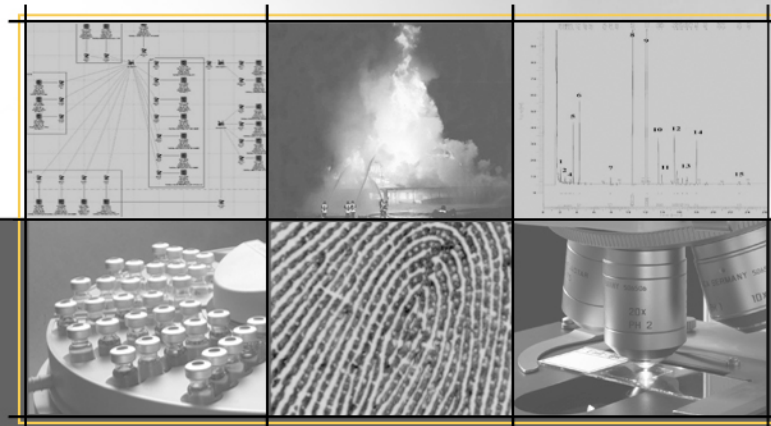


Forensic science is not an oxymoron, it is a discipline in itself

Christophe Champod & Fabiano Riva
University of Lausanne, Switzerland



R. A. Reiss



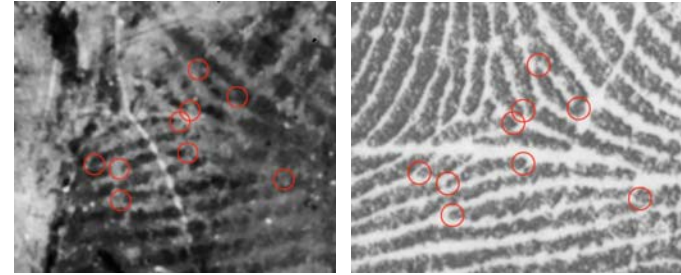
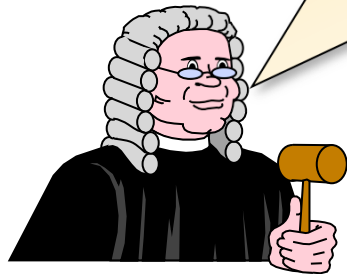
Forensic Science for the 21st Century
Sandra Day O'Connor College of Law,
Arizona State University - April 3-4, 2009

Progress in Forensic Science

> I believe that if we want to do any progress in forensic science, we shall:

- ① Abandon unsupportable claims of **individualization**.
- ② Redefine the **logical underpinning our reporting schemes**.
- ③ When possible, provide opinions that can be supported by **empirical and disclosable data**.

What do you mean by
“certain” ?



It means that, on Earth,
nobody else but the
suspect can be the
source of the mark



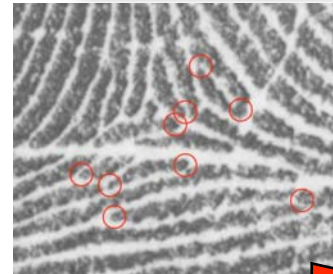
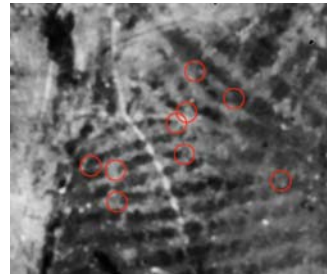
“Earth population
paradigm”



Let's consider *a priori*
10 billion individuals

Recall, this the **Earth
population paradigm**

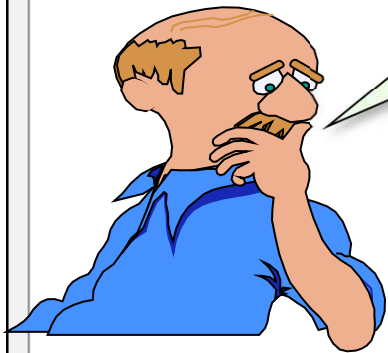
What **strength of evidence** do we
need to obtain a reasonable degree
of scientific certainty ?



