

# Capability Gaps and Secondary Screening

Matthew Merzbacher

May 12, 2015

# DISCLAIMERS

- **Screening of Personnel and Divested Items at the Checkpoint**
- **Screening of ~~Personnel and Divested~~ Items at the Checkpoint**
- **Screening of ~~Personnel and Divested~~ Items at the ~~Checkpoint~~**
- **Screening of ~~Personnel and Divested~~ Items at the ~~Checkpoint~~**

# SWWC: THE MULTI-MODAL DETECTION IRONY

- **TSA must be more agile, adding (or removing) detection in an evolving world**
- **Changing detection to one part of a complex system can have serious unintended consequences, including potentially decreased detection**
- **Without a model and a measure, all is lost**
  - A complex model (or a system that demands a complex model) is much more likely to be wrong, leading to bad conclusions

# SOME COSTS OF IMPROVED DETECTION

## → Equipment costs

- Purchase, Operation, Maintenance, Replacement, Development, Redundancy, ...

## → Alarm resolution cost

- Additional Alarms & New Alarms

## → Costs of Complexity

- Modeling
- Validation
- Testing

## → Training costs

## → Capability gap costs



Today's Topic: The downstream effect of improving detection

# DETECTION MODELING IS REALLY HARD

→ **False alarm modeling can be boiled...**

→ **Detection modeling is not so simple**

- Detection must be “by threat”
  - Is a loss of 5% in category A OK as a tradeoff for 20% improvement in category B?
- Cost of false negative is challenging to estimate
- Measuring detection performance depends on correlation between levels

