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Towards Understanding Population Behaviour of Conducted Energy Weapons

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Research Goals: Non-lethal Weapons

Technical

- Establish a uniform test procedure
- Understanding CEW performance
- Evaluate population of in service CEWs
- Prepare for the next generation of CEW

Regulatory

- Establish a testing database across jurisdictions
- Regularize testing
- Minimum test procedure

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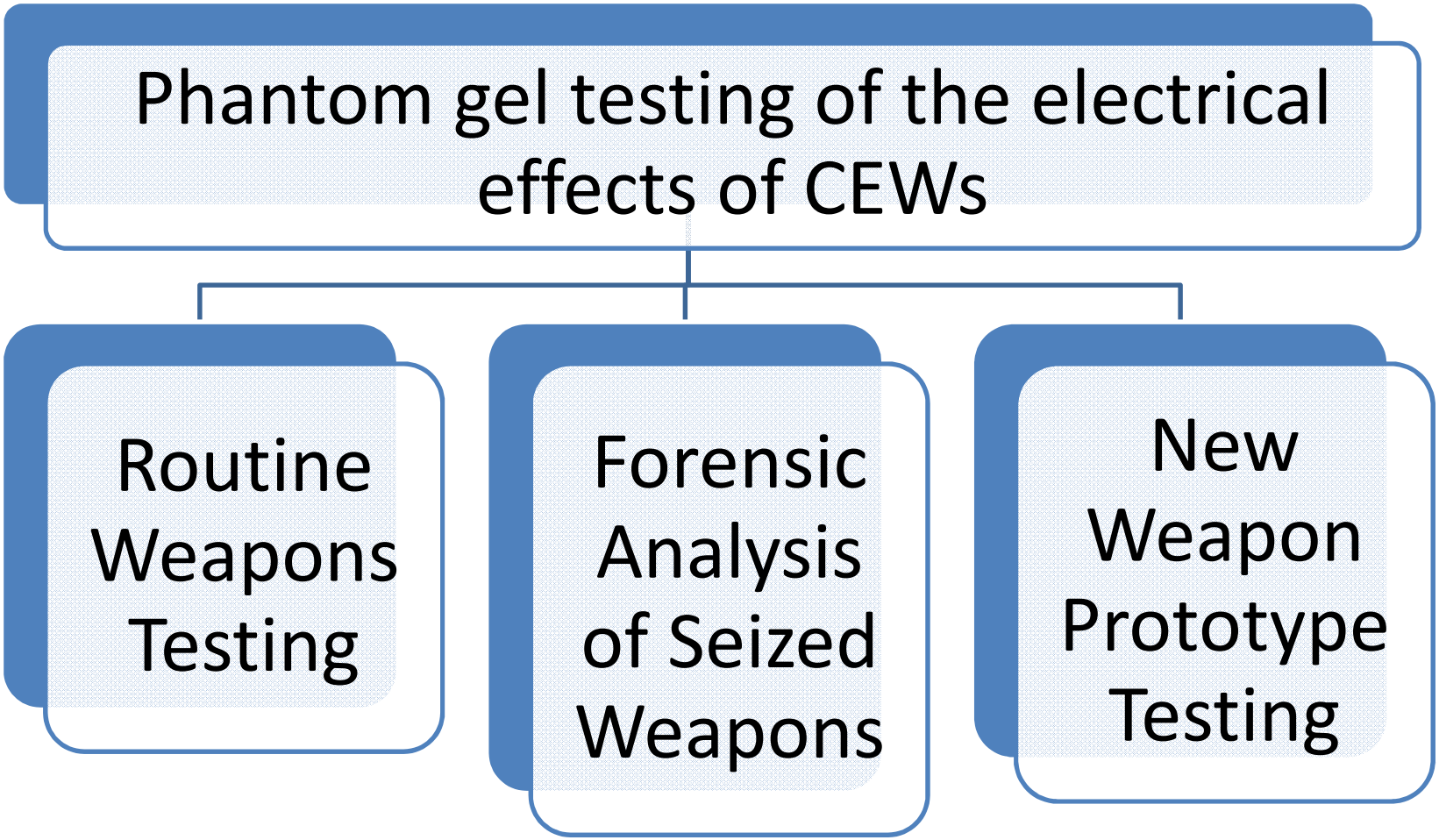
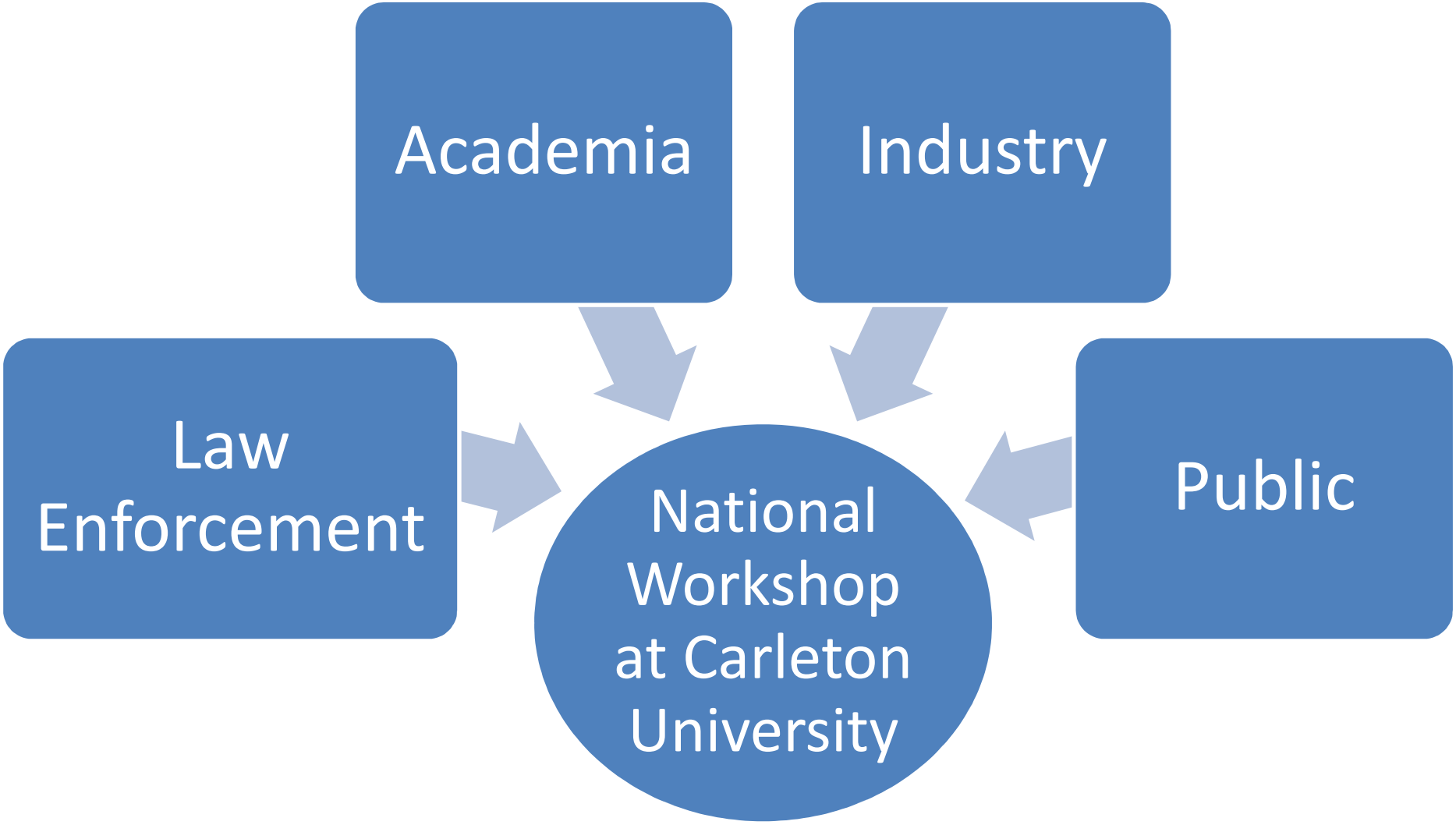
Testing of Conducted Energy Weapons