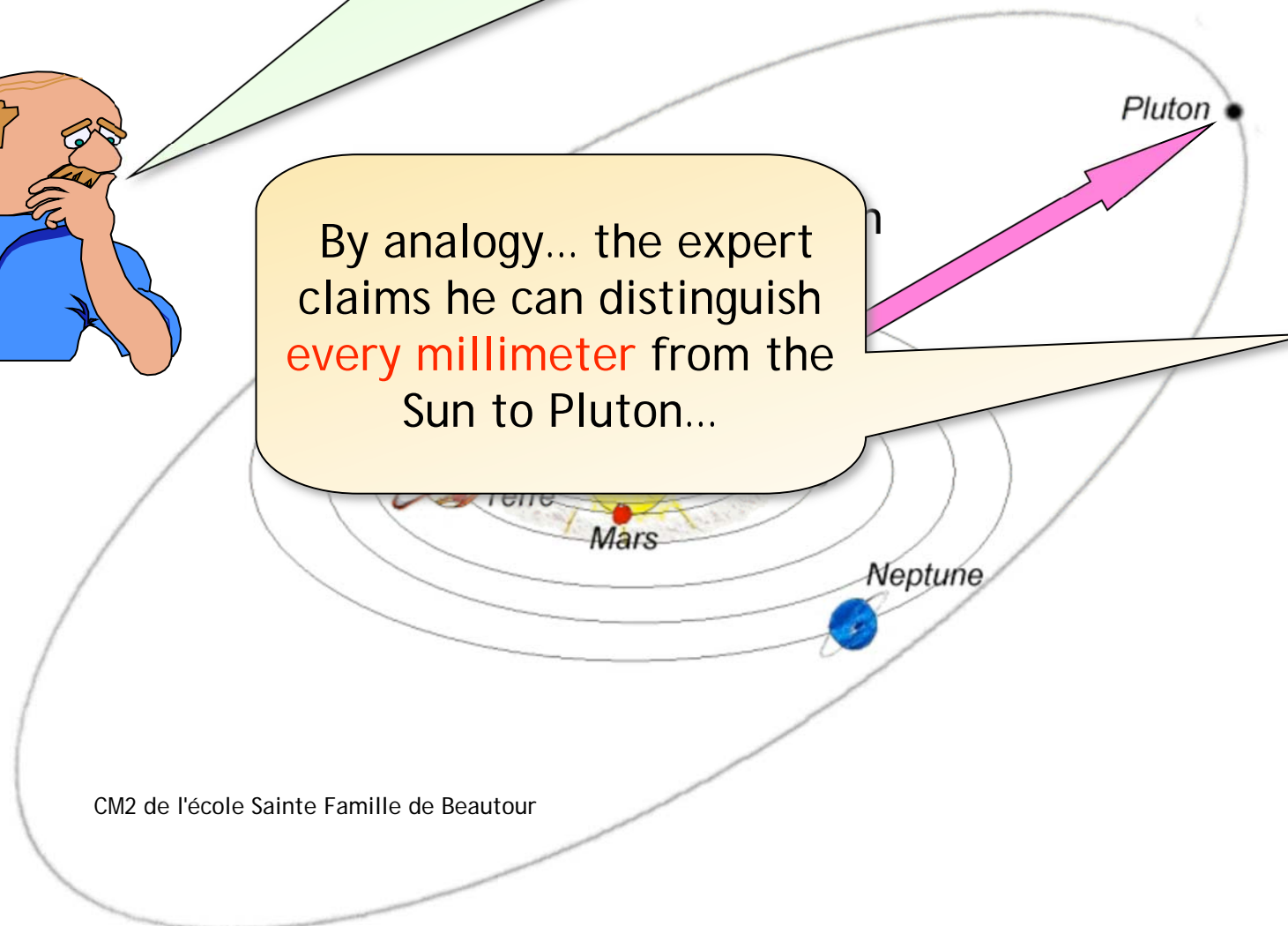
Mr DOE is **one
among 10
billion**

Mr DOE has left the
mark to a **reasonable
degree of scientific
certainty**

Hence we talk about a **likelihood ratio** of the order of 10^{15} or more



By analogy... the expert claims he can distinguish **every millimeter** from the Sun to Pluton...



