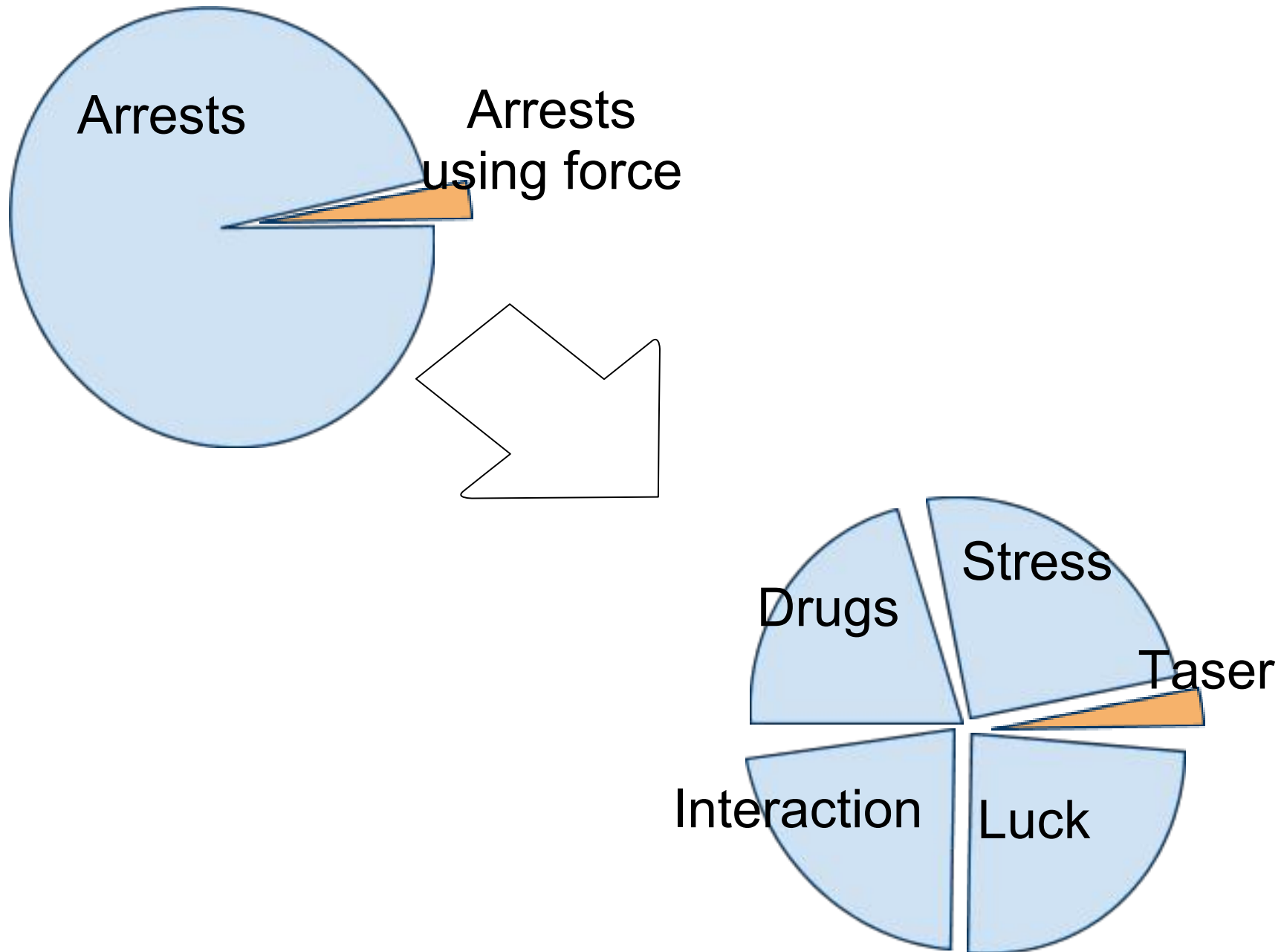


# ***CEW Workshop 2009:*** **Themes**

Andy Adler

Professor, Canada Research Chair  
Systems and Computer Engineering  
Carleton University

# Theme: *Complex / Multifactorial*



# Theme: *Trust*

- Population / Police
- Police / Weapons
- Police / Training

# Theme: *Risk*

- "Safe" is wrong word
- Taser's have a *relative risk*
- Taser's are best choice is many situations

# Theme: *Research*

- Expectations of scientific justifications
- "Evidence Based" policing
- Police initiated research questions
  - Lack of funding, except for crisis
- Need to improve academic / police collaboration

# Theme: *Lessons*

Reality: invested public \$\$ in Tasers

- Manage current "crisis"
- Learn lessons for next police technology

# Theme: *Testing*

- Performance measurement  
*Is **this** weapon reliable?*
- Risk measurement  
*how should we use **these** weapons?*
  - Are there subject groups that are especially vulnerable?
  - Does risk increase after multiple shots?
  - What should officers be looking for?

