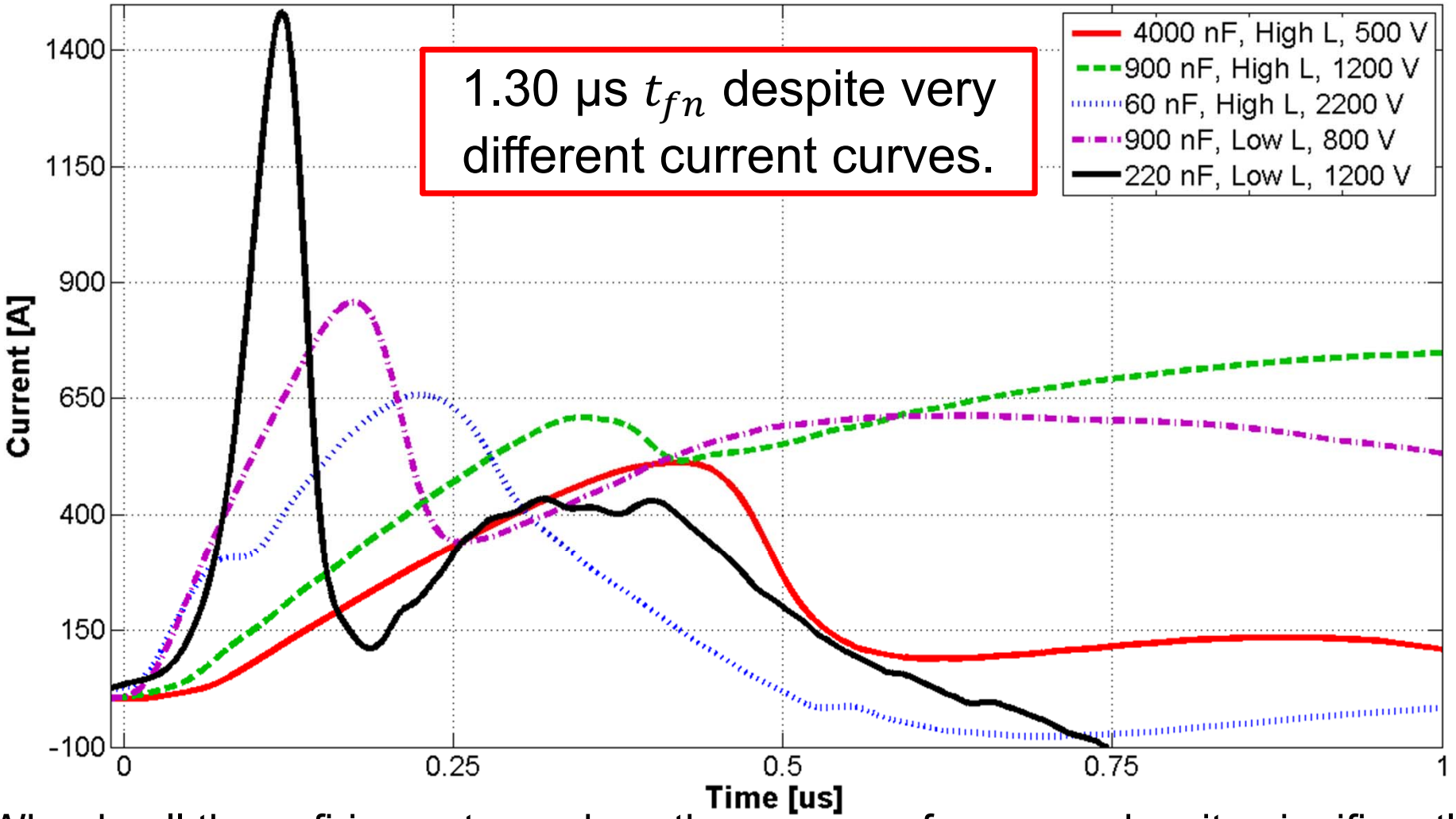
- Detonation wave in IP shock initiates high-density output pellet.
- Performance generally determined by “function time.”