→ **Each screening level is different**

- But we need to consider the whole end-to-end system
- Human-in-the-loop

→ **False alarm modeling can be boiled...**

# MODEL: HOW MUCH DO FALSE ALARMS COST?

→ **Quick cost model, useful for identifying value proposition**

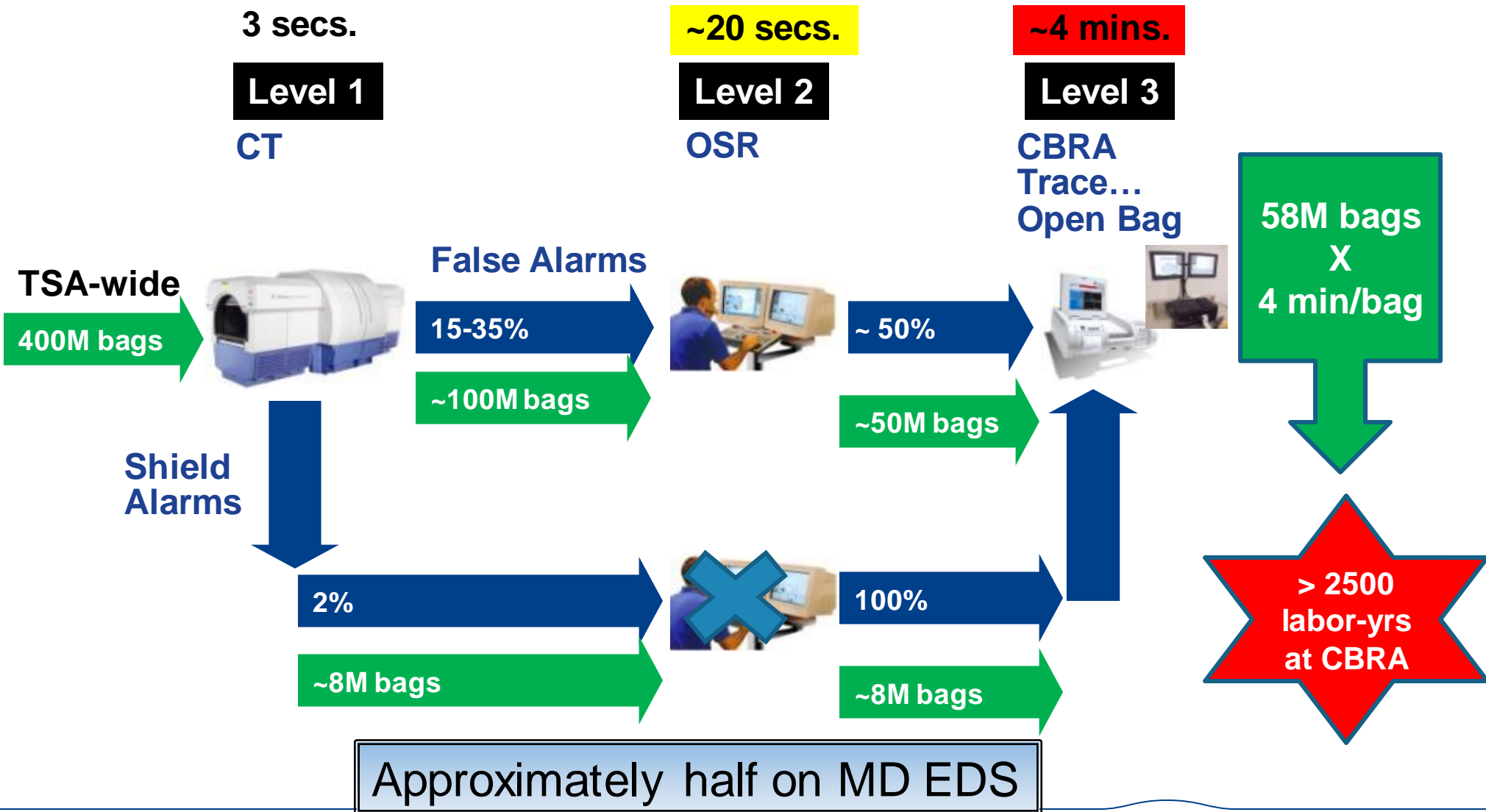
→ **Estimate CBRA hours**

- Use Morpho's fleet-wide alarm rates
  - International flights run higher than domestic flights
