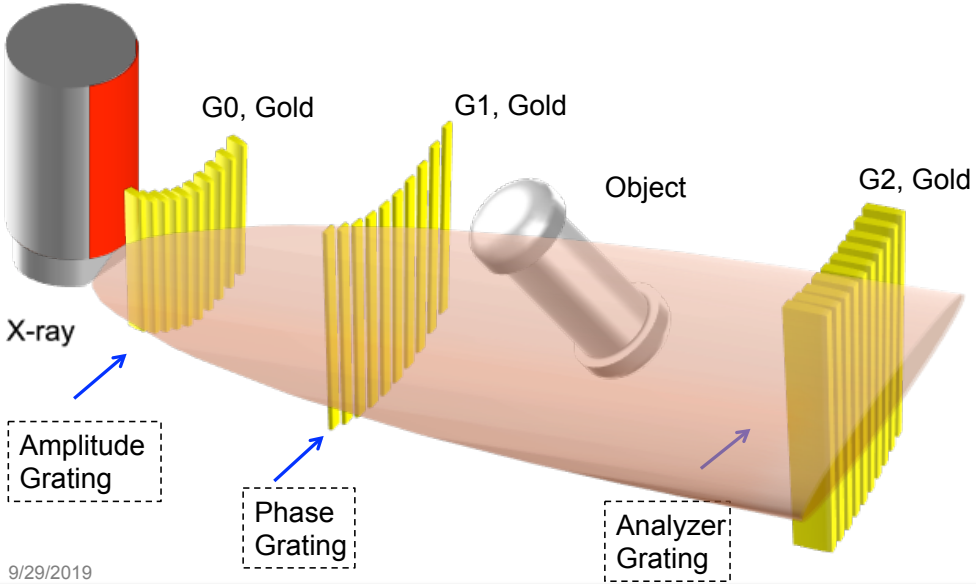
# DPC Enabled Checkpoint and Checked Bag X-ray Scanners

M. YUEN, Y. CHENG, C. CHANG, J. P. WILDE, P. HANSEN, G. HERRING, N. GUPTA, C. LIN, L. GALAMBOS, L. HESSELINK

HESSELINK@EE.STANFORD.EDU

We are grateful for the support from DHS TSA through Contract Number:

HSTS04-17-C-CT7224

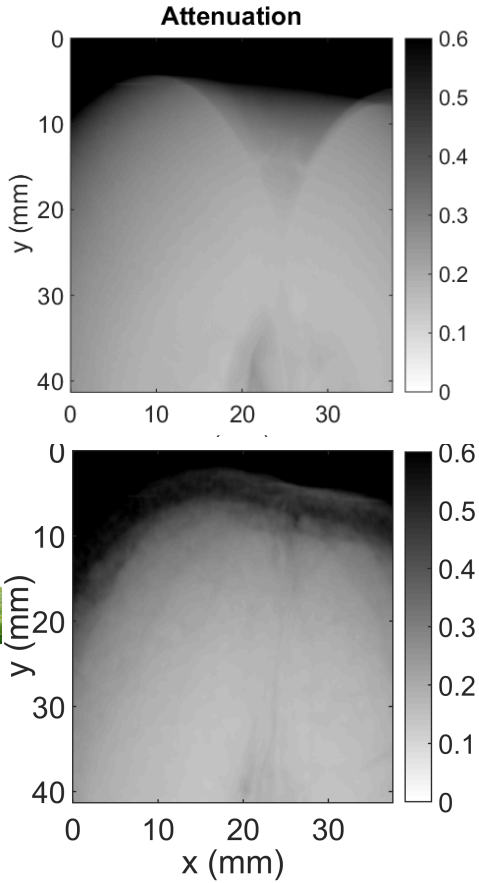


# DPC Can Significantly Improve Detection of Challenging Threat Items, While Reducing FAR

- Space: Improved detection of threat items for aviation security at checkpoints and checked bag, i.e. lower false alarm rate (FAR)
- Solution: Differential Phase Contrast (DPC) 3-D X-ray CT Imaging
  - DPC measures absorption, phase, and scatter (dark field) simultaneously
- Results:
  - Accurate detection of thin threats, liquids and powders
  - The new signature information will reduce FAR that are critical to expanding threat detection ability and achieving high passenger throughput
  - No change in CONOPS and user interfaces
  - Enable installed base CT scanners through upgrade kit
- TRL 6
- Contact information: Professor Lambertus Hesselink, hesselink@ee.stanford.edu

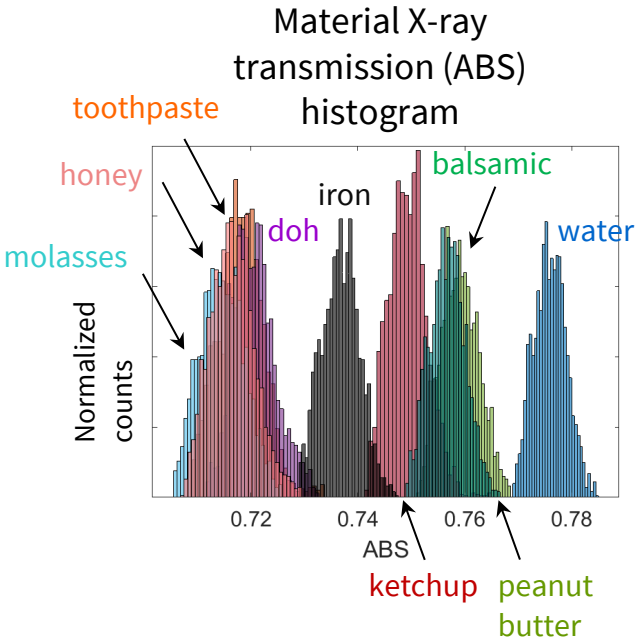
# Apples versus Oranges using DPC

*DPC measurements offer quantitative as well as qualitative advantages over conventional absorption (attenuation) CT measurements*



