

# MeV Imaging for Security Inspection

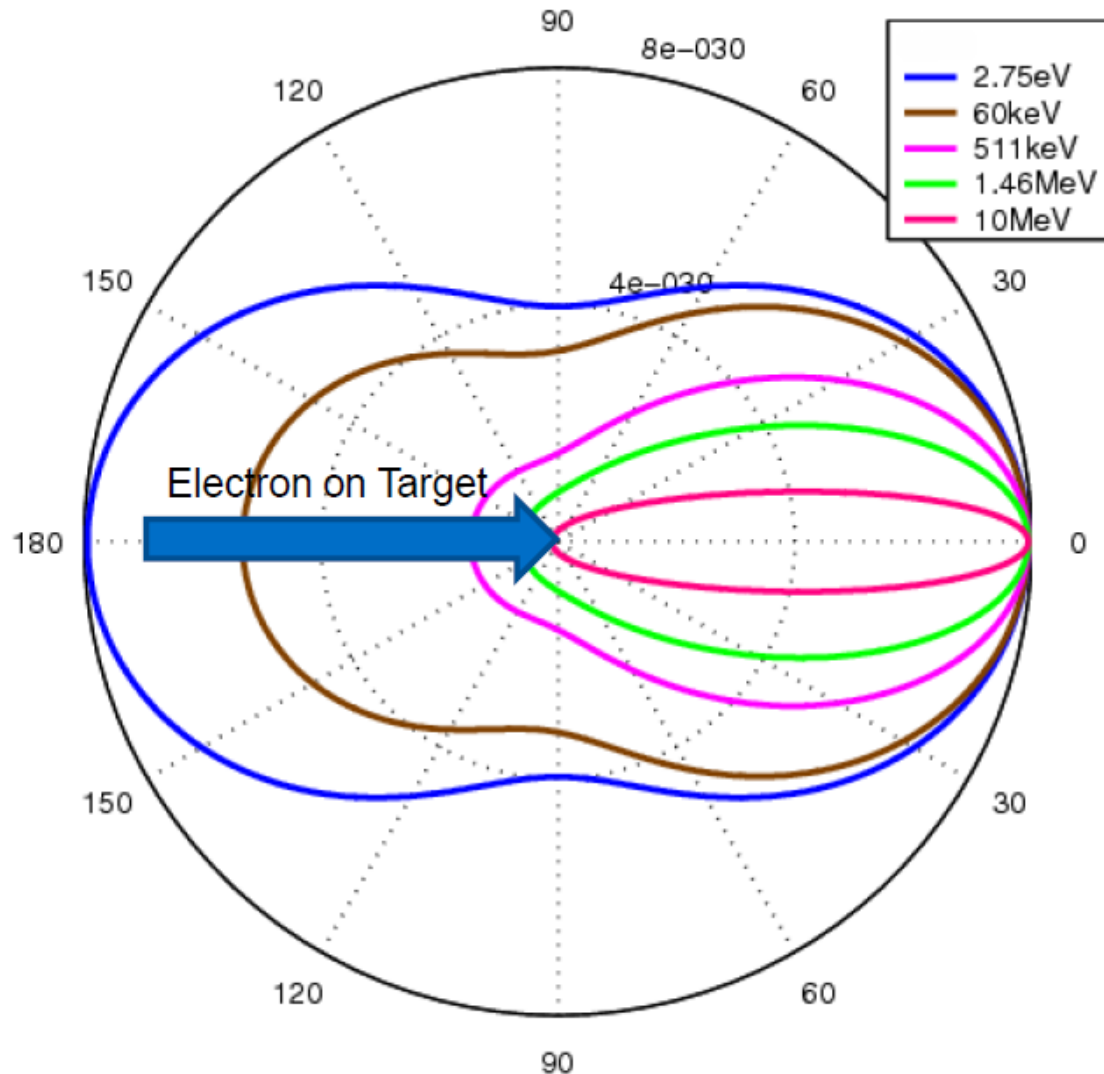
Brendan Allman

# Agenda

---

- Physics
- High Energy Imaging
  - Dual Energy
  - Scintillator detectors
  - High speed
- XBOX3 linac