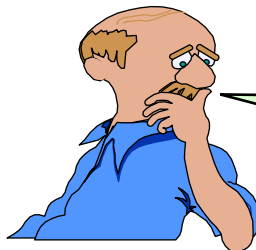
① Individualization



We need to move away from the Earth population paradigm



And completely **abandon the concept of individualisation**



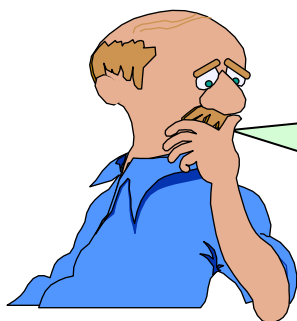
There is no need to be certain to be useful

Forensic Expert Opinion

Balance?



Logic?



If we can get the logic right - then
this helps us to maintain balance

Probability of the evidence given the prosecution case

Probability of the evidence given the defence case

$$\Pr(E|H_p)$$

$$\Pr(E|H_d)$$



The single most important advance in forensic science thinking is the realization that the scientist should address the *probability of the evidence*

The ratio of these two determines the way that the scales of justice are tilted by the scientific evidence

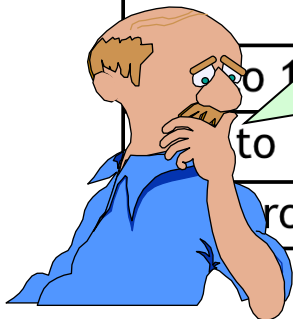
$$LR = \frac{\Pr(E|H_p)}{\Pr(E|H_d)}$$



② Reporting Scheme

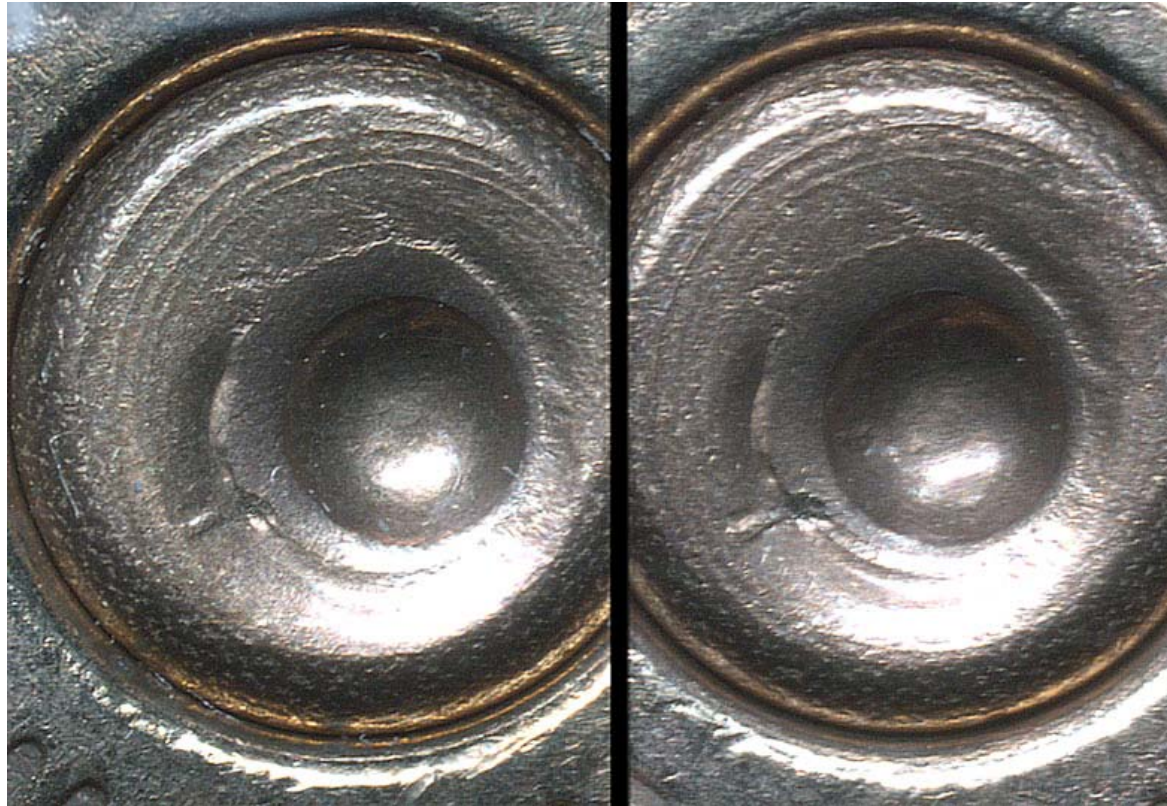
> It should be based on sound logical principles