Testing: A Common Interest



Consensus on testing

A cause for concern

- High-profile cases concern the public
- Braidwood Inquiry: recommends independent , regular testing

Investigation

- Several independent large population characteristic studies

Industry Agreed Upon Testing Protocol

- Minimize the error of system components to less than 1%
- http://curve.carleton.ca/papers/2010/CEW-Test-Procedure-2010-ver1.1.pdf

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Important Questions

- Who is at risk?
  - The subject and the operator
- Are all weapons the same?
  - Variability over time
  - Operational lifecycle
- Testing Parameters?
  - Voltage, current, charge, pulse repetition frequency, and pulse duration

Testing Methods

Weapons of interest:

- Most common model in use in Canada over the past decade
- Weapons were aged between one and ten years
- Serial number proxy (X00-nnnnnn)
- All weapons were owned by active police services in Alberta, Ontario, and Nova Scotia
- 270 weapons fired 1061 times provided the raw data for analysis

TASER® X26™ CEW

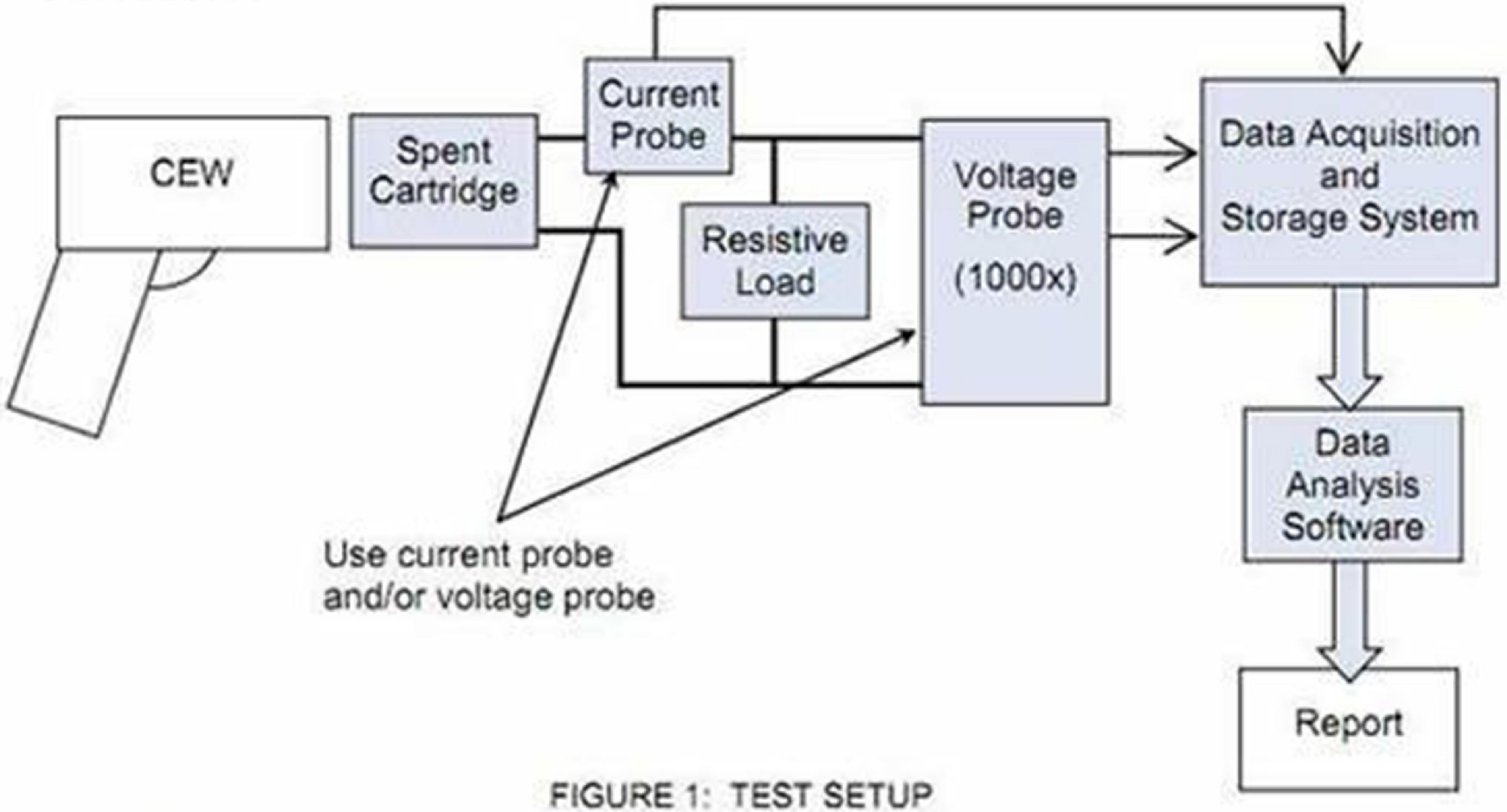


FIGURE 1: TEST SETUP

Data Collection

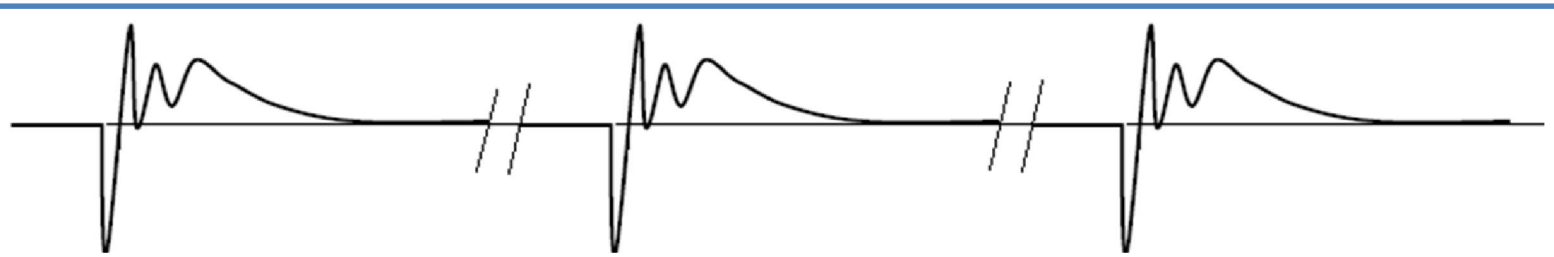
Figure 1: Test setup

X-26 Performance Specifications and Ranges

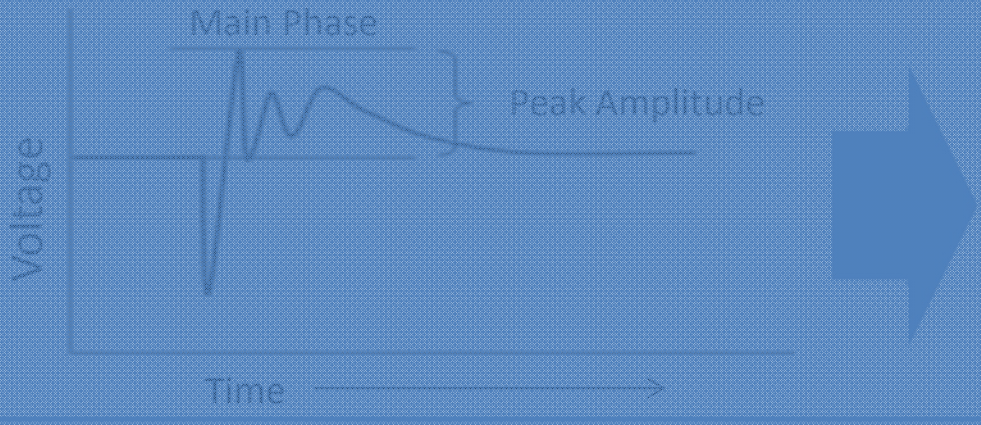
Testing Parameters	Lower Limit	Mid-range	Upper Limit
Voltage (volts)	1400	1960	2520
Current (amps)	2.3	3.25	4.2
Charge (µC)	80	102.5	125
Pulse Repetition Frequency (pps)	16.5	18.3	20
Pulse Duration (µs)	105	130	155