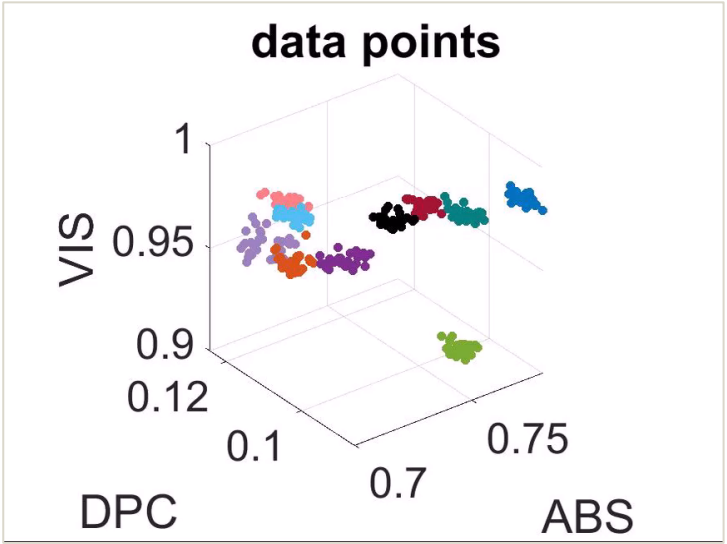
# DPC Enabled X-Ray Imaging Reduces False Alarms

*Tri-signature data accurately resolves identification conflicts*




DPC

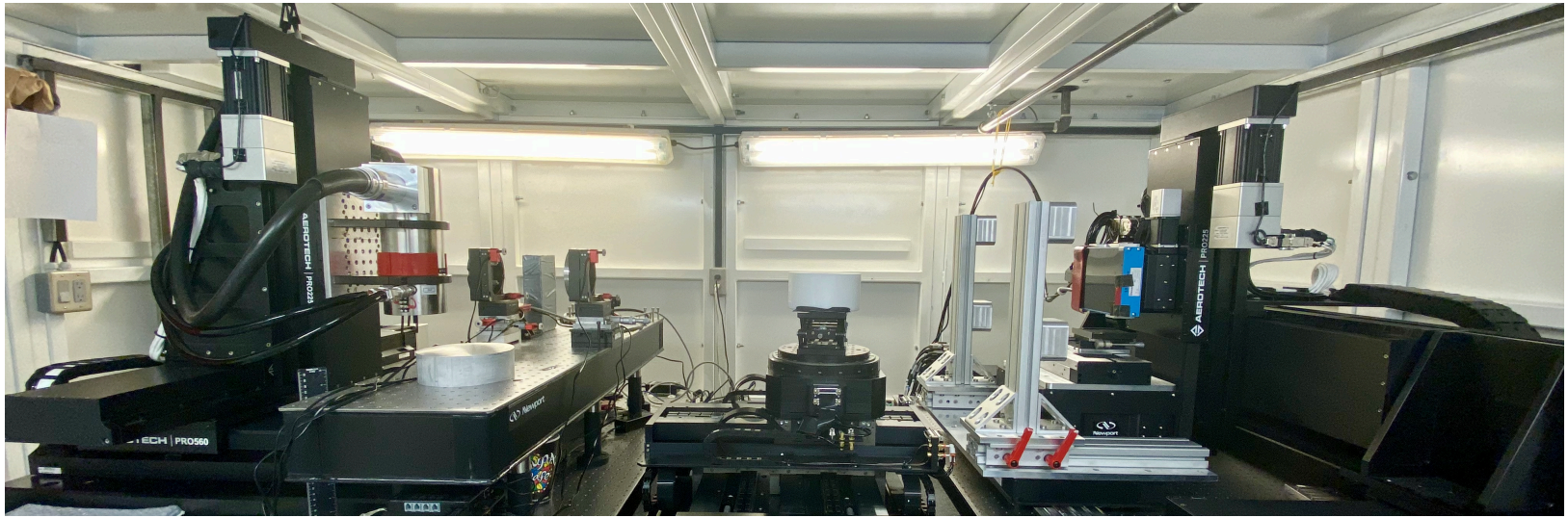
DPC removes overlap in absorption measurements through two additional measurements, Phase (DPC and scatter (VIS)




Conventional Absorption CT cannot accurately identify each item

DPC Enabled CT accurately identifies all items

# 3-Fates Facility at Stanford



# Summary

- DPC independent tri-signatures, Absorption, Phase and Dark Field (DF) can be used to distinguish materials that cannot be distinguished by Absorption signatures alone
- DPC Tri-signatures improve detection of:
  - Thin threats
  - (Low density) liquids
  - Powders
- Automatic discrimination systems can be implemented with DPC tri-signatures
- DPC has the potential to significantly reduce FAR
- Stanford technology ready for transfer to industry