LR	
$> 10^6$	Extremely strong evidence to support H_p
10^5 to 10^6	Very strong evidence to support H_p
10^3 to 10^5	Strong evidence to support H_p
10^2 to 10^3	Moderate evidence to support H_p
>1 to 10^2	Limited evidence to support H_p
1	Inconclusive, the findings does not help to progress towards H_p or H_d



Unfortunately, the reporting scales currently proposed by document examiners, footwear mark examiners, firearms/toolmarks examiners do not stand scientific scrutiny

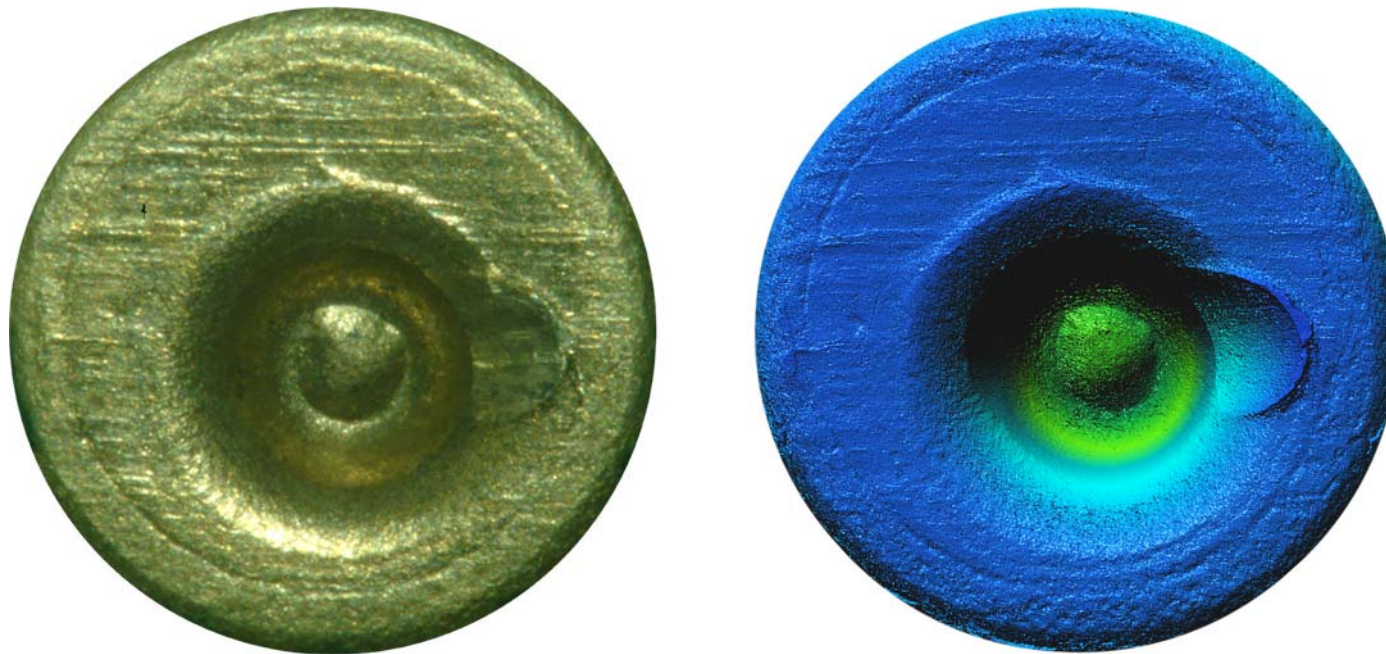
Support opinions with relevant data



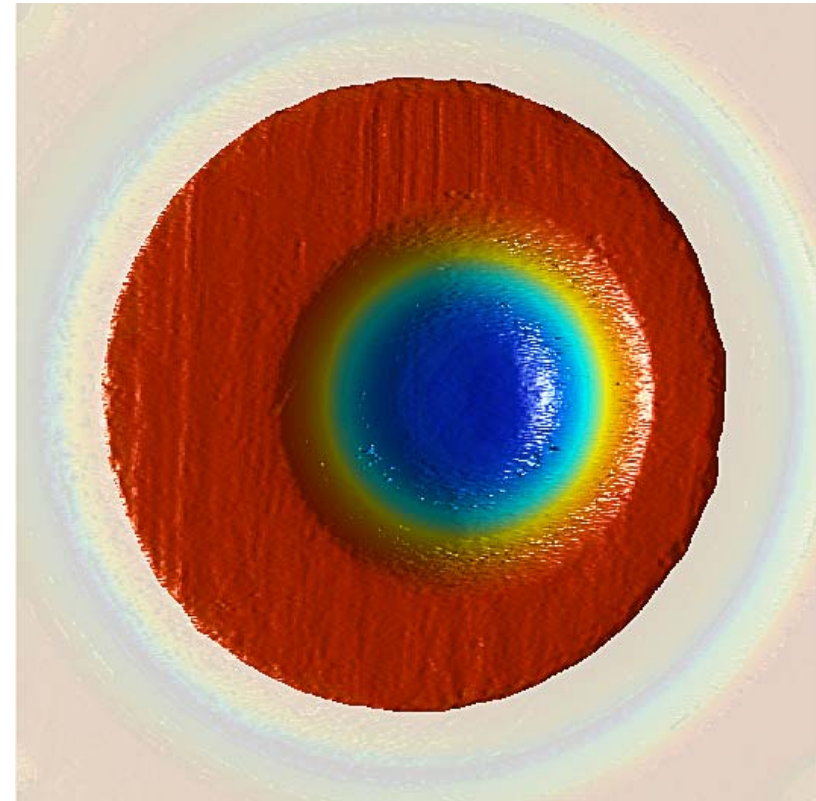
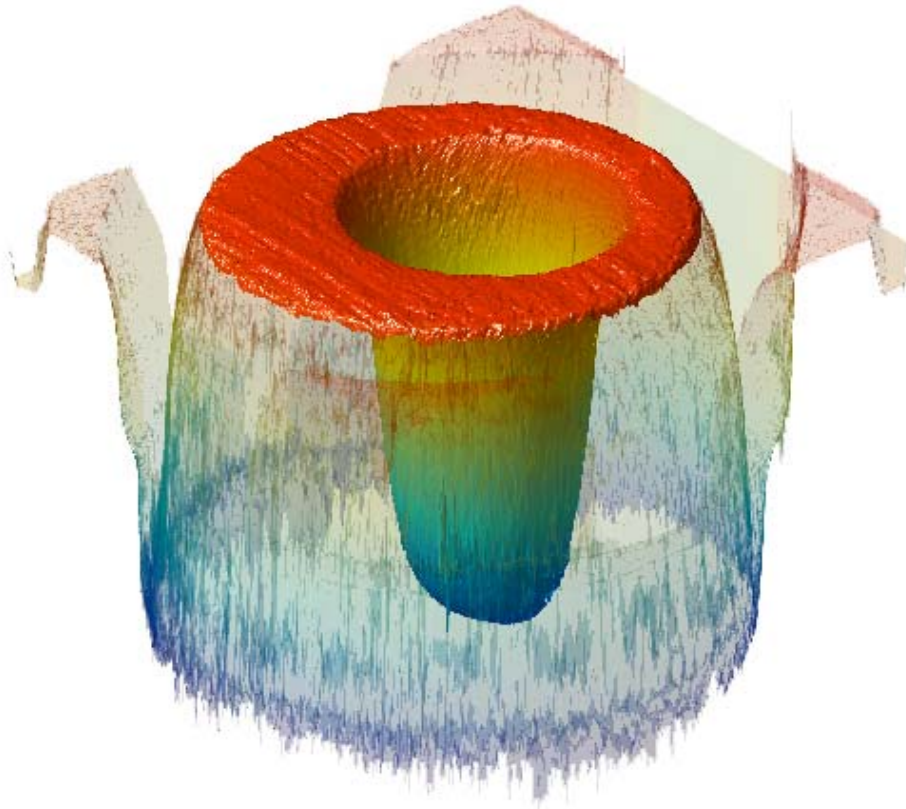
Was Q (left) fired by the same gun (SIG 9mm parabellum) as K (right)?