- Assumptions:
  - 4 minutes/bag in CBRA
  - 50% OSR clear rate

→ **Case study of a single day at a busy int'l airport terminal**

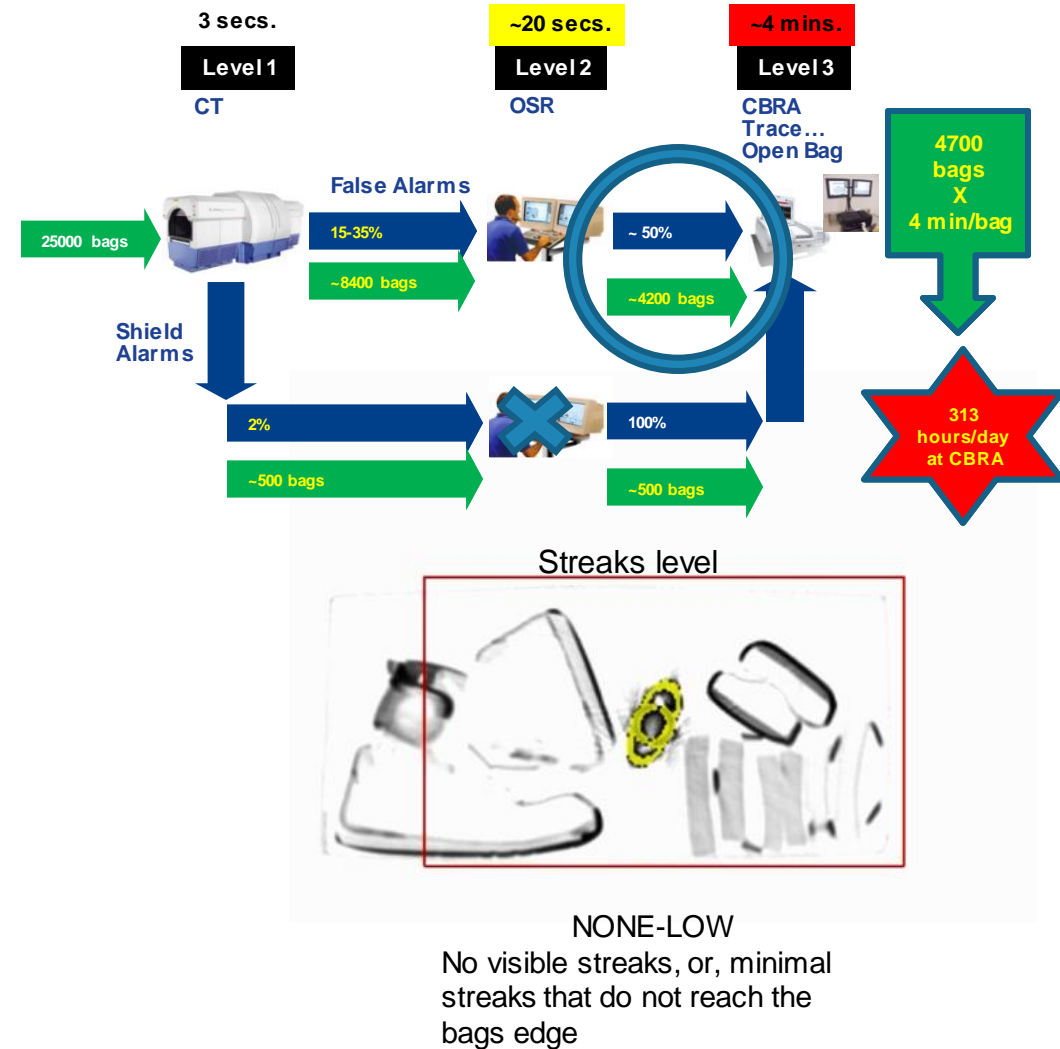
- Extrapolate to TSA fleet for the year
  - Doesn't account for minimum staffing considerations
  - Bag data from Conde Nast, which includes all airports
  - Assume MD handles 50% of TSA bags (Top 9 busiest airports and 17 of top 25 have MD scanners)