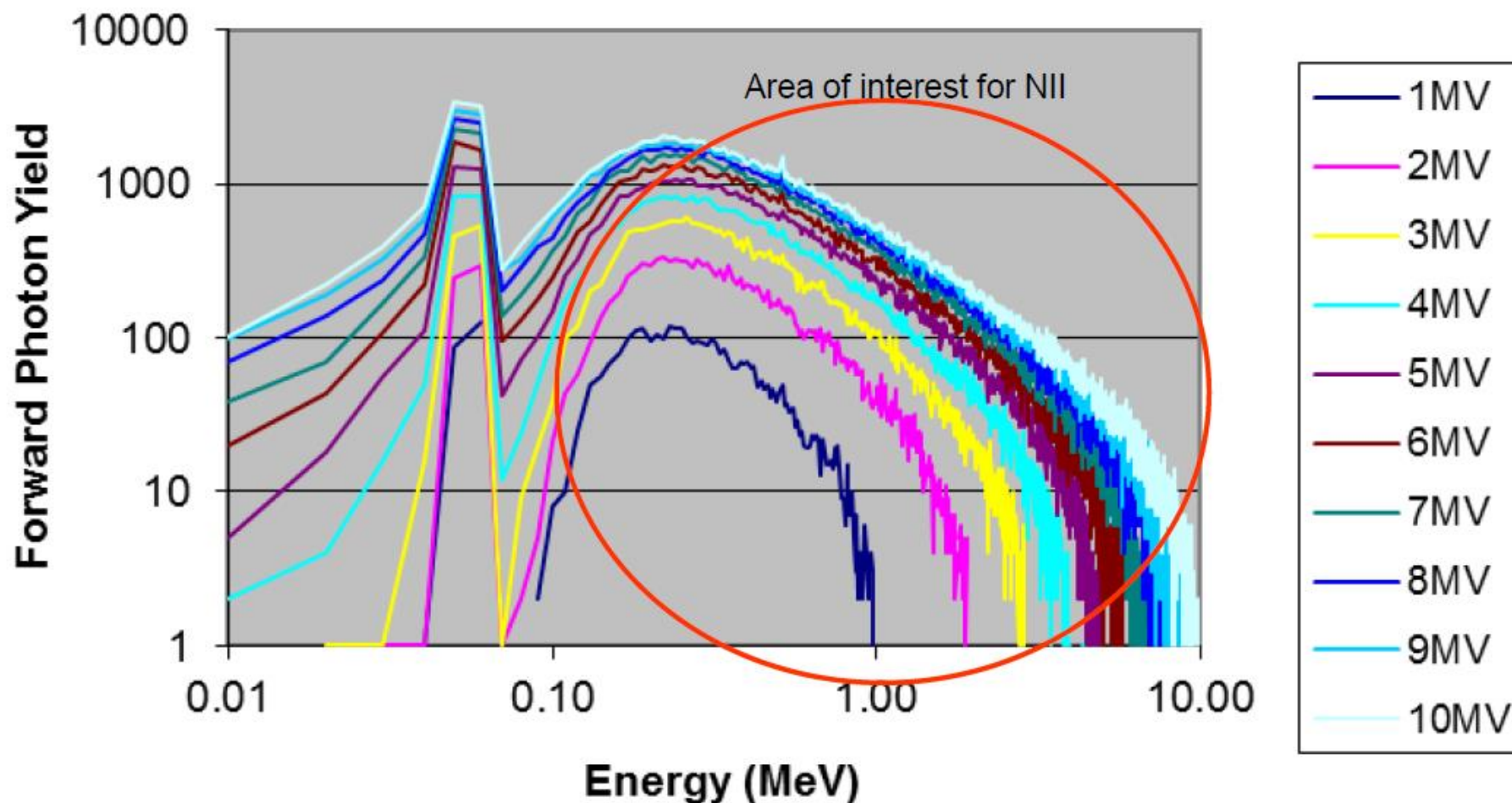
# Xray Generation



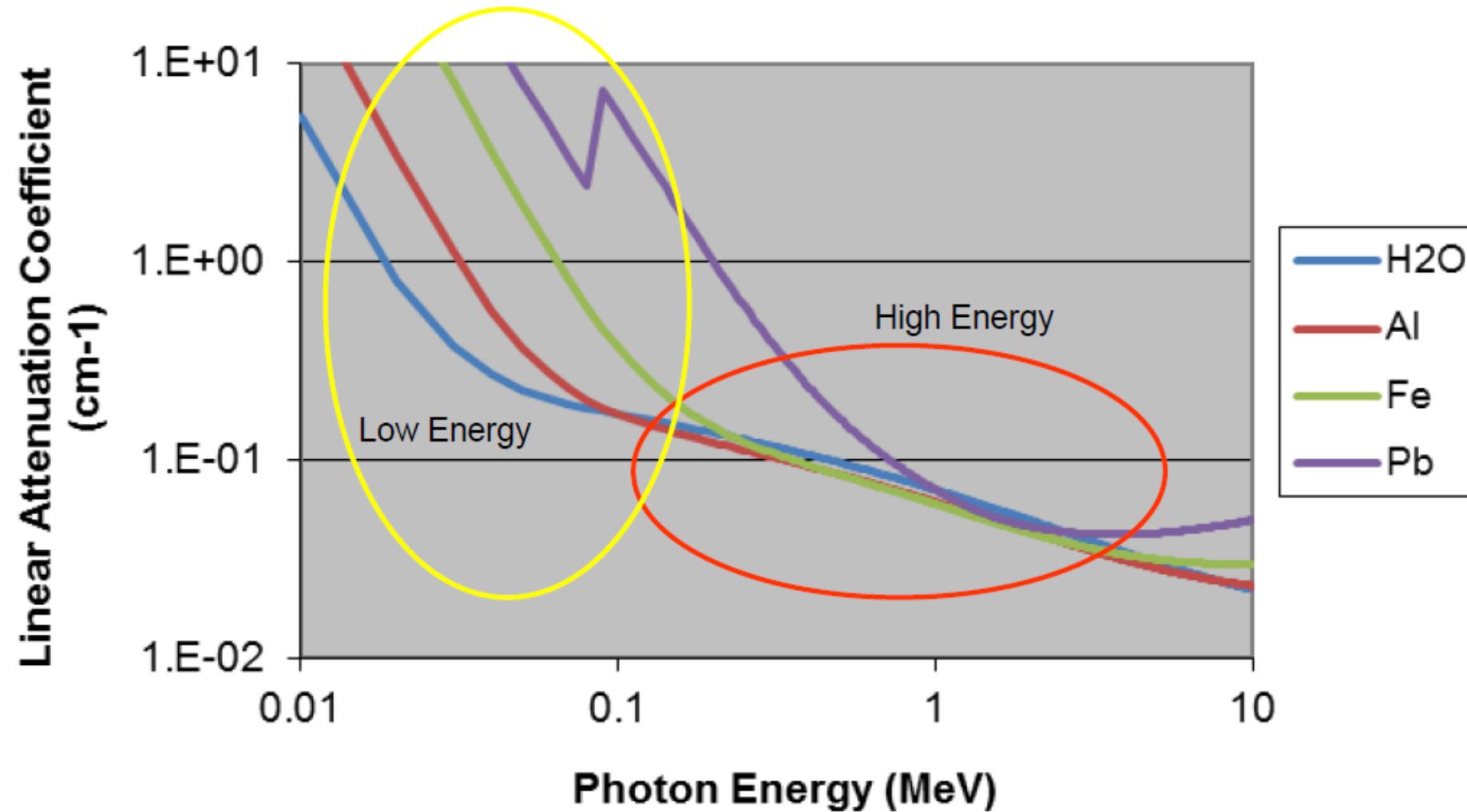
At low energies, X-ray production is almost isotropic