Measurements with Nanofocus μ scan



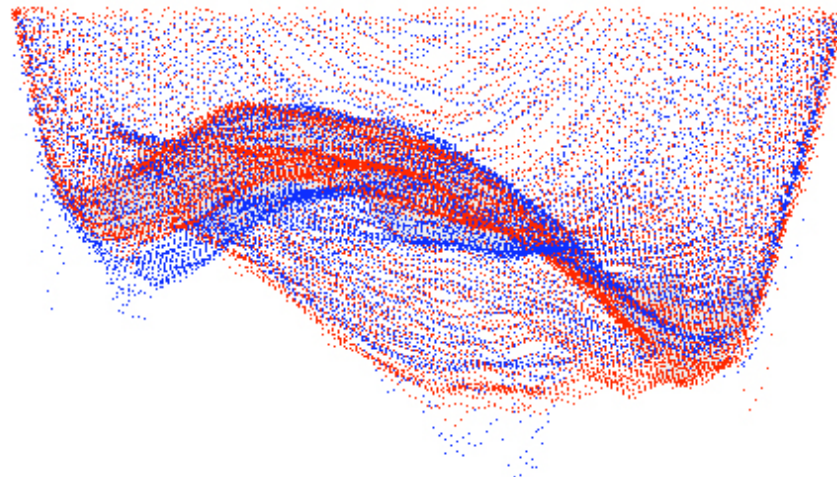
Primer Cup Cutting



Automatic segmentation of the primer cup by exploiting normal vectors

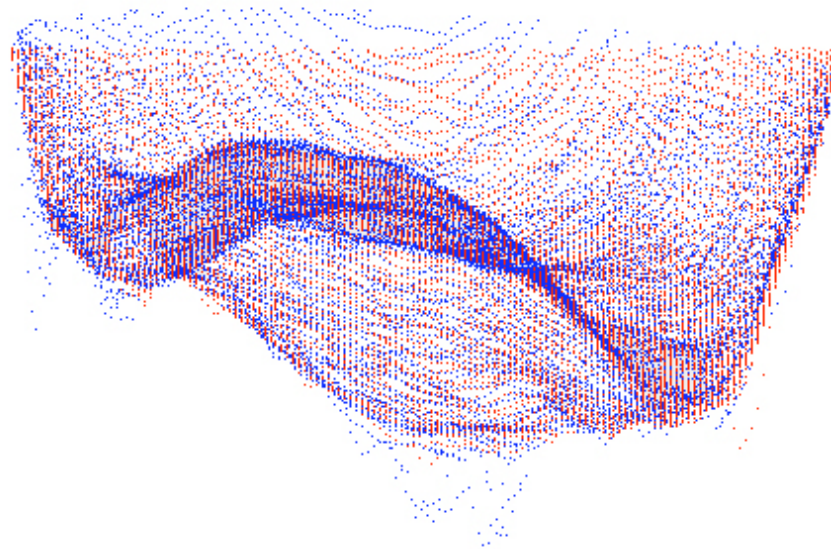
ICP - Iterative Closest Point

Firing Pin Mark Alignment



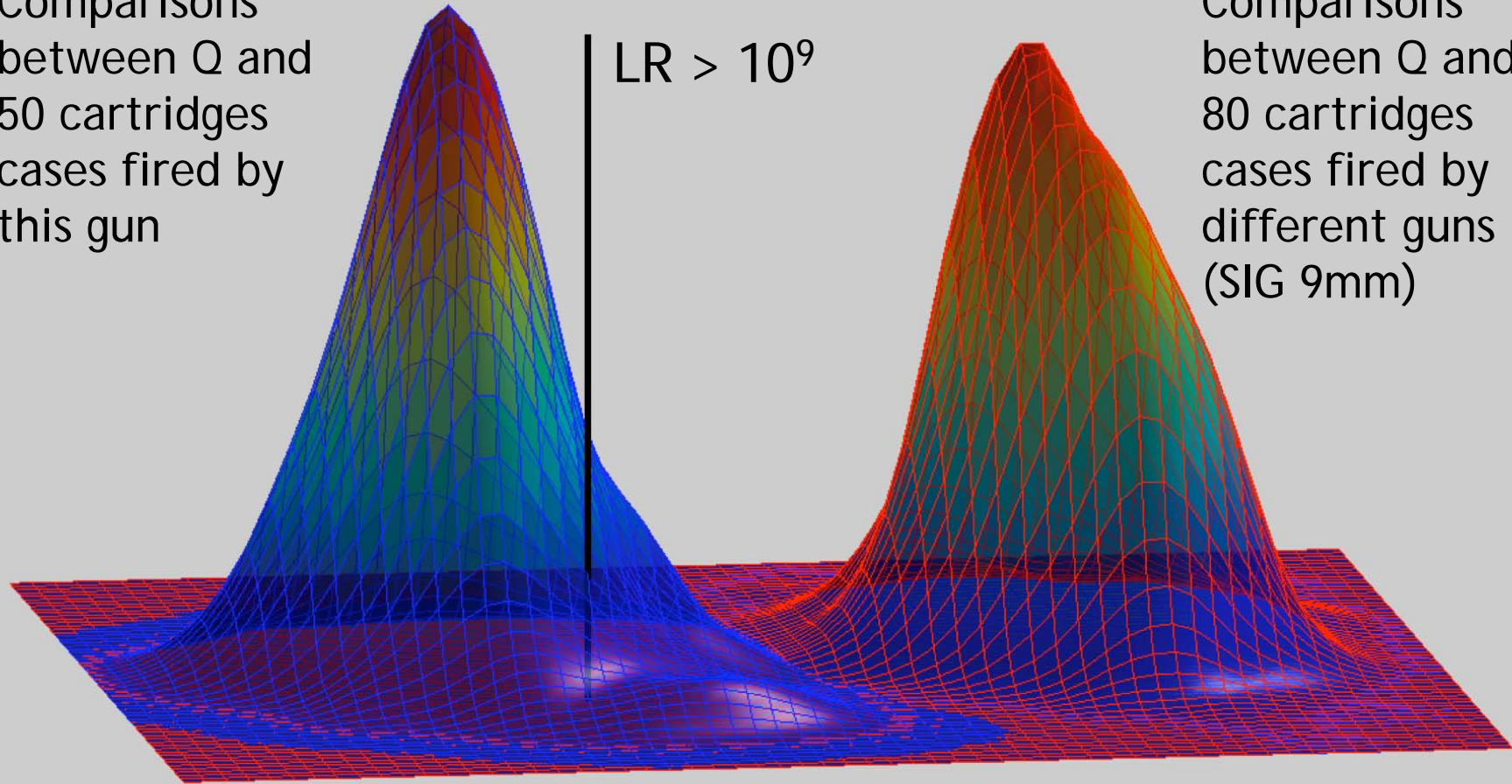
ICP - Iterative Closest Point

Firing Pin Mark Alignment



③ Informed opinion with data

Comparisons
between Q and
50 cartridges
cases fired by
this gun



Comparisons
between Q and
80 cartridges
cases fired by
different guns
(SIG 9mm)

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