Definition of Function Time (t_{fn})

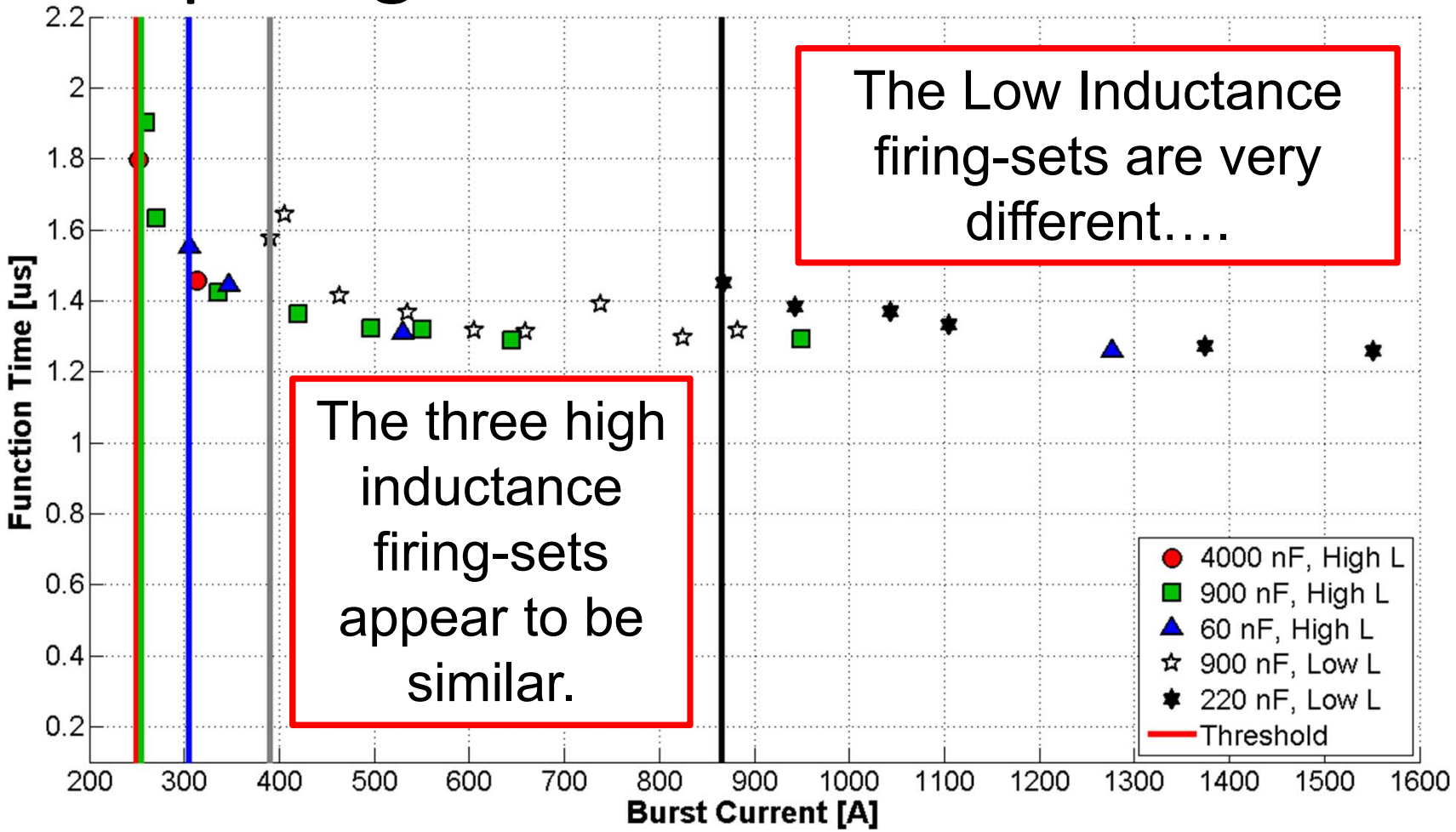


Similar Detonator Behavior with Different Firing-sets



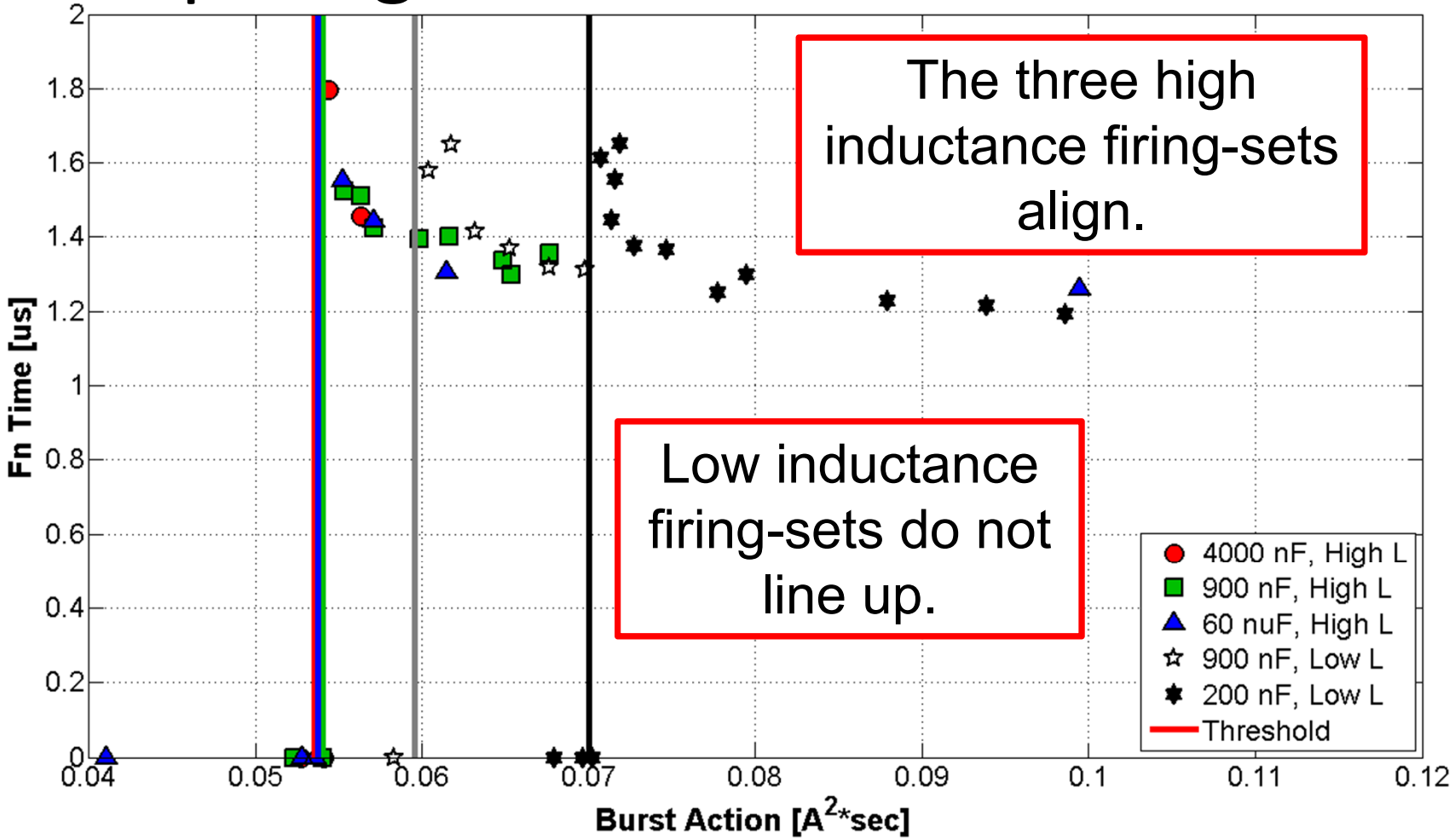
Why do all these firing-sets produce the same performance despite significantly different inputs? There must exist some link between them and detonator performance.