At high energies, X-ray production is much more forward directed

# Xray Spectra – High Energy



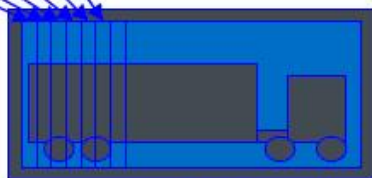
# Material Attenuation



# System Geometry



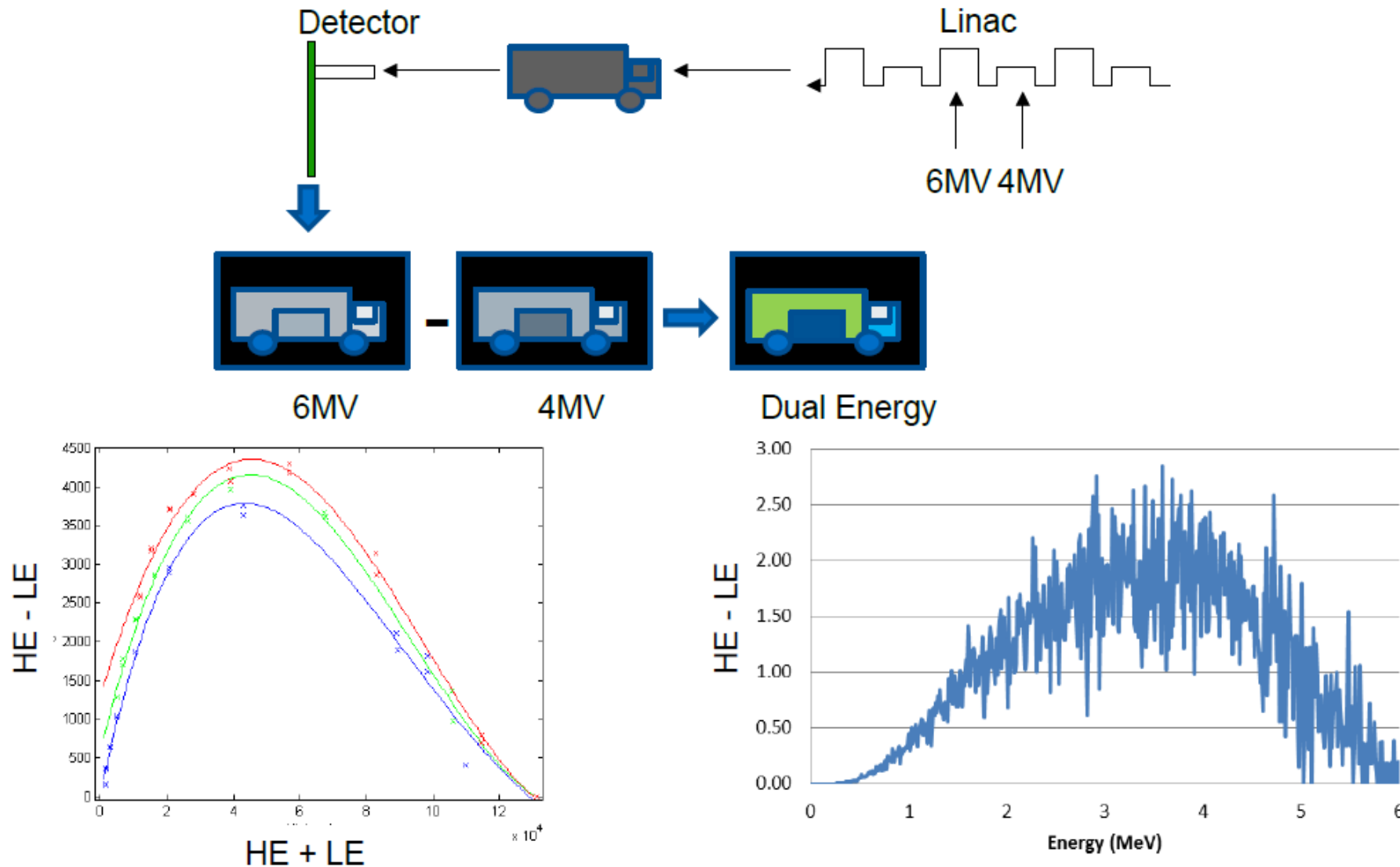