# FLEET-WIDE ANNUAL EXTRAPOLATION



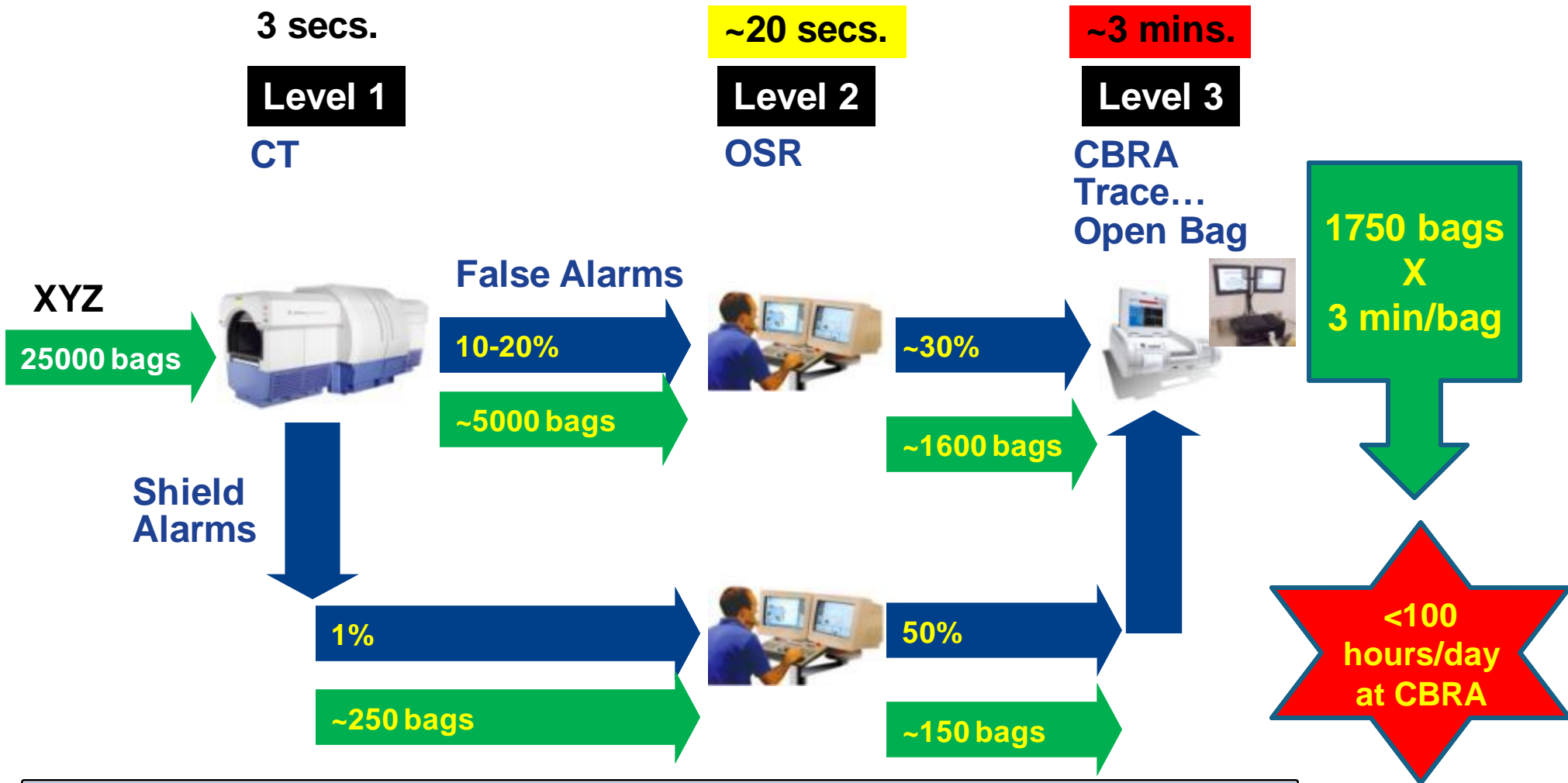
# IMPROVED ON-SCREEN ALARM RESOLUTION

- Existing OSR “Least Common Denominator” philosophy
- Not using the full upstream capability downstream
- High-Resolution 3D images
- By-Type OSR (Fusion)
  - Virtual Clustering
    - By alarm type
    - By bag complexity
- Expected results:
  - Lower CRBA rates
  - Better detection
- Why not?
  - Complexity & Cost