Comparing Burst Currents



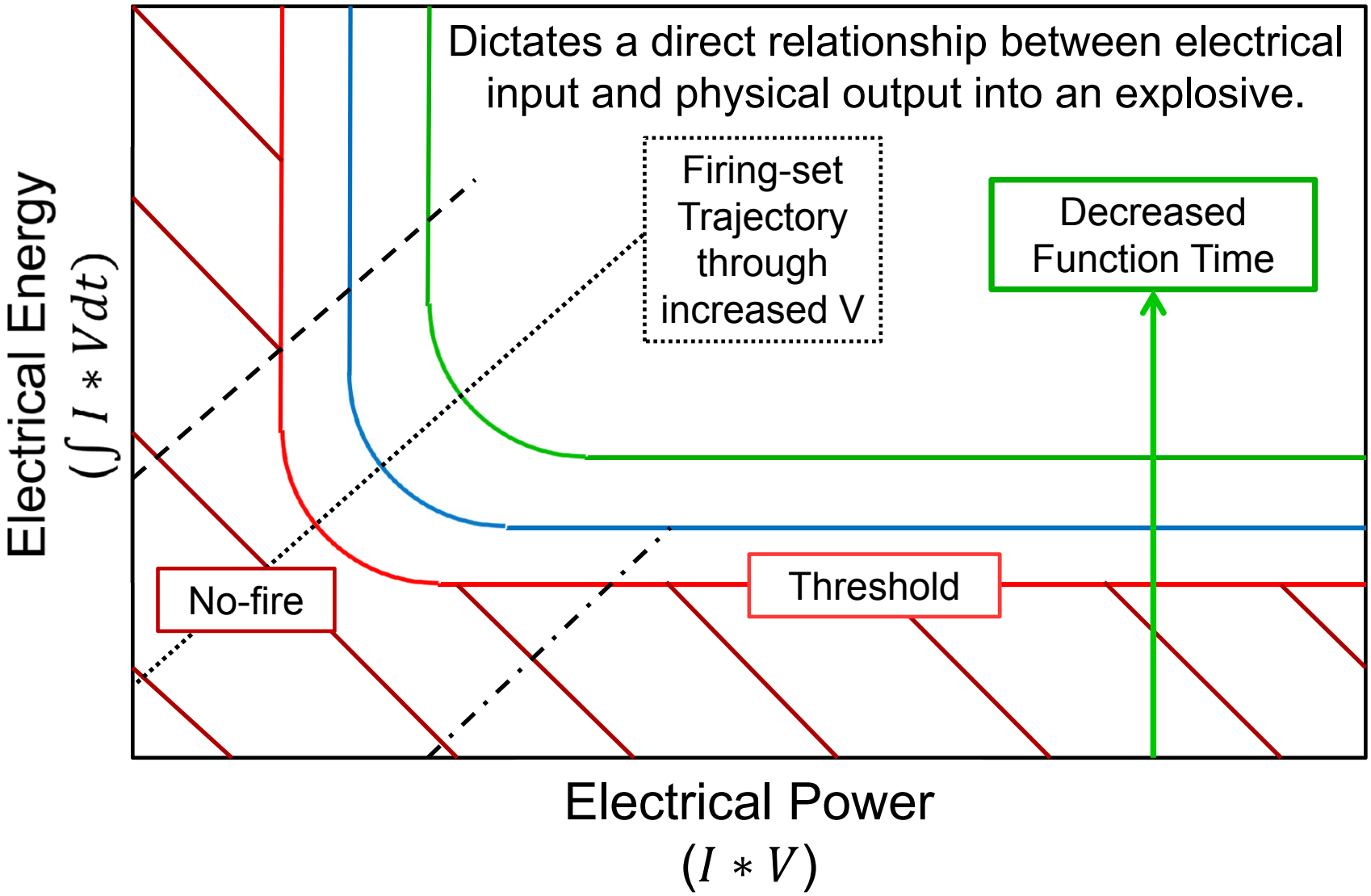
Burst current does not collapse the data in this region. In Tucker's paper, burst current did collapse data for his cable discharge system and high capacitance/high inductance systems (i.e. slow discharge rates.)