Pulse Characterization

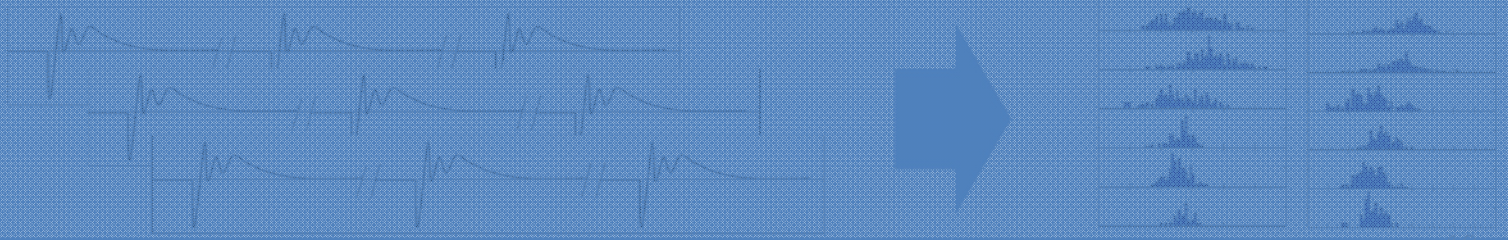
Pulse Train



Single Pulse

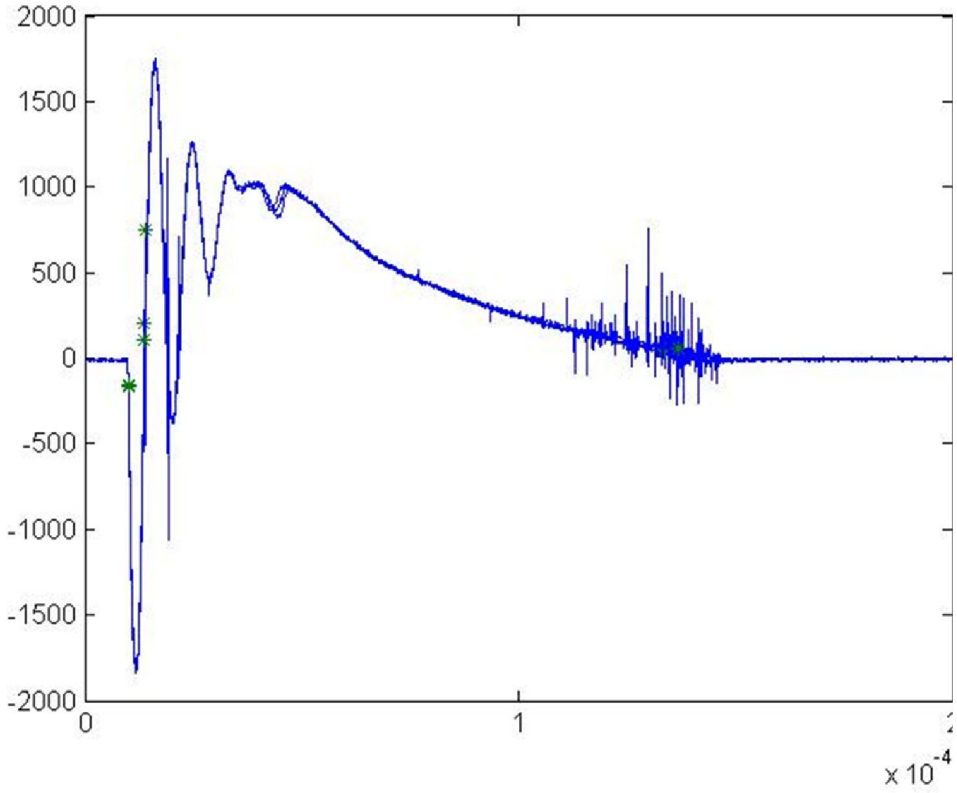


Multiple Shots

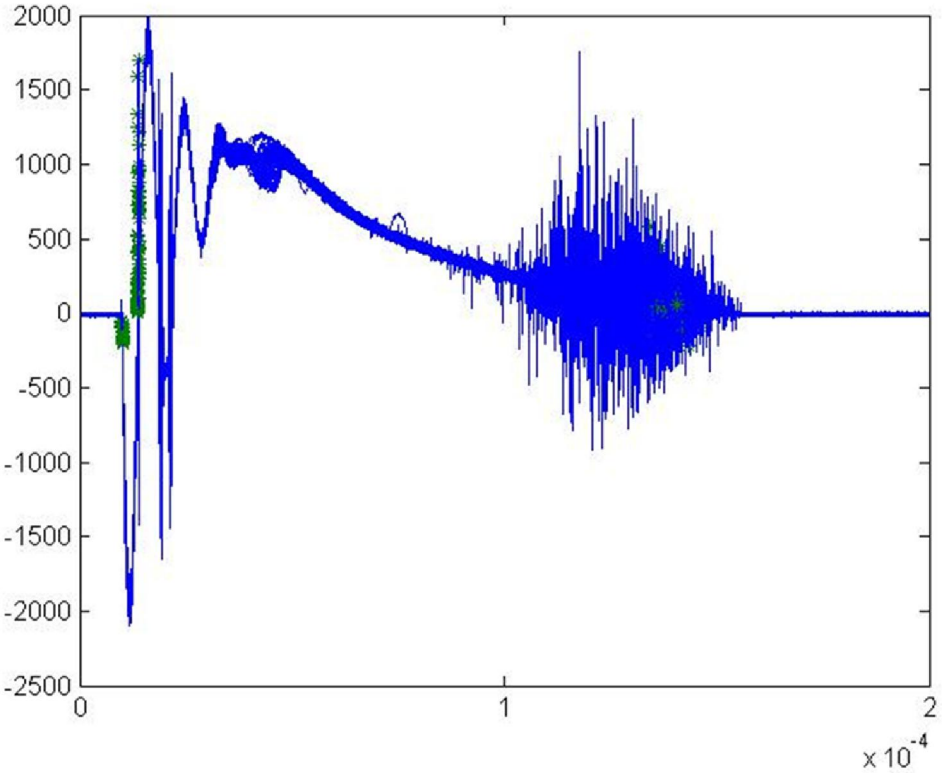


Statistical Analysis

One pulse

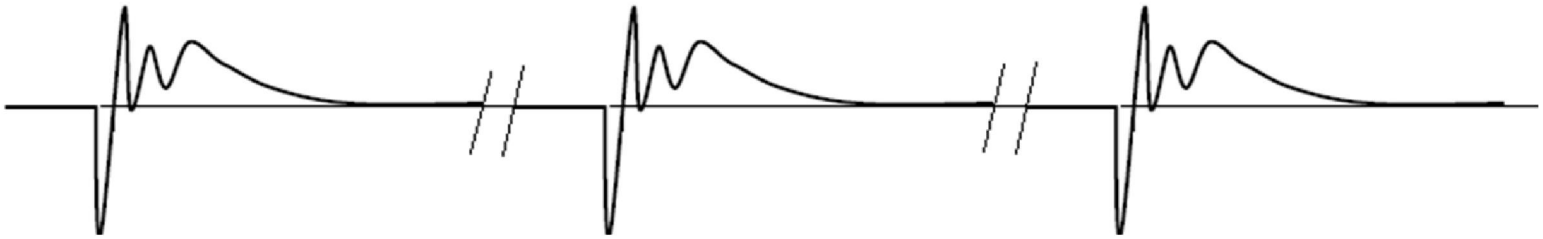


84 Pulses

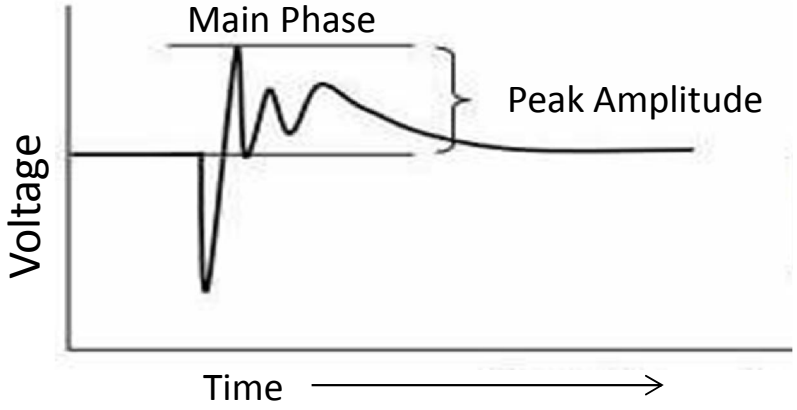


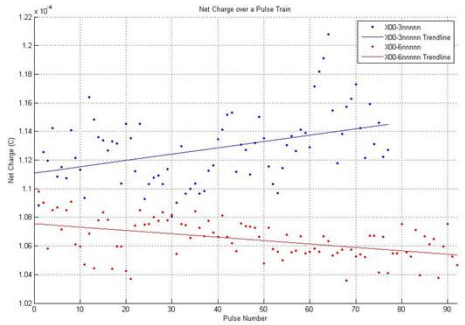
Pulse Characterization

Pulse Train



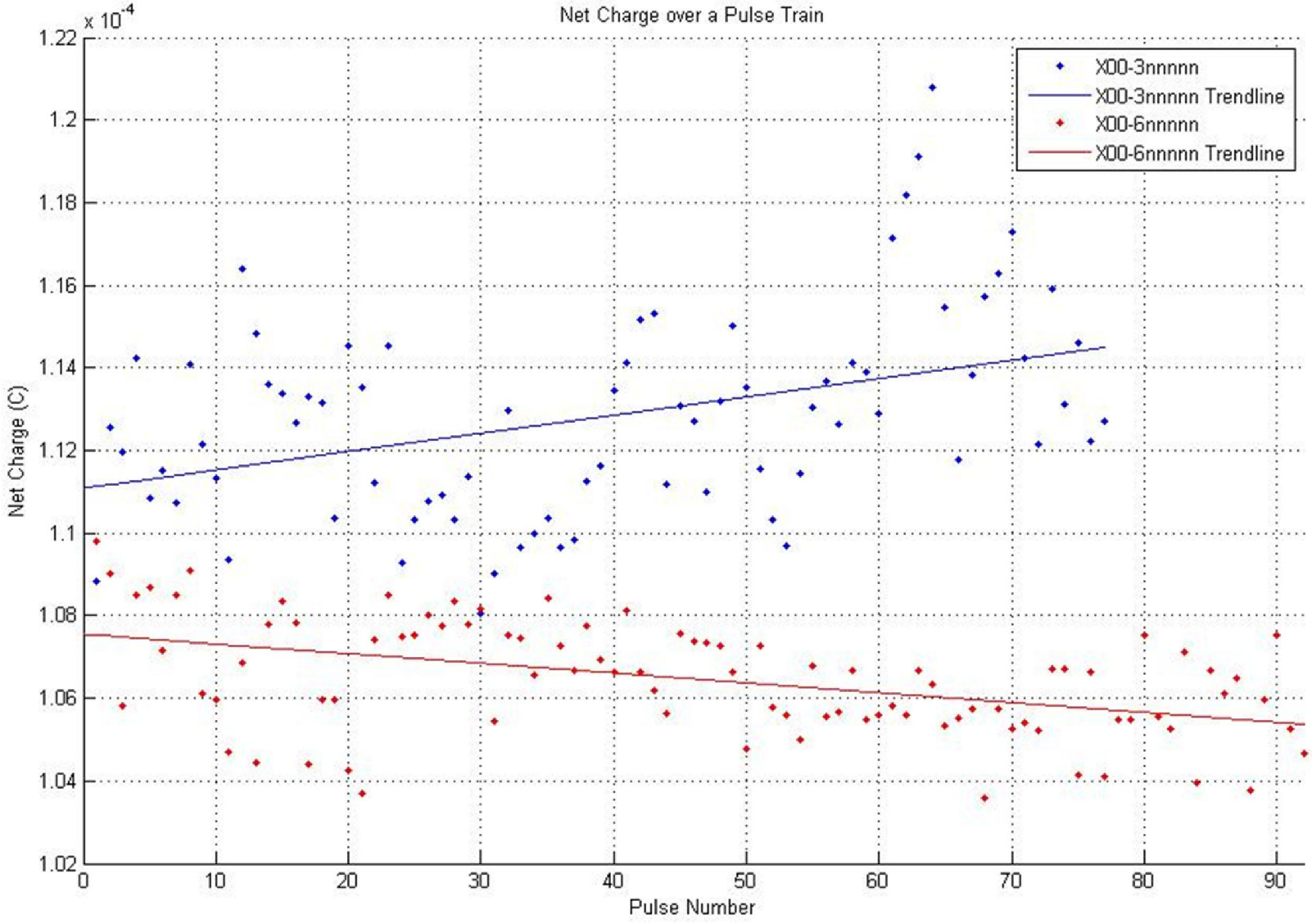
Single Pulse



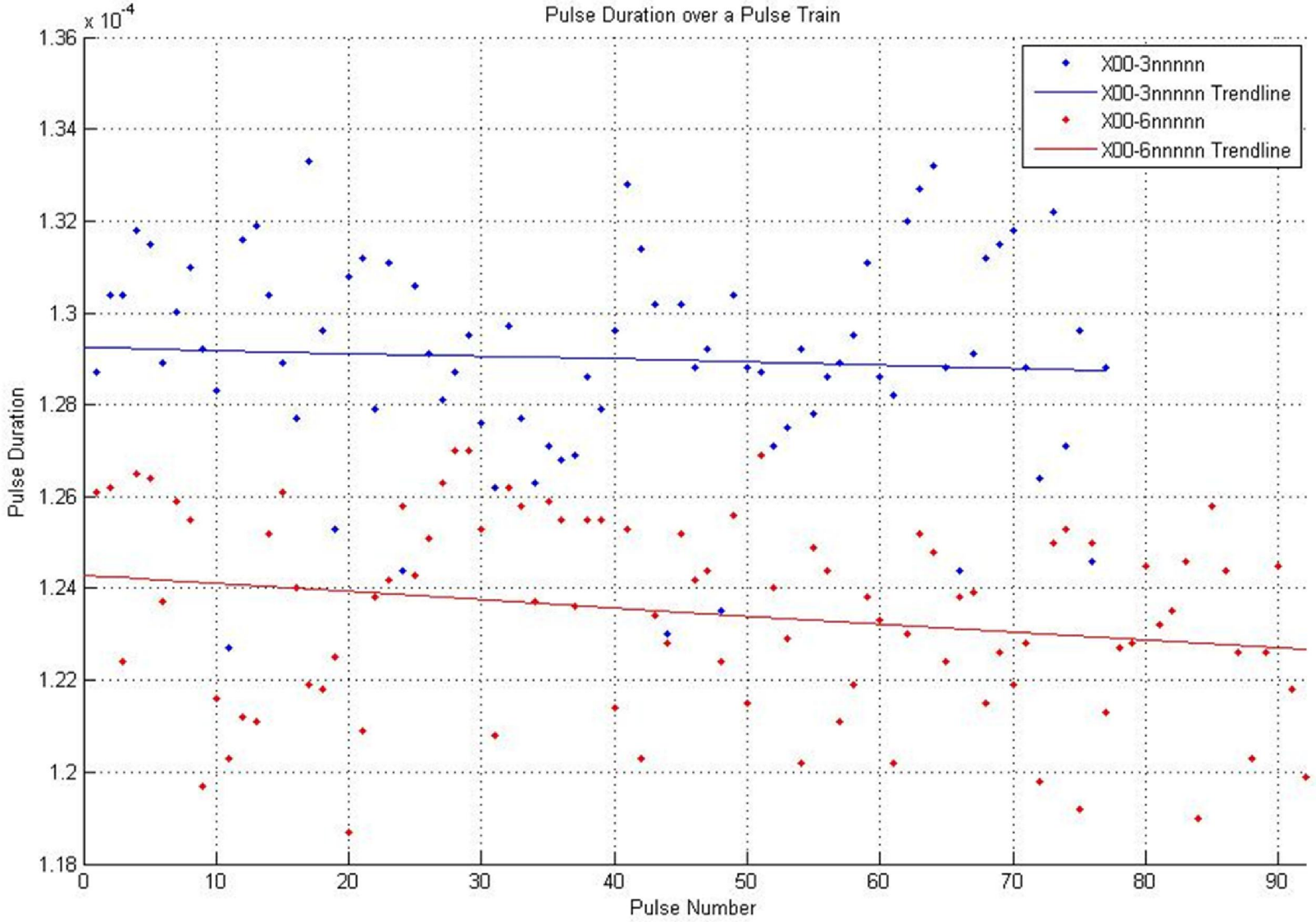


Multiple Shots

Results – Net Charge

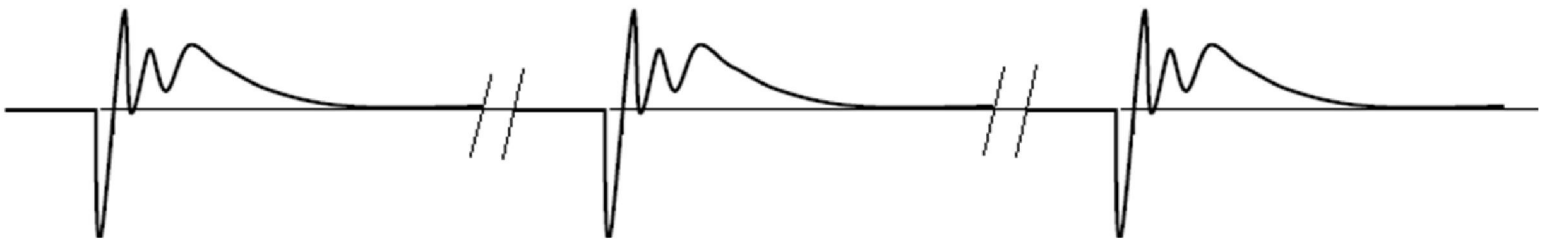


Results – Pulse Duration

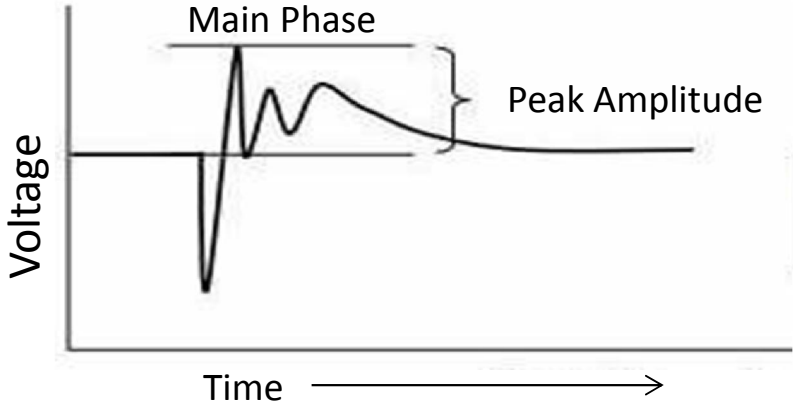