# LONGER-TERM GOALS (INCLUDING SIMPLE RBS)



3x reduction in labor at CBRA with existing technology

# DETECTION IN AN EVOLVING MULTI-LEVEL WORLD

- What good is it to alarm upstream if the downstream system throws the alarm away?
- Do changes upstream cause new types of alarms that are not well-suited to downstream technologies?
- What about new alarms?



# EXAMPLE

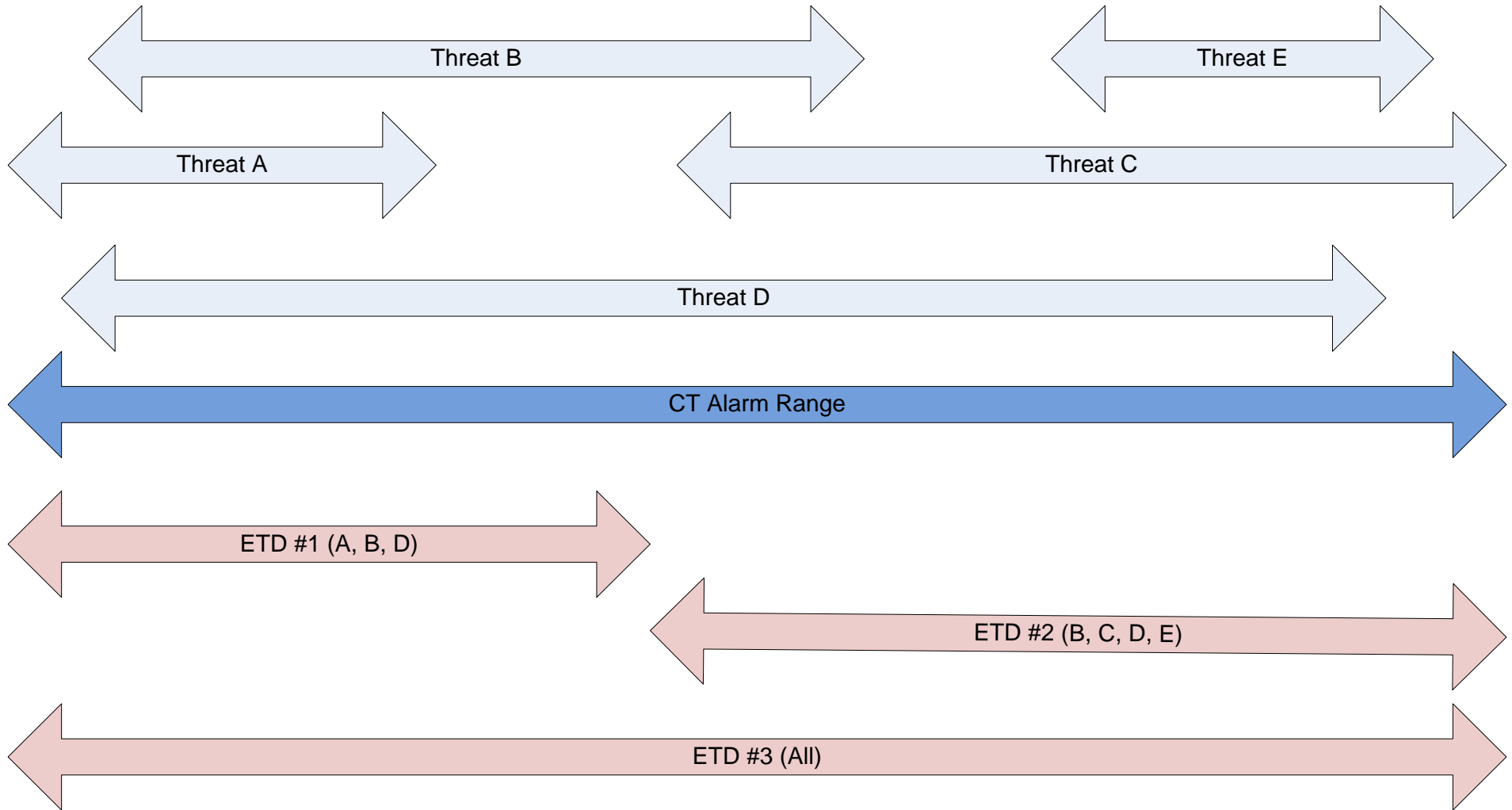
## → Addition of HME detection on Checked Bags