Comparing Action at Burst

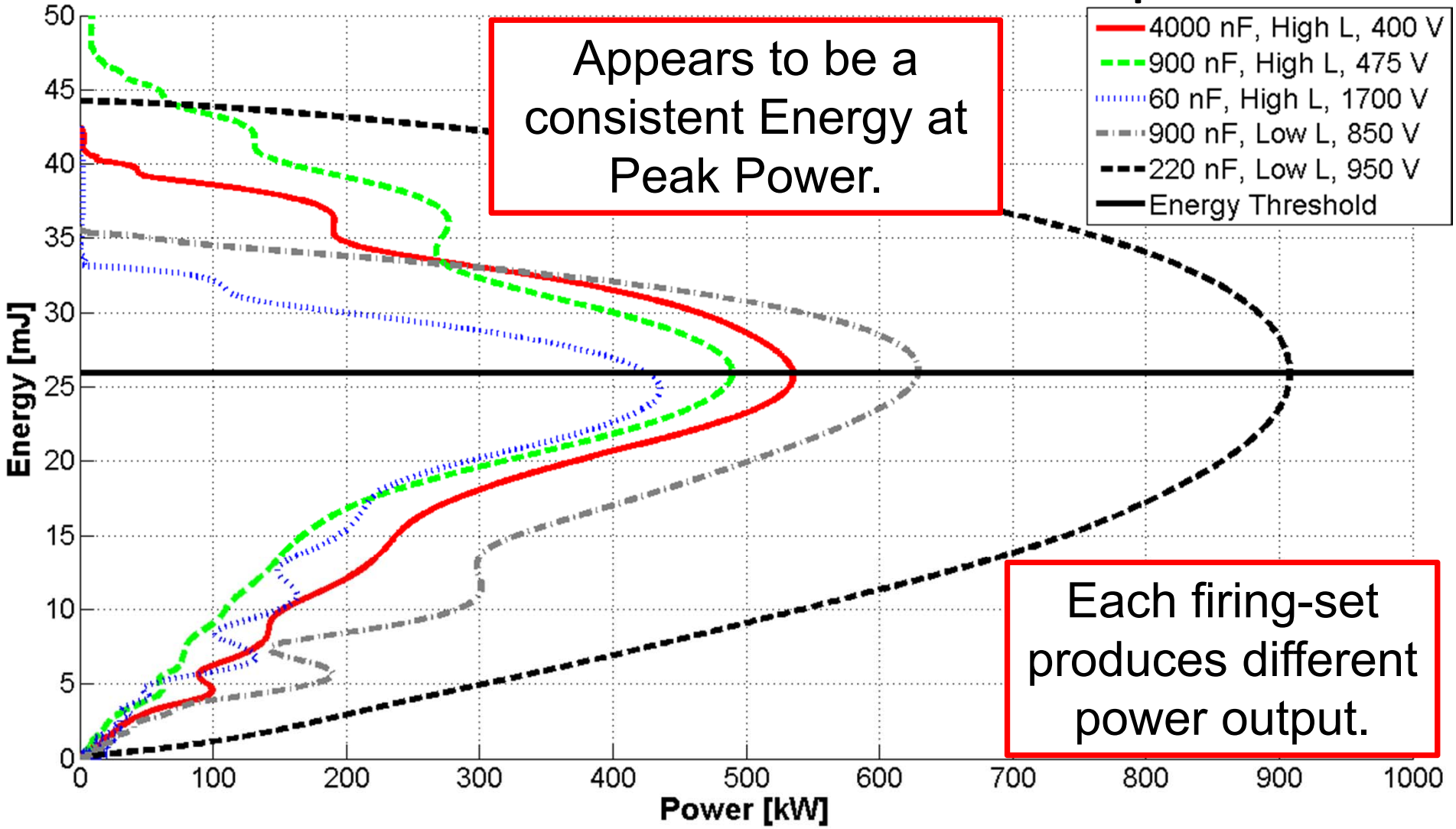


Action does not collapse the data in this region. Tucker's use of action was for determining burst requirements with a cable discharge system, and wasn't necessarily applied to detonator performance.