X-Ray  
Pulses



Operator Workstation

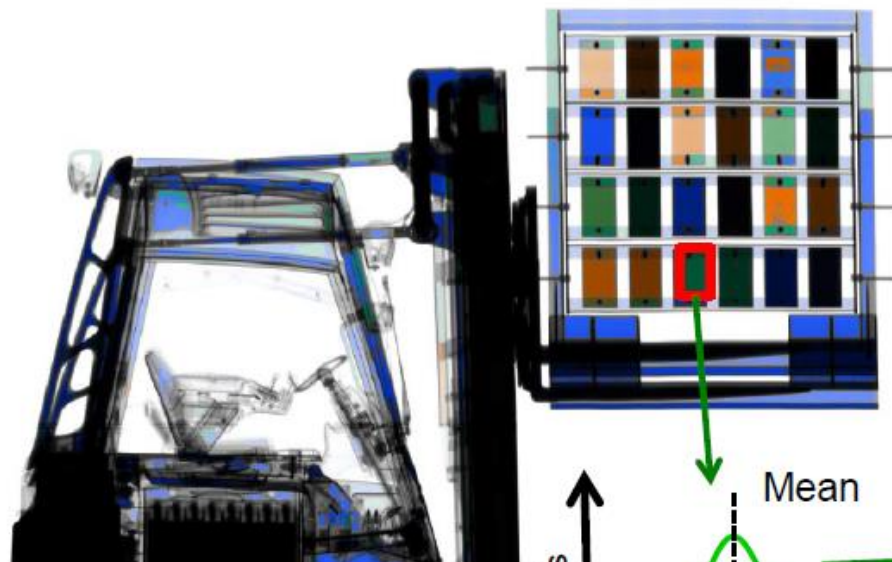


# Dual Energy Imaging

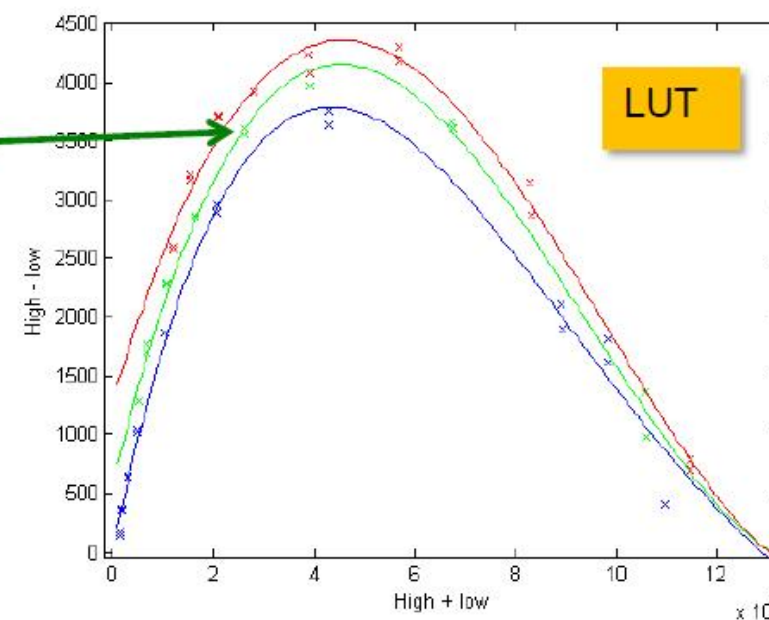
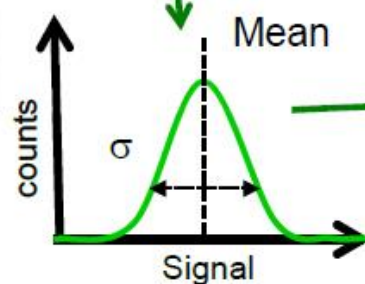