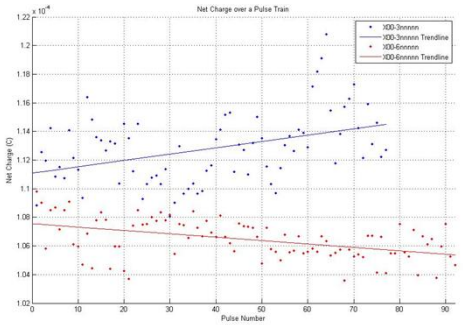
Pulse Characterization

Pulse Train

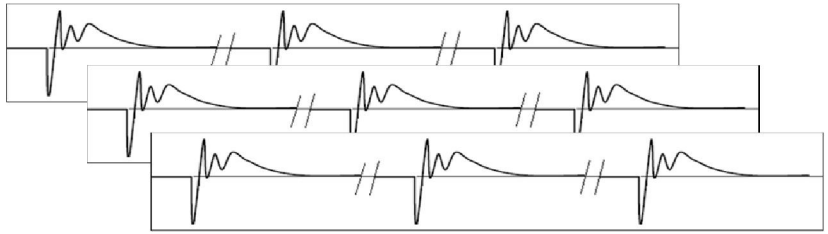


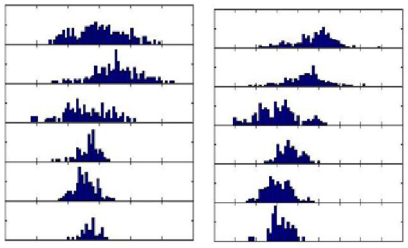
Single Pulse



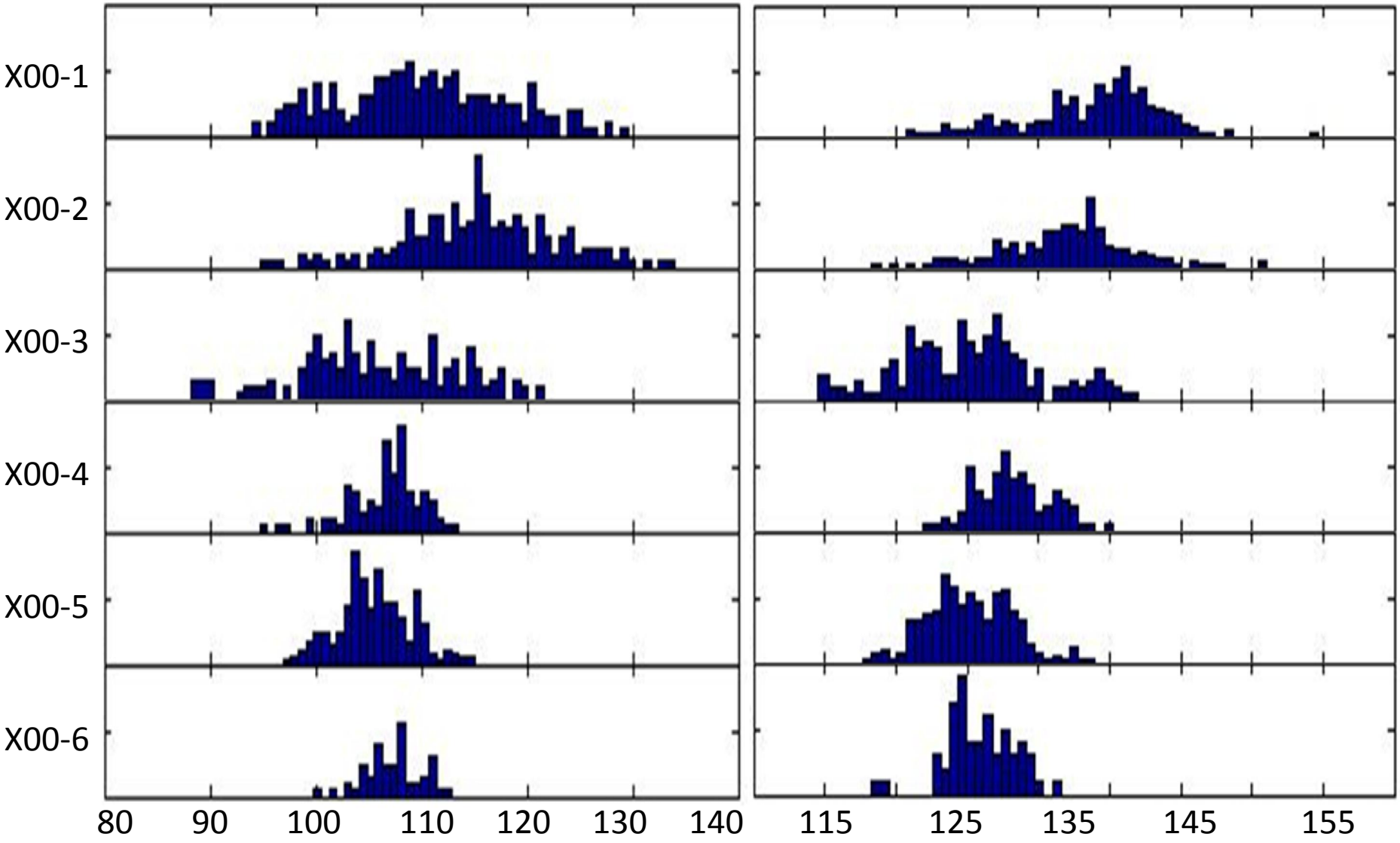


Multiple Shots





Results



Net Charge (µC) N=1061

Pulse Duration (µs) N=1061

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Results

Standard Deviation	Older serial #			Newer serial #		
	X00-1nnnnn	X00-2nnnnn	X00-3nnnnn	X00-4nnnnn	X00-5nnnnn	X00-6nnnnn
Peak Voltage (V)	174	143	224	116	178	93
Peak Current (I)	0.29	0.34	0.38	0.19	0.30	0.16
Net Charge (μC)	7.8	7.3	7.0	3.4	3.4	2.6