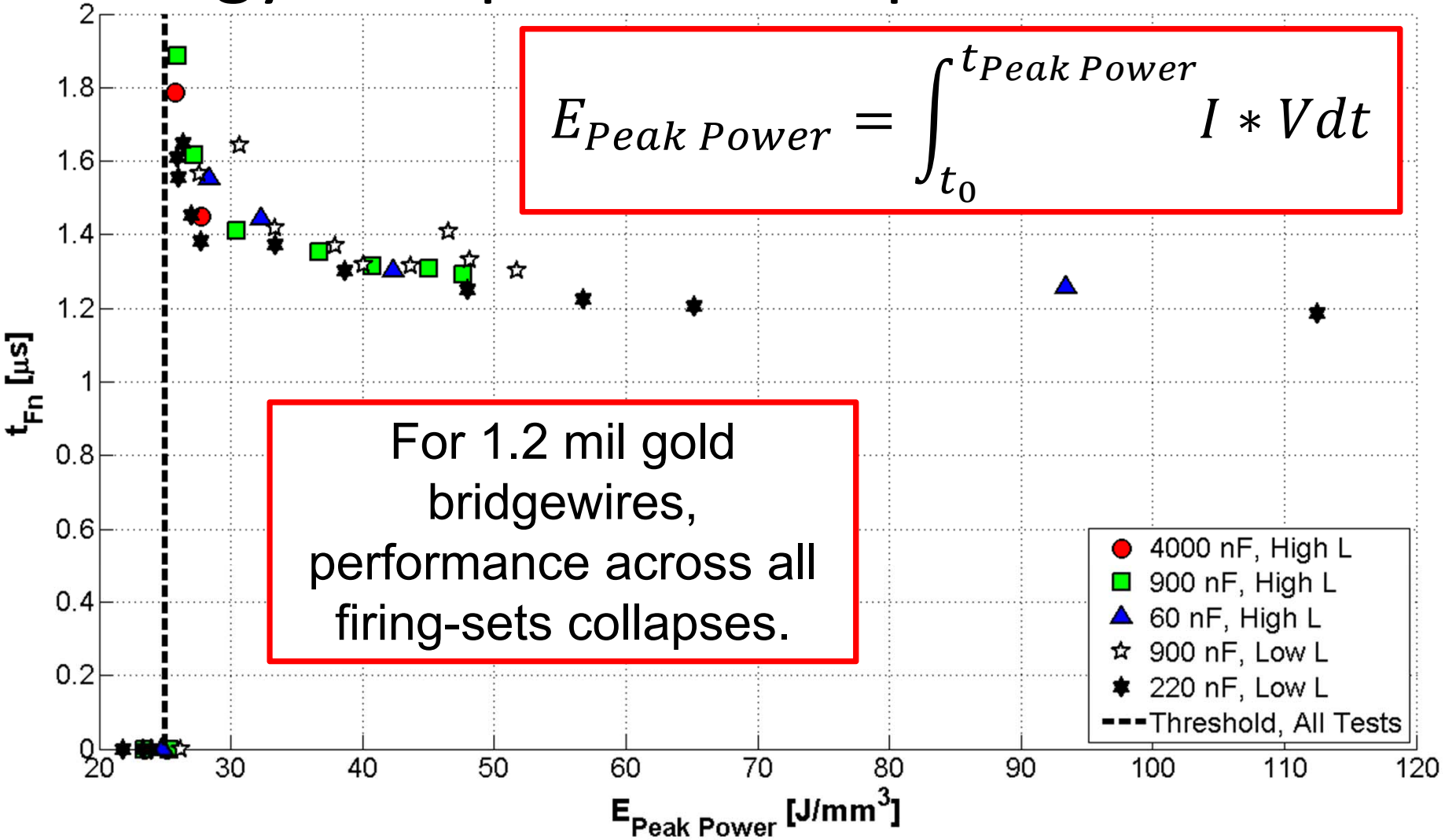
Designing an Electrical James Space



Detonators Near Threshold in P-E Space

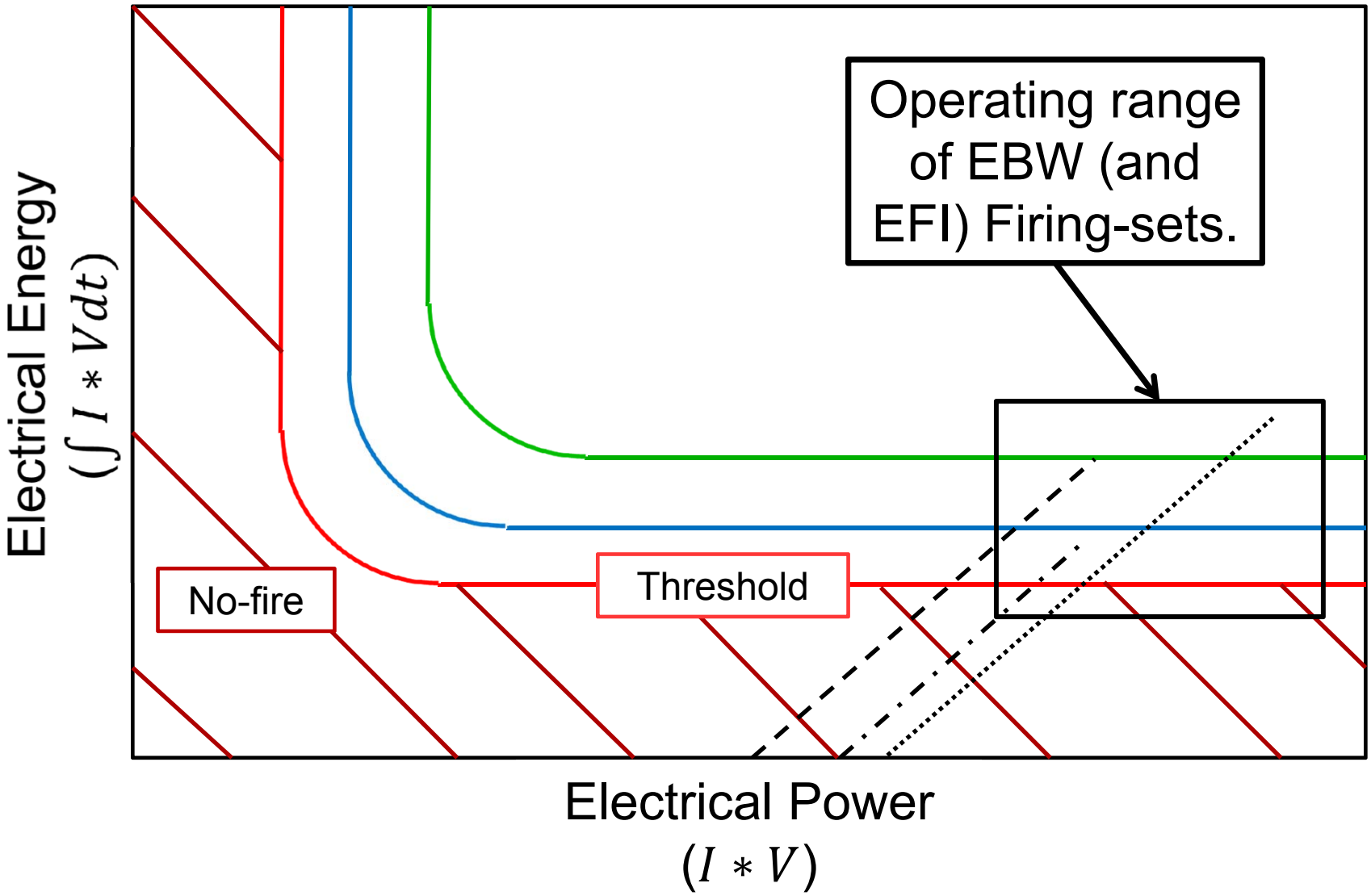