- New alarms (toiletries) that may be hard to resolve downstream
- Changes to distribution of alarm types
- Additional alarms that may flood system

## → Capability Gap:

- Are downstream operators and ETDs ready?
- What can be done?
- And is it simple/goof-proof?

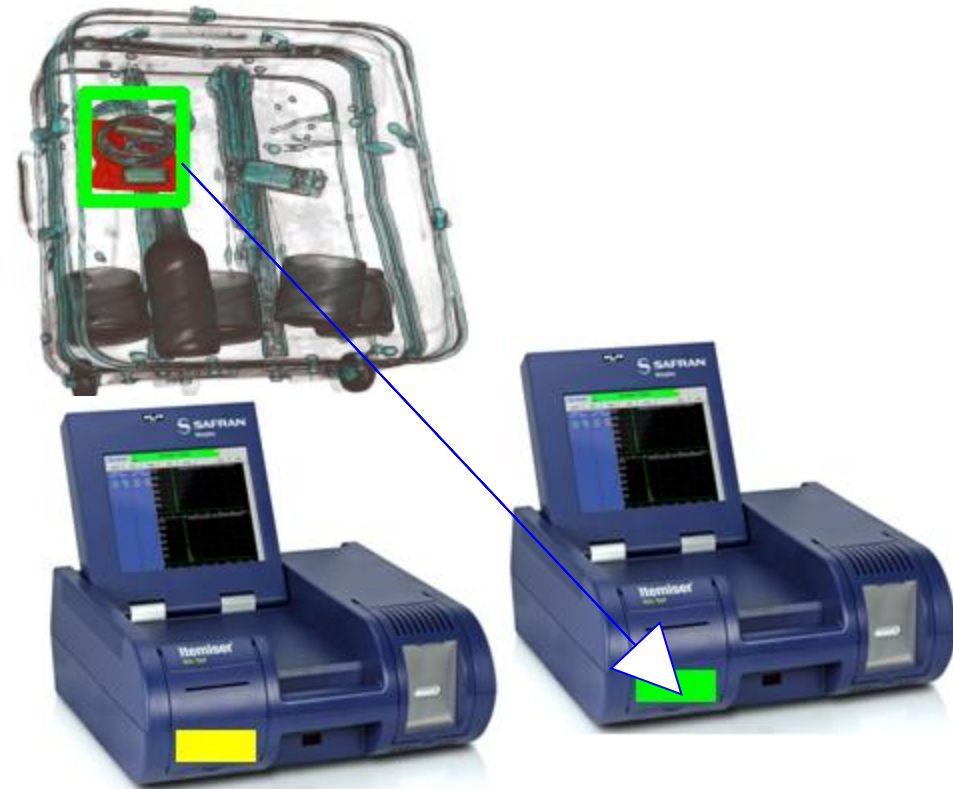
# BY-TYPE ETD



# F-WORD: IMPLEMENTING BY-TYPE ETD

## → EDS alarm can inform ETD to lower FA (and improve detection)

- Even if ETD & EDS are different manufacturers, assuming there is a protocol in place
- Based on alarm characteristics (e.g., CT value, homogeneity, etc.)
- Subject to upstream misclassification
- Practical data fusion demonstration
- Selecting ETD device based on these characteristics can improve ETD performance
- Can be automated, but not required



# WHAT ABOUT ADDING TECHNOLOGIES?

→ **Diffraction**

→ **QR**

→ **Sniffing**

→ **Additional Species**

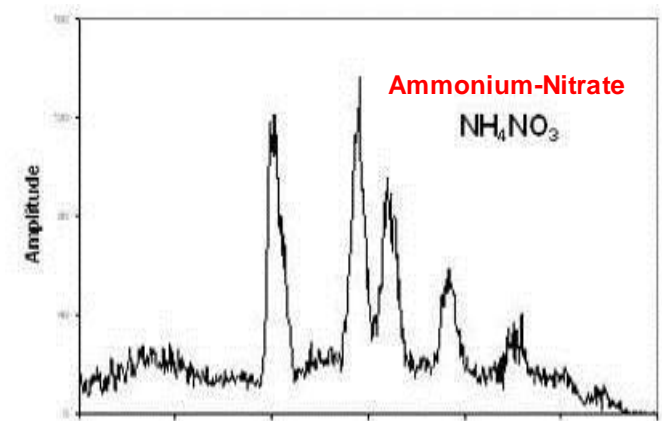
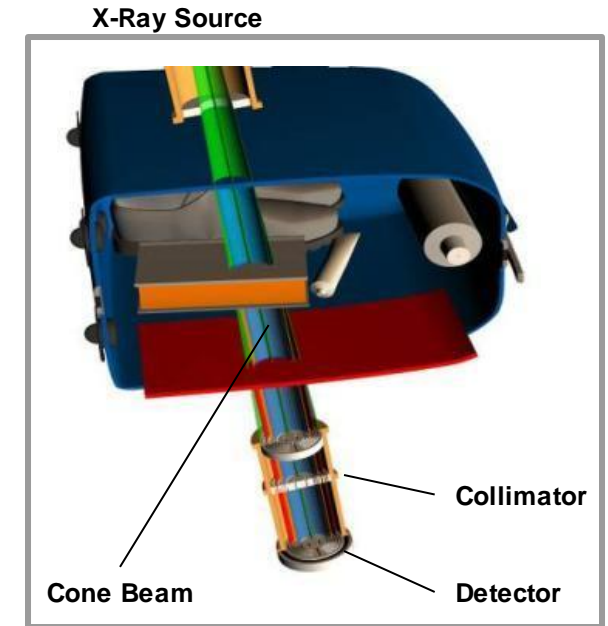
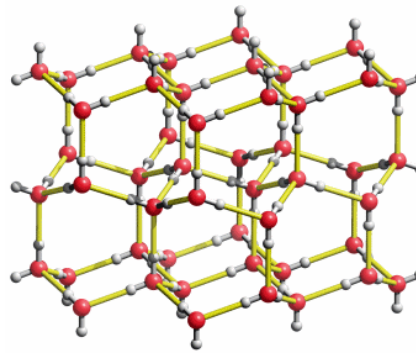
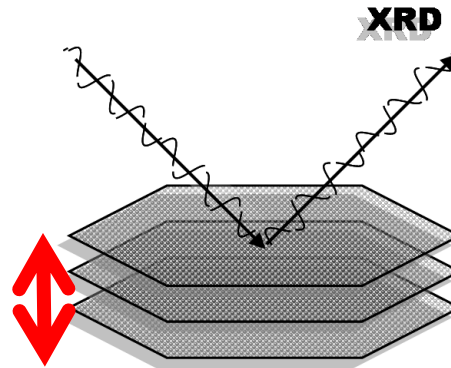
# WHAT'S SO SPECIAL ABOUT XRD?

