Template Measurement Approach

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Craig R. Tewell

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Template Approach

- Template is created from the signature of an item known to be a nuclear weapon / component
- Confidence in confirming an unknown item is gained by comparing signature to template
- Template is likely to be classified and must be secured.
- Comparison to template must be done behind an information barrier.
- Mathematical tolerance for comparison must be chosen with care

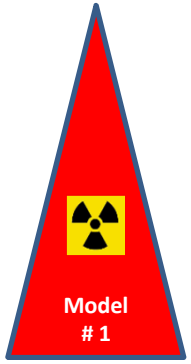
Notional Inspector Perspective

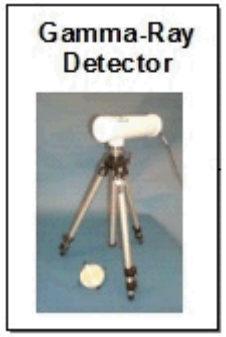
Step 1: Establish Template

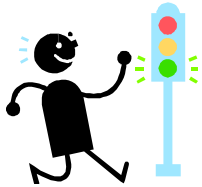
High Confidence Item is a Nuclear weapon/component

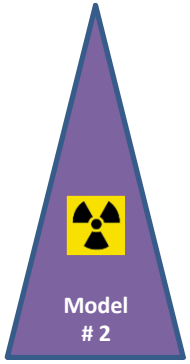
Step 2: Secure Template Storage

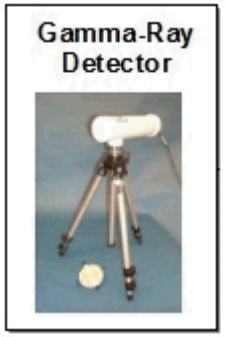
Step 3: Compare to Template







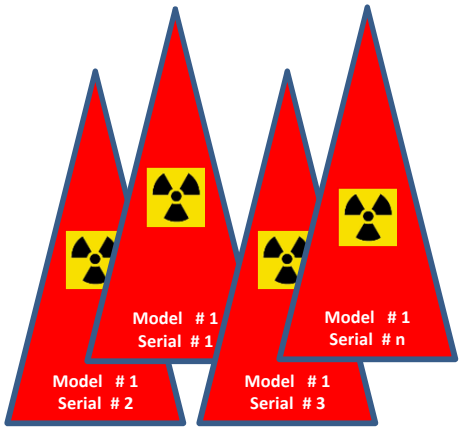


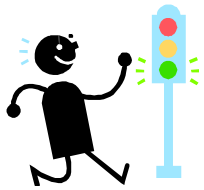


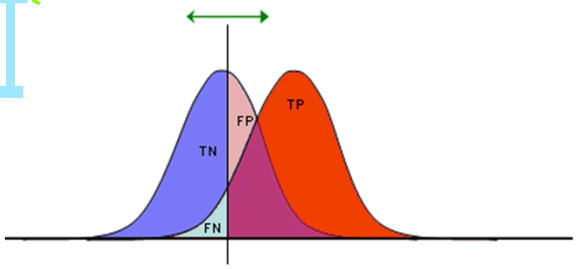
Choosing a Template

- What is the goal of the template?
  - Comparison of type of nuclear weapon / component
  - Identification of a specific nuclear weapon / component
- Reliable signature
  - combination of attributes of a given nuclear weapon/component that are classified
  - *measurable* combination of signature elements for a given nuclear weapon/component in a given configuration
- Effects of measurement conditions on template must be understood and controlled
- Must establish a tolerance for comparison to template
- Maintain chain of custody of the classified template

Confirming Nuclear Weapon/Component by Type







Model 1	Model n
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FN	TN
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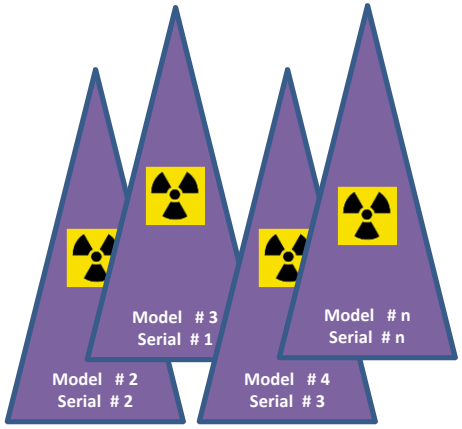
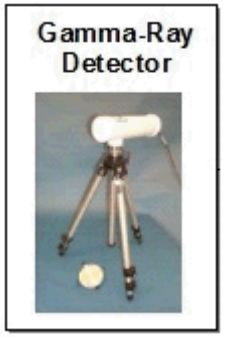
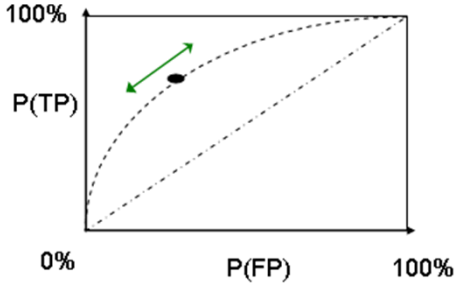
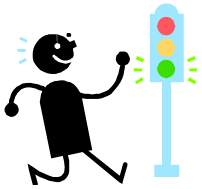
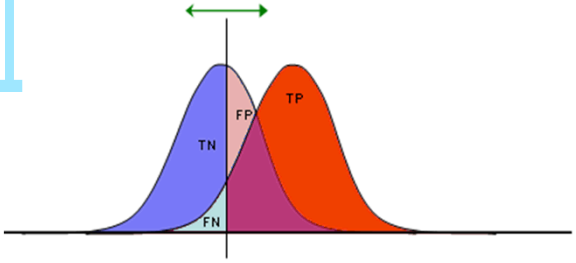