Energy Collapses the Disparate Data

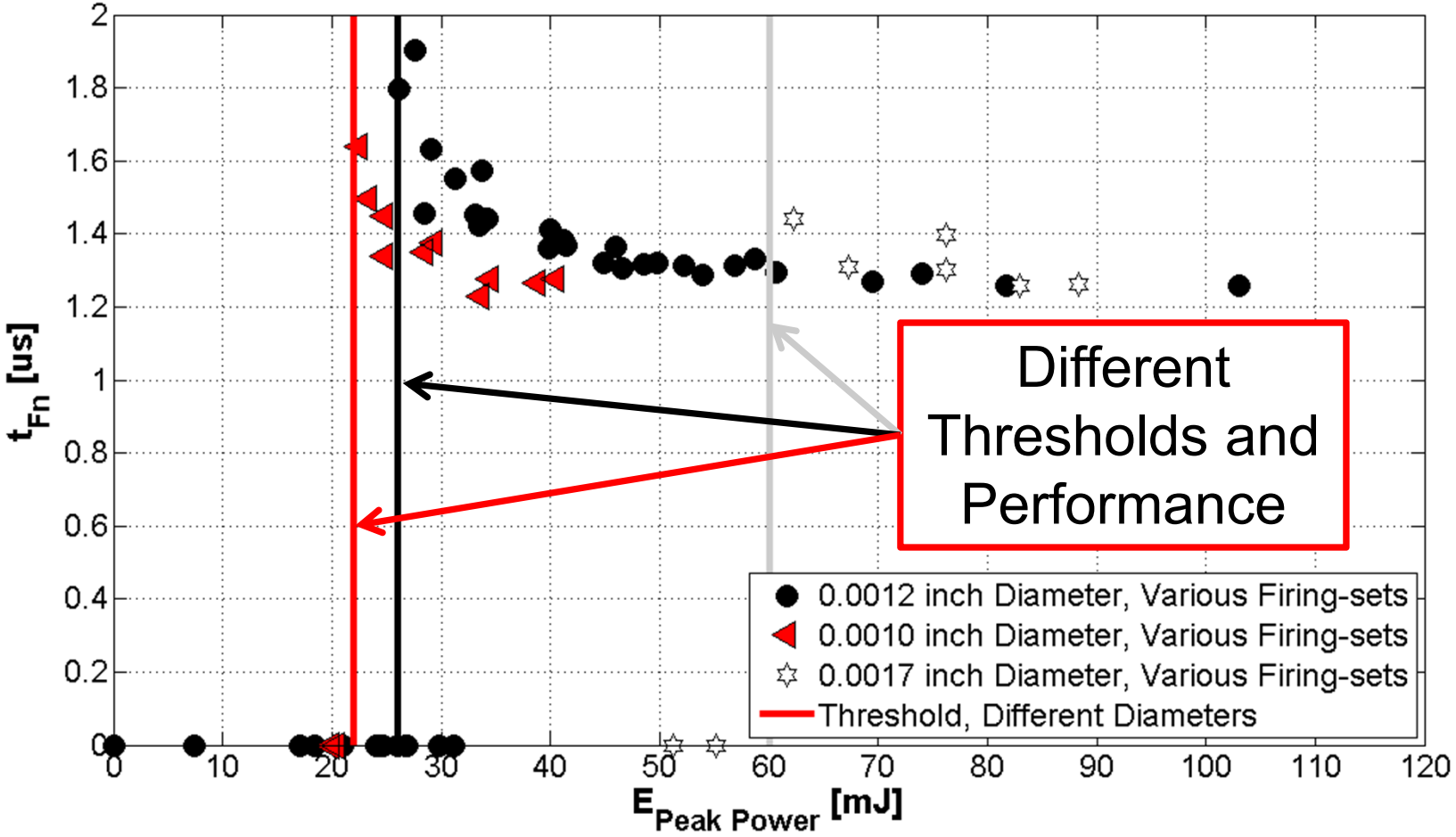


Measuring voltage at the bridge is necessary for determining detonator performance.