# Theme: *Reliability*

- What are the failure modes?
  - Gas discharge tube aging?
- What is weapon life span?
- Can we identify problem serial numbers?
- How often should we test?



# Theme: *Standard*

We need a standard for testing.  
It doesn't need to be complicated.  
It does need to be done now.

Consensus on:

- Load
- Parameters
- Measure all pulses, take maximum

# Theme: *Research Plan*

- Theme #1: models
- Theme #2: retrospective analysis
- Issues
  - Working relationship police/government/academics
  - Research can't just focus on Taser.  
Goal has to be broad use of force.

# Quick summary of presentations

- Cindy Bir, Wayne State U., Detroit
- Joel Johnston (S/Sgt., Justice, BC) & Chris Butler (Inspector, Calgary PS)
- Mike Joy, U. Toronto
- Peter Layden, Solicitor General, Alberta
- Pierre Savard, École Polytechnique, Montréal
- Ian Sinclair, MPB Technologies, Montréal
- Rick Wyant, CRT Less Lethal, Seattle

# Talk: *Cindy Bir*, Wayne State U.

Pigs with stress (via hemorage) + Taser

Increased Taser shots increased acidosis

Subject Number	Weight (kg)	Survival Status	Survival Time Post Exposures
<b>Control Stress Group</b>			
2018	44.0	Survived	NA
2017	52.0	Survived	NA
2019	45.6	Survived	NA
<b>Control CEW Group (20 Exposures)</b>			
2020	46.0	Survived	4.0 H (euthanized)
2026	45.8	Survived	4.0 H (euthanized)
5003	46.7	Survived	4.0 H (euthanized)
<b>Experimental Group (Stress + 20 CEW Exposures)</b>			
2021	43.6	Non-survival	2.5 H
2022	44.8	Non-survival	3.5 H
2023	44.8	Non-survival	2.5 H
2024	48.4	Survived	4.0 H (euthanized)
2025	48.0	Non-survival	3.0 H

# Talk: *Joel Johnson*, Justice, BC

The law enforcement community supports relevant Quality Assurance Testing that is:

- Affordable
- Accessible
- Logistically feasible

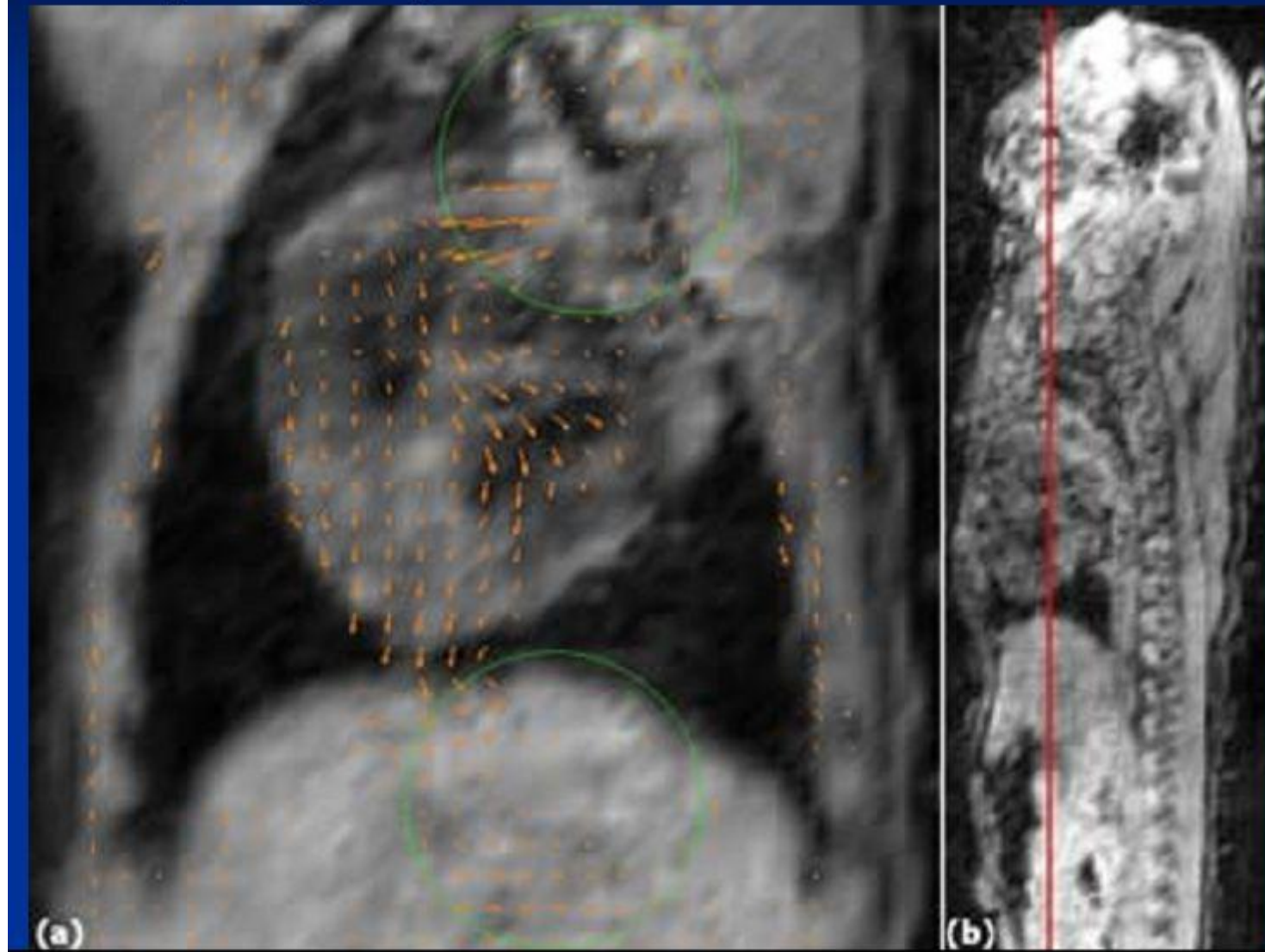
Quoted listserv member:

"... on the one hand, I am fed up with the media-driven frenzy ... on the other hand, [we must] ensure that our equipment is well-maintained and operating ... there must be a logical, defensible protocol and process for regular testing of CEWs.

# Talk: *Mike Joy*, U. Toronto

Current  
Density  
MRI can  
visualize  
flow of  
current in  
body

Vector plot superimposed on double resolution MRI



# Talk: *Peter Layden*, SolGen, AB

Two controversies:

- Abuse of the device
  - Because no standard / transparent system to report on and monitor the use of force
- Electrocution
  - remains issue because the science is not clear.  
Tied to a sub-issue: approval of force option

Themes:

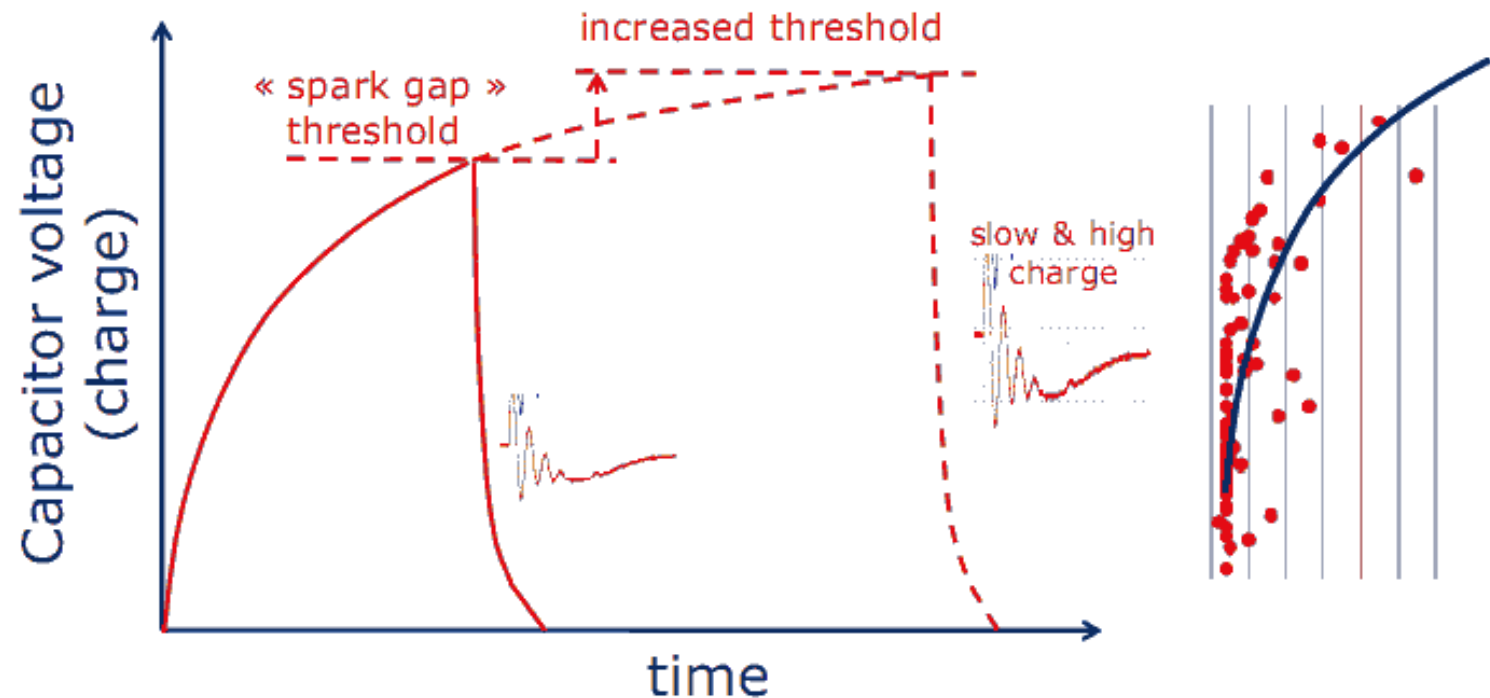
- Science Informing Policy
- Learn from CEWs to prevent future problems

# Talk: *Pierre Savard*, Polytech. Mtl

Spark Discharge tube:

*Taser  
failure  
mode?*

2. High charge and slow rate:  
Cause: higher threshold of spark gaps?





# Talk: *Pierre Savard*, Polytech. Mtl

Proposal for a

“safety  
centered”

Test

approach

## 4. Design of test protocols: A proposed “safety centered” approach

- 
- “Realistic worst case approach”:
    - Maximum CEW values (current, charge, voltage, rate) instead of average values
    - Minimum realistic load
    - No spark tests (“fool proof approach”)
    - Inclusion of a “safety factor” in IEC60479-2 to account for spontaneous extrasystoles and increased pathological susceptibility to arrhythmias
  - Example:
    - The net charge of a single impulse should never exceed  $X \mu\text{C}$  when connected to a  $Y \Omega$  load

# Talk: Ian Sinclair, MPB Technologies

- How a Taser works
- Results
- Waveforms
- History of specs from Taser International
- Test Results
- Unusual weapons functions

CEW Details			Overall CEW Status:		
Model Number	-	X26	In Tolerance		
Serial Number	-	X00-012345			
Battery Status	percent	90			
CEW Temperature	degrees Celsius	24			
Software Revision	-	15			
Load Resistance	ohms	594.66			
Comments:	-				