Pulse Duration (μs)	4.7	4.5	4.9	2.6	3.0	2.4
Pulse Repetition Frequency (pps)	1.8	1.7	1.4	0.7	0.07	0.03

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Discussion

- Testing of conducted energy weapons provides valuable data which when operationally applied will improve operator and subject safety.

- Test data are not regularly shared

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Room for Improvement

Technical Standards

- Guided & agile
  - Follow developments in technology
- Taser International sets performance standards
  - User/testing organizations verify and validate units

Regulations

- Are they a necessity?
  - Brittle and differ from one jurisdiction to another
- Uniform procedures and protocols

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Conclusion

- Weapons had a wide range of performance based on Serial Number order
- Testing in Canada is becoming more regular
  - Alberta, British Columbia, Quebec, Nova Scotia
- Weapons older than five years have reached the end of their design lifetime
- Newest CEWs show the most consistent performance characteristics

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Publications

- Dr. Adler's web page: http://www.sce.carleton.ca/faculty/adler/
- The Canadian CEW Test Procedure: http://curve.carleton.ca/papers/2010/CEW-Test-Procedure-2010-ver1.1.pdf
- Towards a Test Standard for CEWs: http://www.sce.carleton.ca/faculty/adler/publications/2011/dawson-LLW2011-test-standard-CEW.pdf
- Towards a Portable, Memory-efficient Test System for Conducted Energy Weapons: http://www.sce.carleton.ca/faculty/adler/publications/2011/rahmati-CCECE2011-CEW-test-system.pdf
- Towards a Test Protocol for Conducted Energy Weapons: http://www.sce.carleton.ca/faculty/adler/publications/2013/adler-2013-CEW-test-protocol.pdf

References

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- Justice Braidwood: http://www.braidwoodinquiry.ca/