Theoretical Operating Region

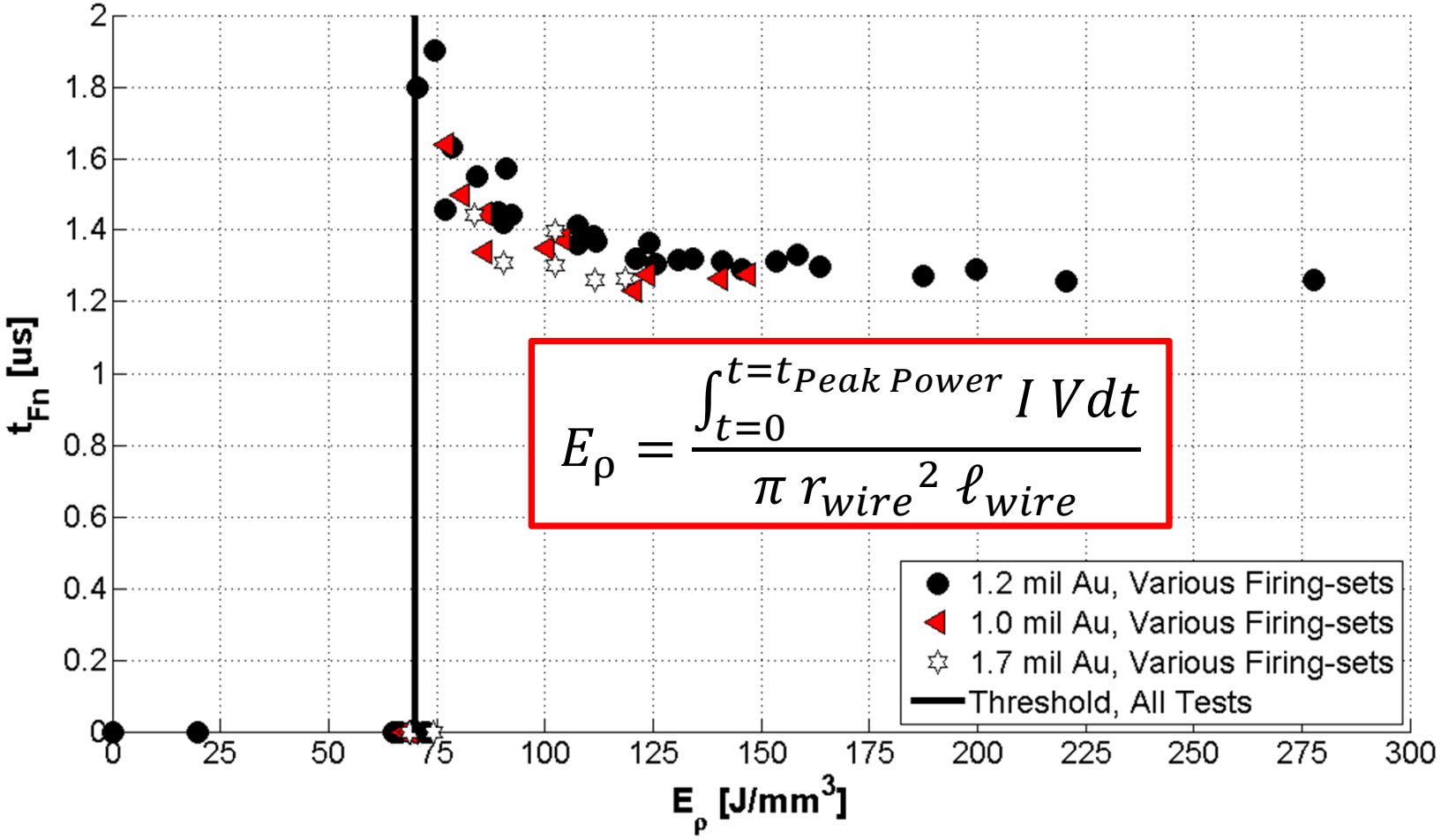


Energy at Burst of Different Wire Diameters



Further normalization is needed to collapse performance of different sized wires.

Burst Energy Density Relates Different Wire Sizes and Different Firing-sets.



E_ρ shows a direct link between electrical input and physical performance. An explosive train can now be mapped from a single series of tests, but performance inferred across the entire spectrum of wires and firing-sets.