# Dual Energy Imaging

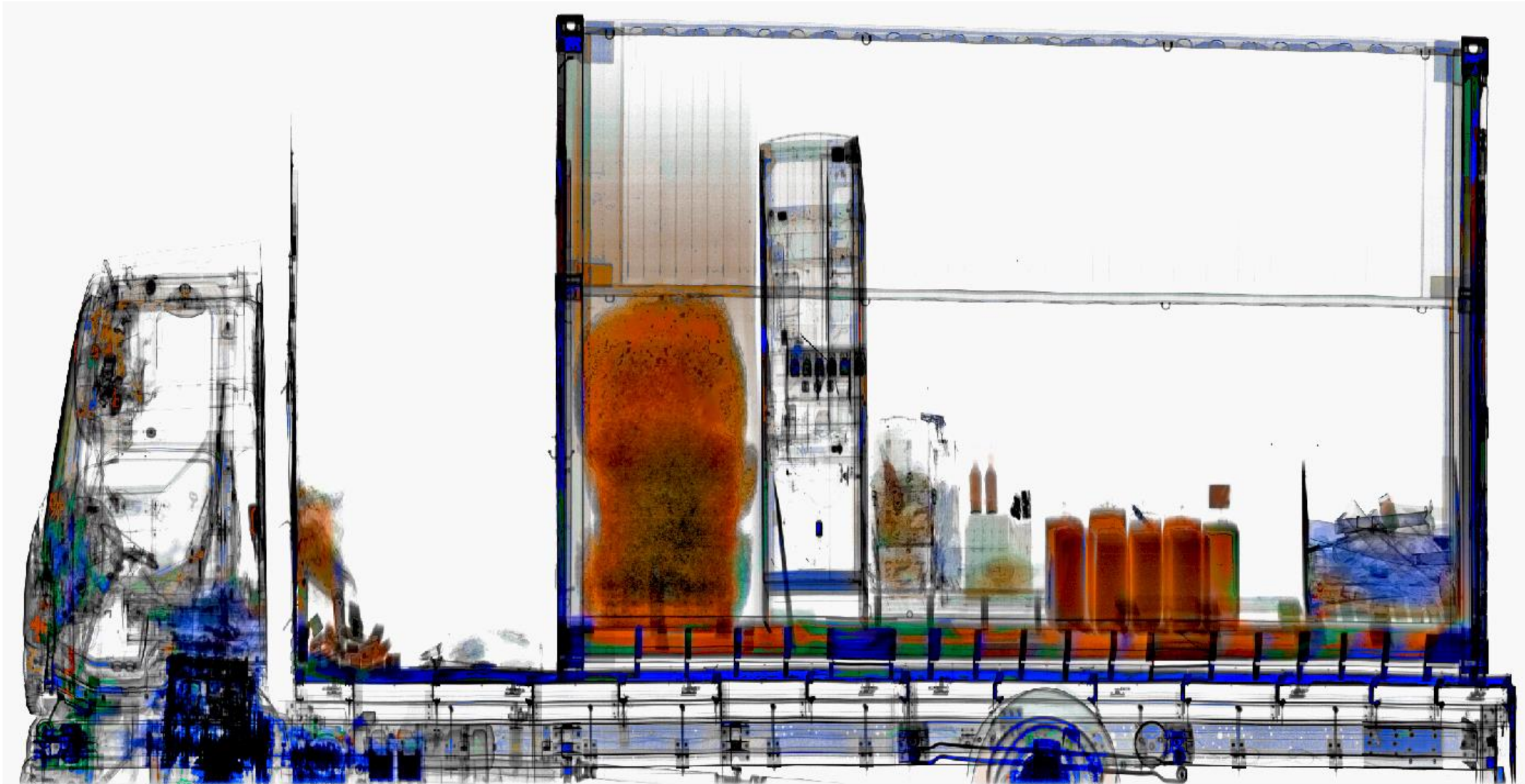


Orange = Plastic  
Green = Aluminium  
Blue = Steel





# Material Separation Capability



# Contraband Discovery

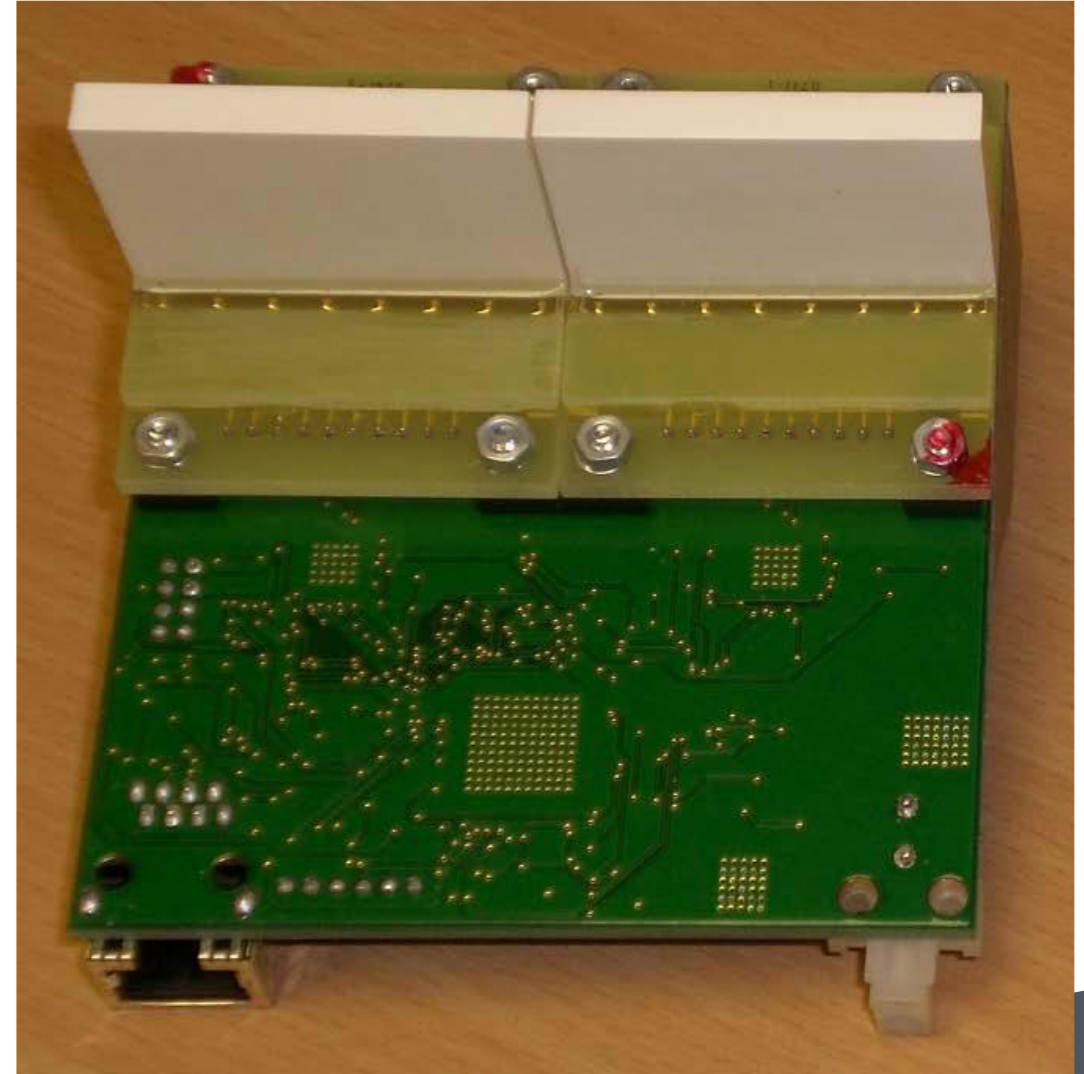
384kg (\$140M) of Cocaine in excavator (ACT, July 2019)