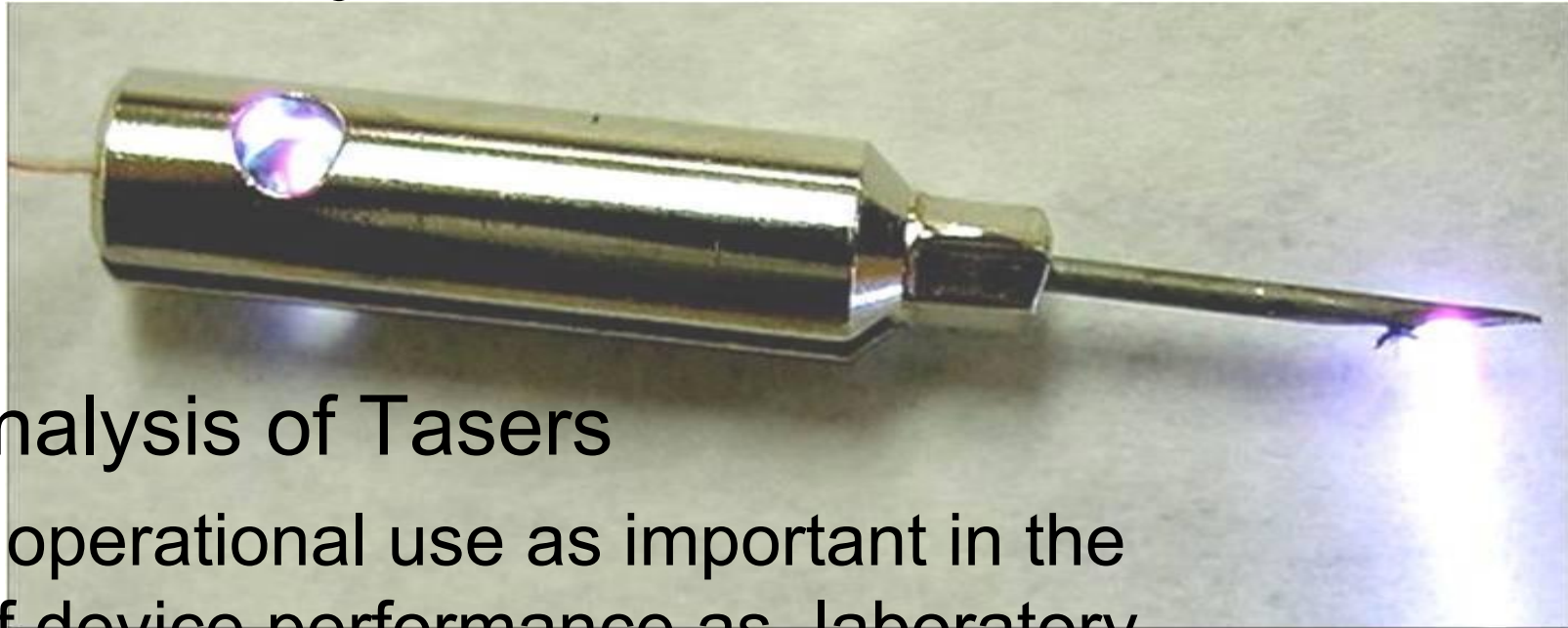
  

TI CEW Operating Parameters					
	Units	Compliance as Found	Value	Limit Minimum	Limit Maximum
Pulse Duration	microseconds	In Tolerance	134.6	105	155
Main Phase Net Charge	microcoulombs	In Tolerance	120.0	80	125
Main Phase Peak Current	amps	In Tolerance	3.43	2.3	4.2
Main Phase Peak Voltage	volts	In Tolerance	2037	1400	2520
Pulse Rate	pulses/second	In Tolerance	18.3	16.5	20.0

Supplemental Test Parameters								
	Units	Average of All Pulses	Standard Deviation of All Pulses	Average of First 8 Pulses	Average of Last 8 Pulses	Average of 8 Max Values	Maximum Pulse	Minimum Pulse
Pulse Duration	microseconds	134.4	1.9	134.8	134.6	137.9	139.0	130.2
Arc Phase Net Charge	microcoulombs	9.0	0.2	9.0	9.1	9.3	9.5	8.7
Arc Phase Peak Current	amps	3.44	0.06	3.44	3.48	3.55	3.62	3.30
Main Phase Net Charge	microcoulombs	119.2	2.2	119.4	120.0	123.0	124.4	113.7
Main Phase Total Charge	microcoulombs	122.6	2.3	122.8	123.5	126.5	127.9	117.0
Main Phase Peak Current	amps	3.39	0.06	3.39	3.43	3.50	3.54	3.24
Main Phase Peak Voltage	volts	2015	34	2018	2037	2079	2106	1925
Main Phase Energy	millijoules	105.2	3.6	105.5	107.2	111.7	114.2	96.1
Full Pulse Net Charge	microcoulombs	110.2	2.1	110.5	110.9	113.8	115.1	105.0
Full Pulse Energy	millijoules	119.7	4.0	120.0	122.1	127.1	129.9	109.7
Pulse Rate	pulses/second	18.3						
Charge/Second	milliamps	2.2						
Energy/Second	watts	2.2						
Duration of Cycle	seconds	4.9161						
Total Number of Pulses	-	90						