- X-rays hit an object
- Constructive interference at certain energies
- Maximum energies depend on molecular distances



## X-ray diffraction

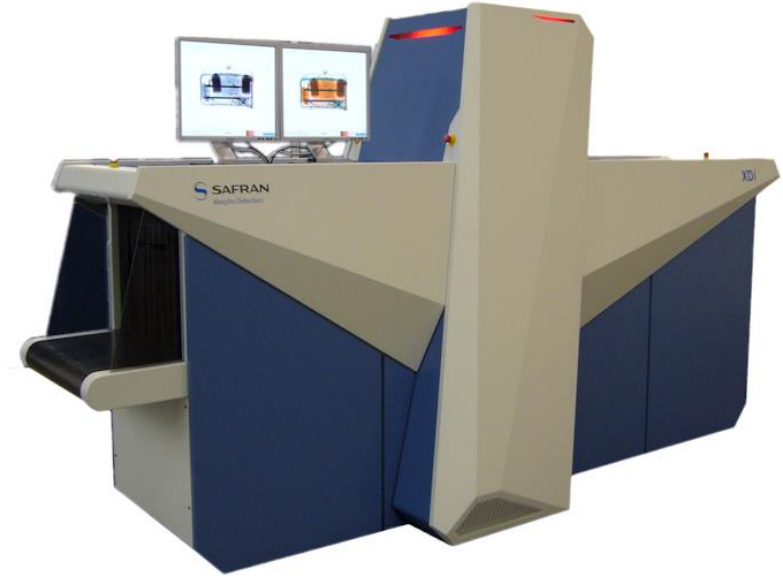
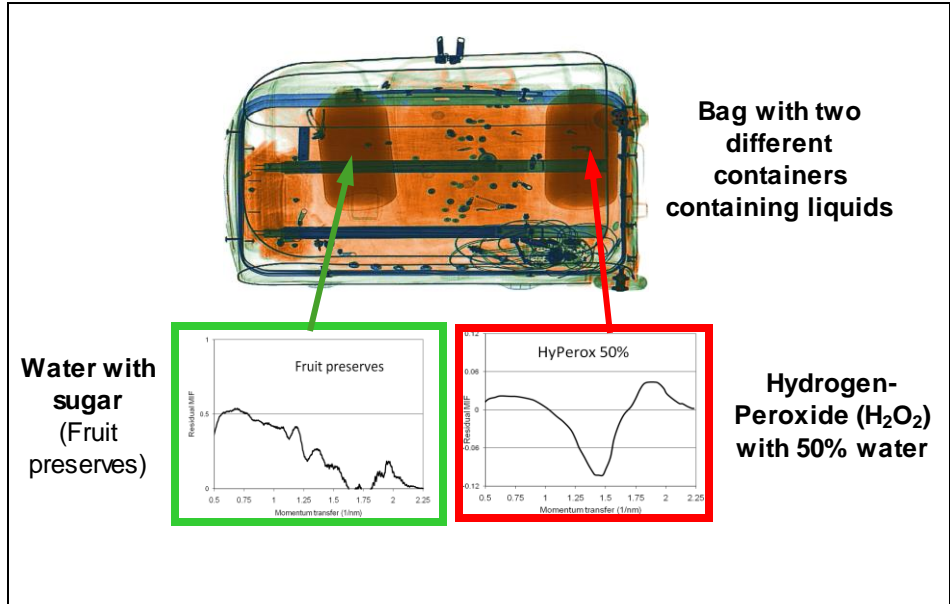
*molecular specific fingerprint*



# XDI/ IN CABIN AND HOLD BAGGAGE SCREENING

→ **Material-Specific detection of solid and liquid explosives**

## Identification of liquids with x-ray diffraction



**Higher passenger satisfaction due to stress reduction:  
No liquid removal of liquids and reduced secondary inspections.**