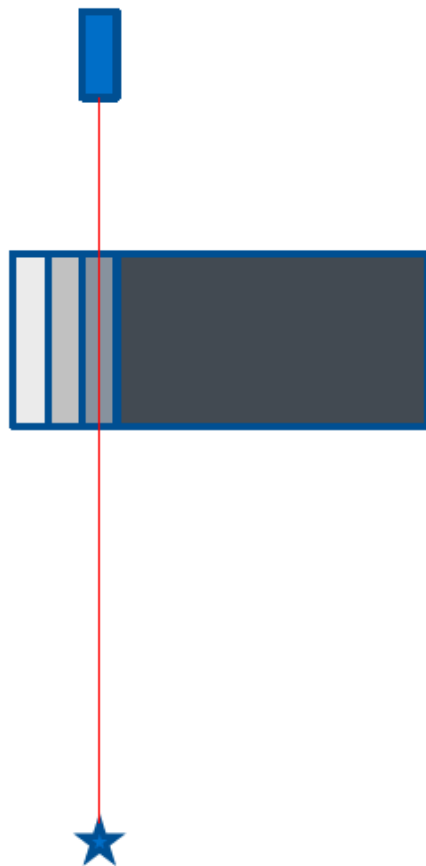
# Scintillation Detectors

- $\text{CdWO}_4$  : 5 x 5 x 30 element
- 16 x 1 elements per board
- 70+ boards per system
- ~1100 pixel, >5m imaging array
- Charge integrating ADC with 20-bit resolution
- 400Hz readout

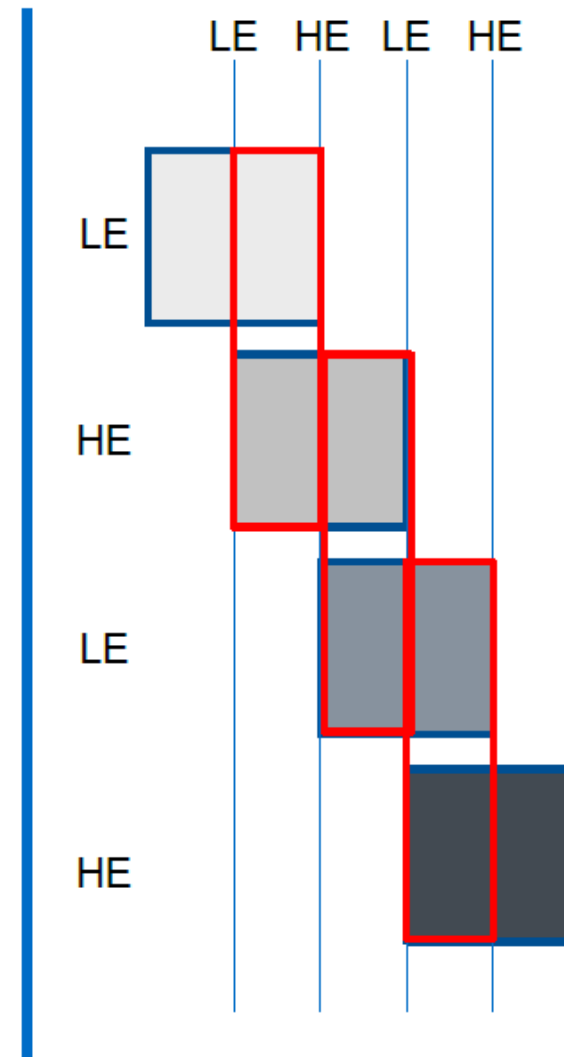
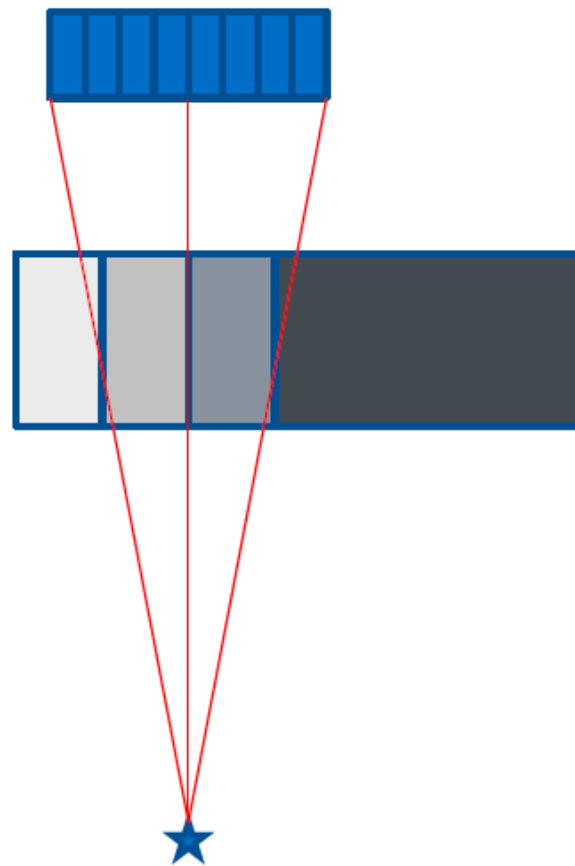