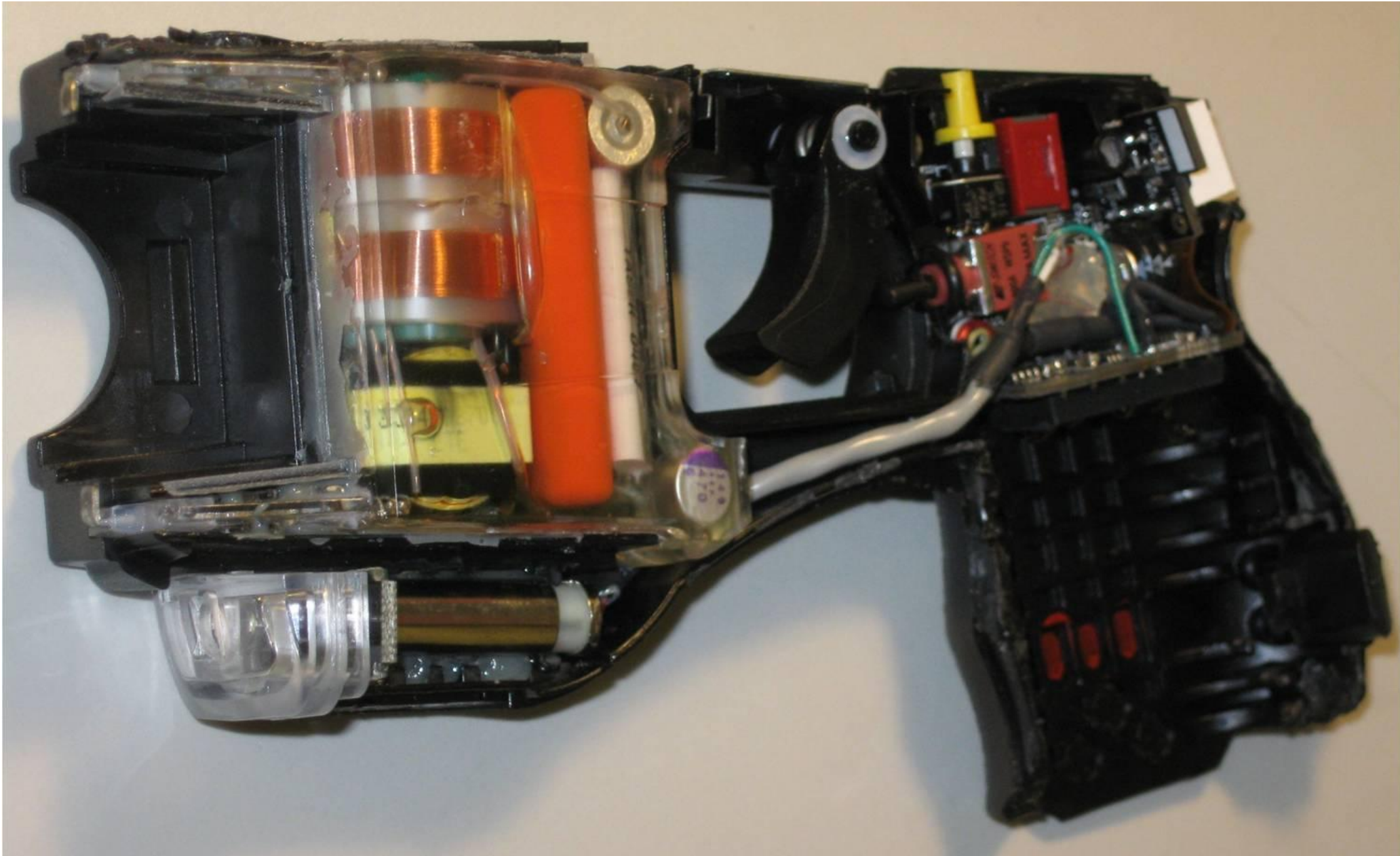
# Talk: Rick Wyant, CRT Less Lethal



## Forensic analysis of Tasers

- context of operational use as important in the analysis of device performance as laboratory testing
- Devices in the field must be maintained
- Less-Lethal manufacturer's claims **MUST** be independently evaluated / verified for scientifically accurate post event analysis

# Taser X26: *Internals*



# CEW Workshop 2010

- Partnership Government / Academic
- Open exchange of data, results, ideas
- Clarify
  - What is known / unknown
  - What we agree on
  - Where the priorities are
- Testing goal:
  - consensus on test principles and methodologies