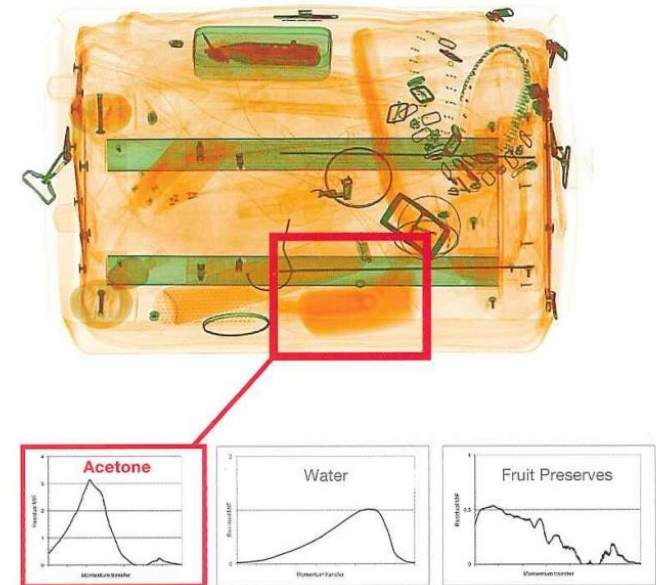
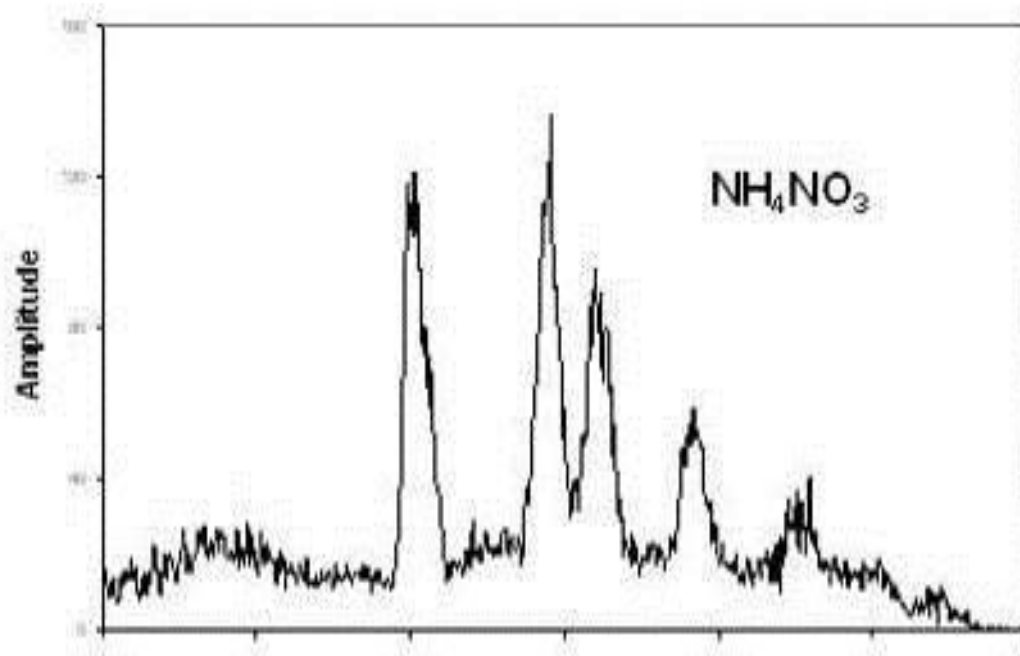


# EUROPE ON FIVE PHOTONS A DAY

→ Would you rather have more data or better data?

→ Better data can yield more data

- Segmentation begets aggregation
- Building a spectrum one photon at a time



# QUESTIONS/COMMENTS

- How do we measure performance in a multi-level system?
- How can we allow fusion across corporate borders without falling into the LCD trap?
- How can we be fast and flexible in responding to new threats and still know what we're doing?
- Does fusion increase overall system brittleness or does it just expose it? Does that matter?
- How do we fuse with other technologies (and species) and avoid the multi-modal irony?
- Metrics Metrics Metrics!