# High Speed Imaging

Fan Beam

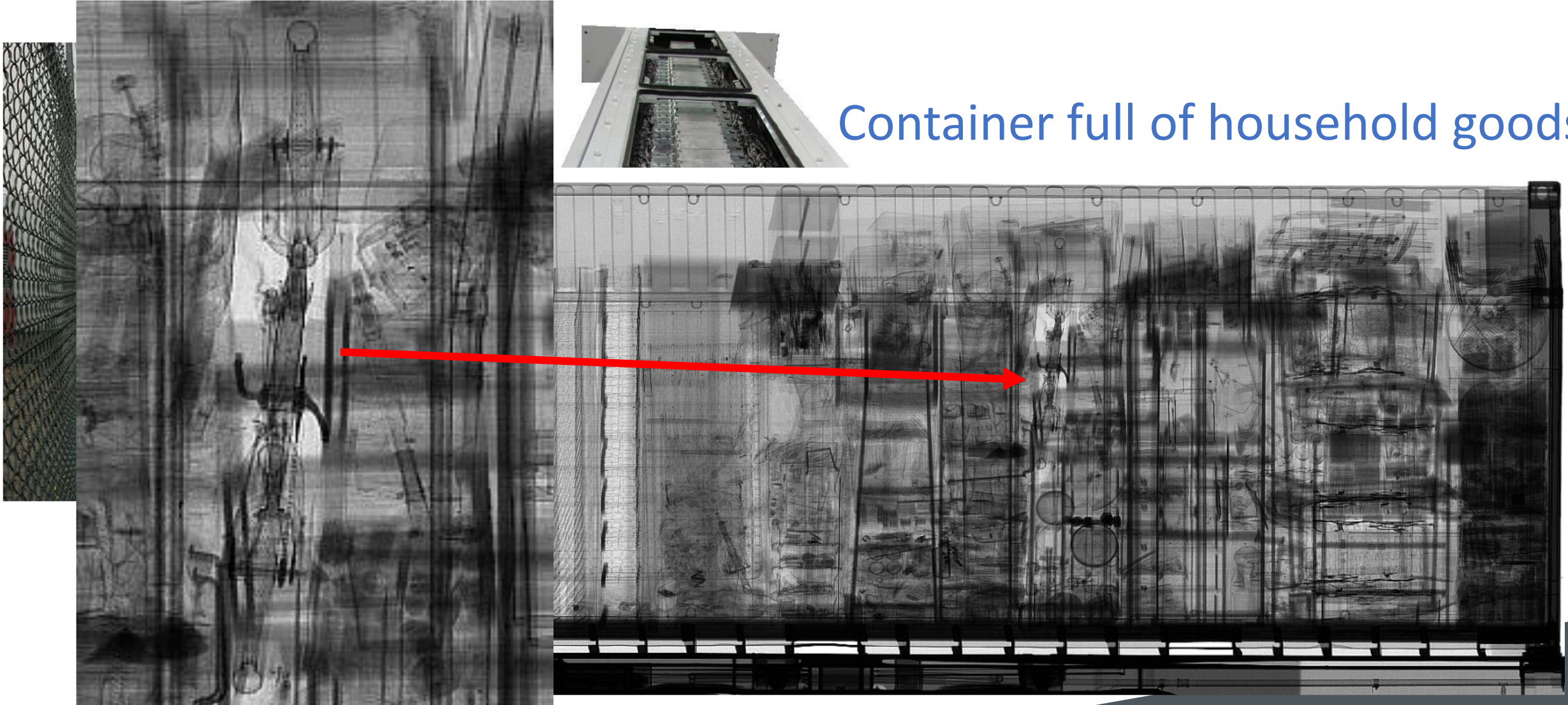


Cone Beam

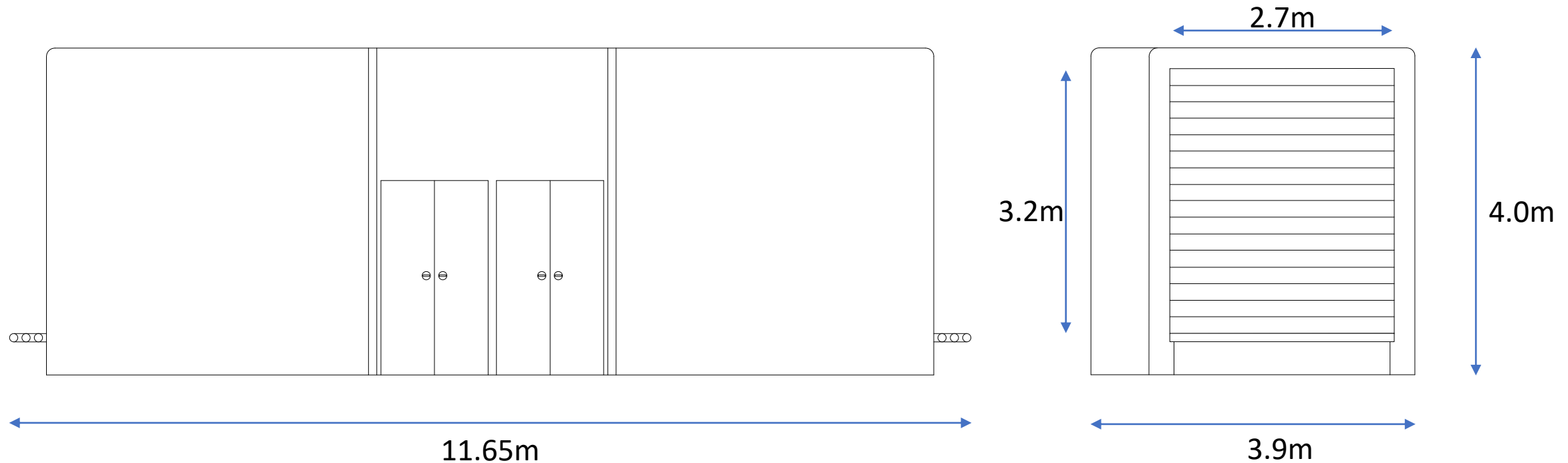


# Eagle<sup>®</sup> R60 – 6MeV @ 60km/hr

Container full of household goods



# Orion<sup>®</sup> 270320DX

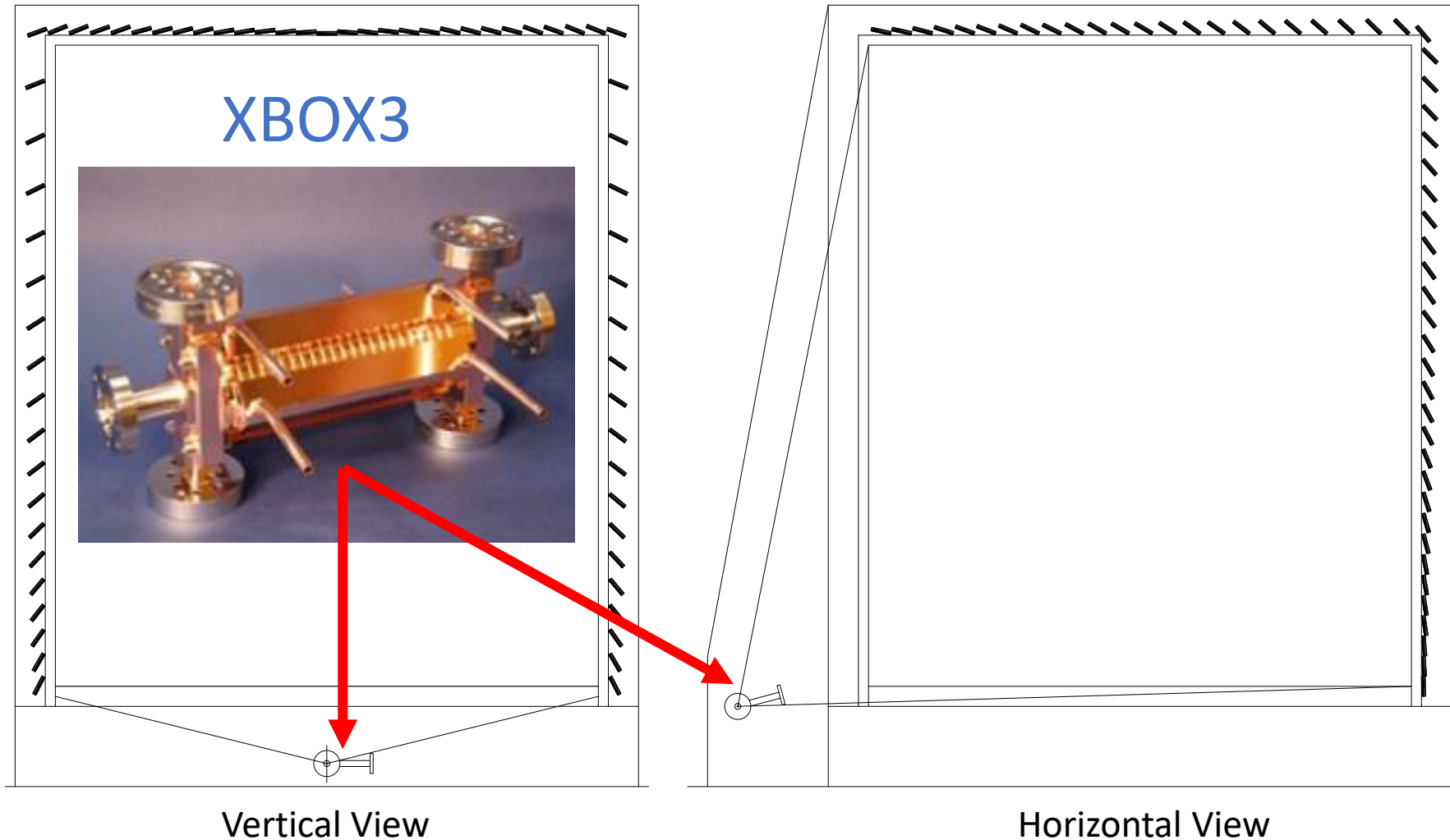


Self-shielded imaging system in the Rapiscan Systems Orion family.  
Dual-view 2MV linear accelerator imaging system.



# Dual-View 2MV Container Imaging System

**Rapiscan**  
systems  
An OSI Systems Company



Shipping Container  
imaging

Anticipated image quality

100mm steel penetration

2mm grid resolution

1mm wire in air

1% contrast at 10%  
attenuation

# MeV Imaging for Security Inspection

Brendan Allman