Identifying a specific nuclear weapon/component





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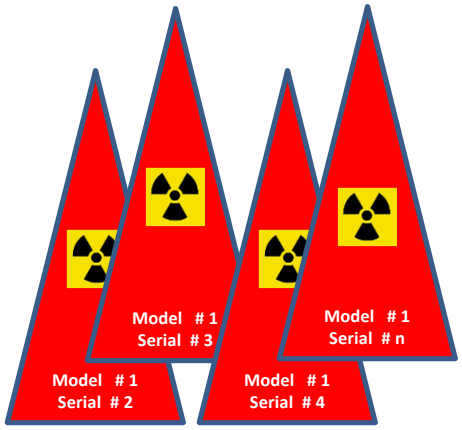
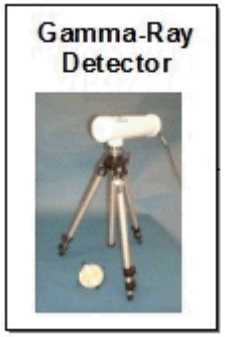
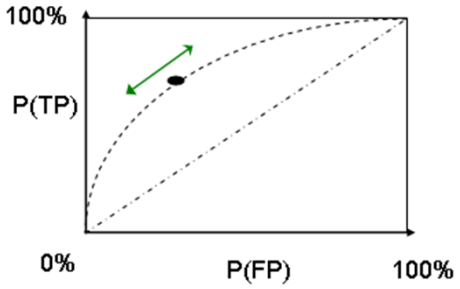
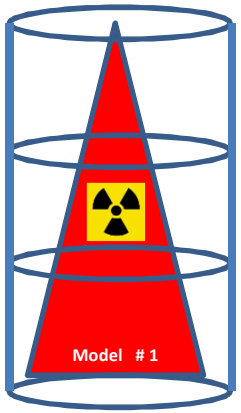
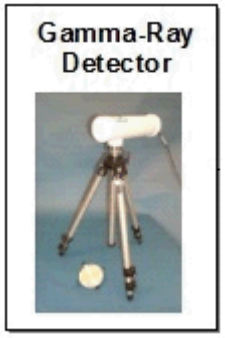


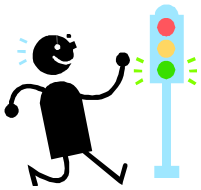


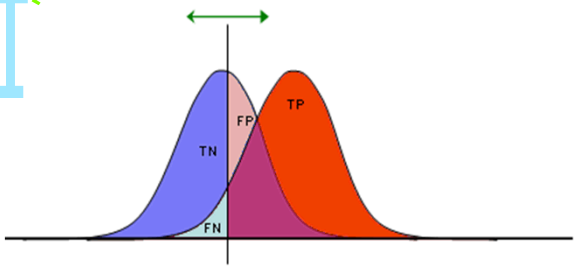


Understanding template signature









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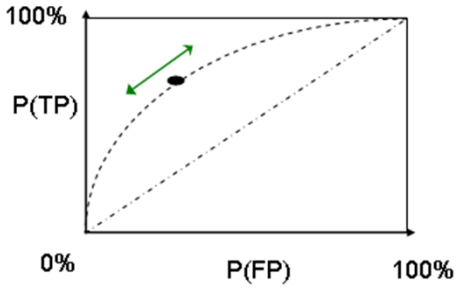

Challenges to Template Approach

- How is a template established in an unclassified manner?
  - Attribute Measurements
  - measured when a nuclear warhead is removed from delivery vehicle
- Does the host need to demonstrate a true negative?
- How do host-inspectors resolve false negatives?

Pantex Demonstration of Radiation Signature Template Matching

- Three technology approaches
  - Radiation Identification System (RIS): NaI
  - Controlled Intrusiveness Verification Technology (CIVET): HPGe
  - Nuclear Weapons Identification System (NWIS): correlated n/γ
- Radiation signatures of different nuclear weapons/components were clearly distinguishable
- Individual nuclear weapon/component identification is very difficult
- Need large population of like and unlike items to demonstrate what level of comparison tolerance is achievable