X-ray diffraction imaging – achievements and challenges

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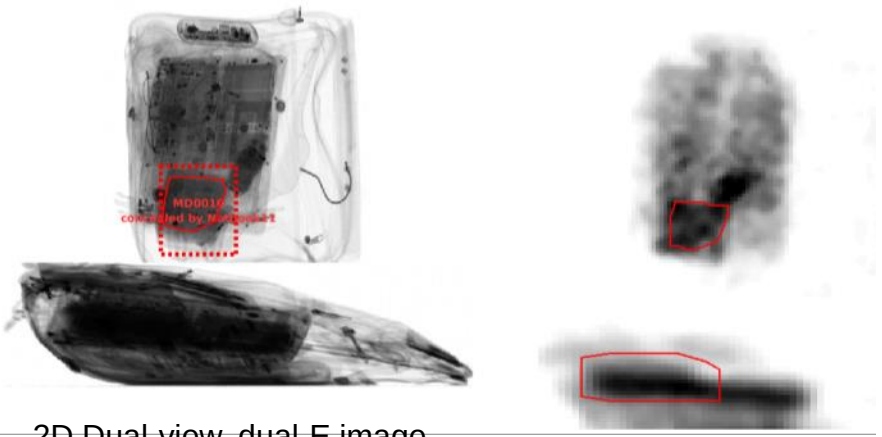
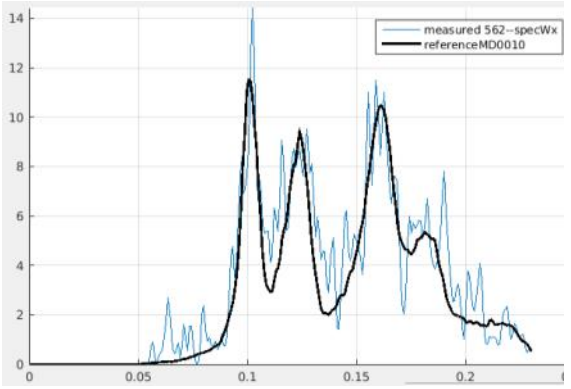
ADVANCED BAGGAGE SCREENING WITH XDI

- Next-Generation screening requires:
  - Explosives & Weapons Detection
  - High P_D
  - Low P_{FA}
- Density and Z_{eff} alone can lead to high FAR, especially with new high-variability HME threats
- XDi (X-ray diffraction imaging)
  - images and identifies materials based on their molecular structure
  - multi-source / multi beam / multi detector topology to achieve throughput comparable to existing transmission systems
- CBS installed at TSL, HBS coming soon
  - Old-school XRD in use worldwide



2D Dual-view, dual-E image data with threat overlay

Internally-used diffraction data with identified threat segment



Diffraction spectra from threat object (blue), overlaid with library entry for the threat material with best match (black)

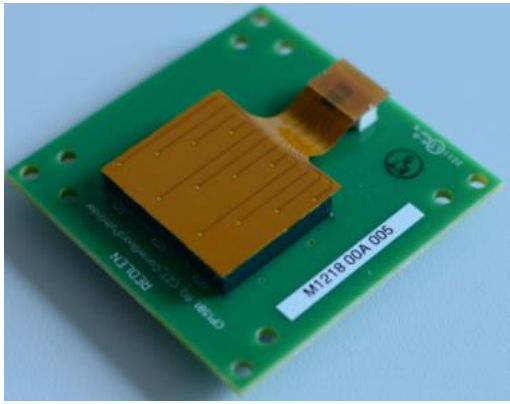
XDi prototype system for checkpoint application

ADVANCED BAGGAGE SCREENING WITH XDI

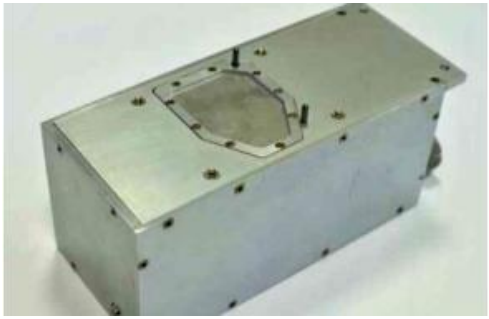
- **XDi required the development of unique components**
  - **Photon counting, energy resolving detectors**
  - **Multi-focus X-ray source**
  - **High-precision multi-beam gantry with primary and secondary collimators**
  - **Data processing algorithms to best utilize photon-count limited diffraction data and combine them with transmission data revealing attenuation properties**
  - **Algorithms to identify explosives**

- **XDi prototype systems for hand luggage (CBS) and hold baggage (HBS) were developed and are in testing by European and US test centers**
- **XDi enables screening checkpoints with well-known X-ray imaging capabilities, ConOps, IQ, plus low FAR for automatic explosives detection**
- **Additional potential for alarm resolution in HBS environment**

Multi-focus X-ray tube



CdZnTe-crystal assembly



Custom-designed detector module

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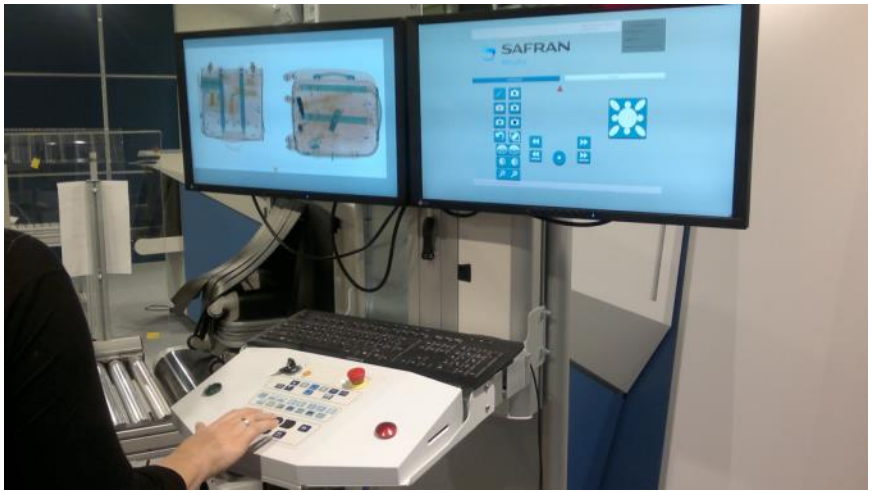
XD*i*-CBS IMAGES



Operator GUI

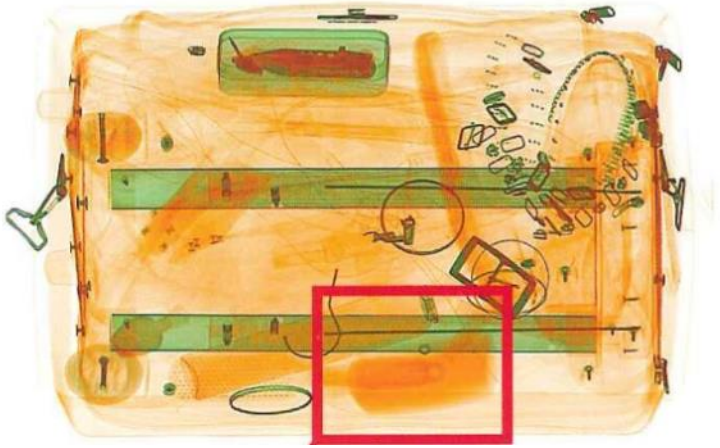
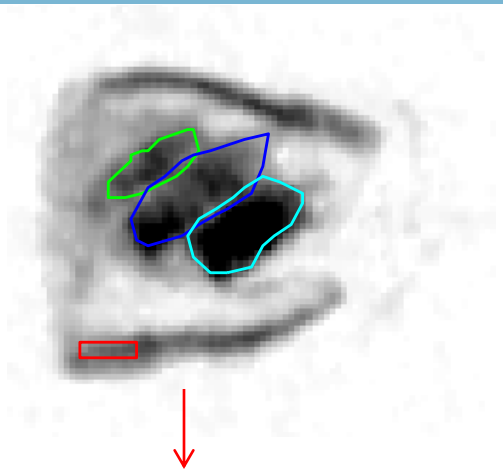
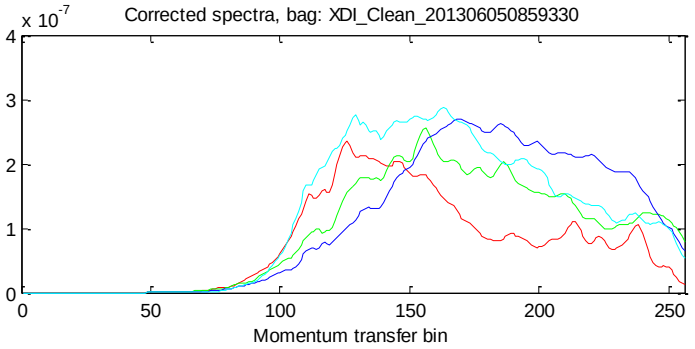


Image with
Threat marks

4-D XD*i* image,
Used internally for
threat detection





Segment spectra
(not accessible by
operator)

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THANK YOU FOR YOUR ATTENTION !!!

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