# *Active Coded Aperture Imaging*

SAND2007-7008C

**Jim Lund, Peter Marleau, Stanley Mrowka, Kevin Krenz, and Nathan R. Hilton**

Sandia National Laboratories, Livermore CA

**What is it?**
**History**
**Why do it?**
**Will it work?**
**Active apertures!**
**Summary**

**Sandia is a multi-program laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under contract DE-AC04-94AL85000.**

Sandia National Laboratories

# Imaging with a passive aperture

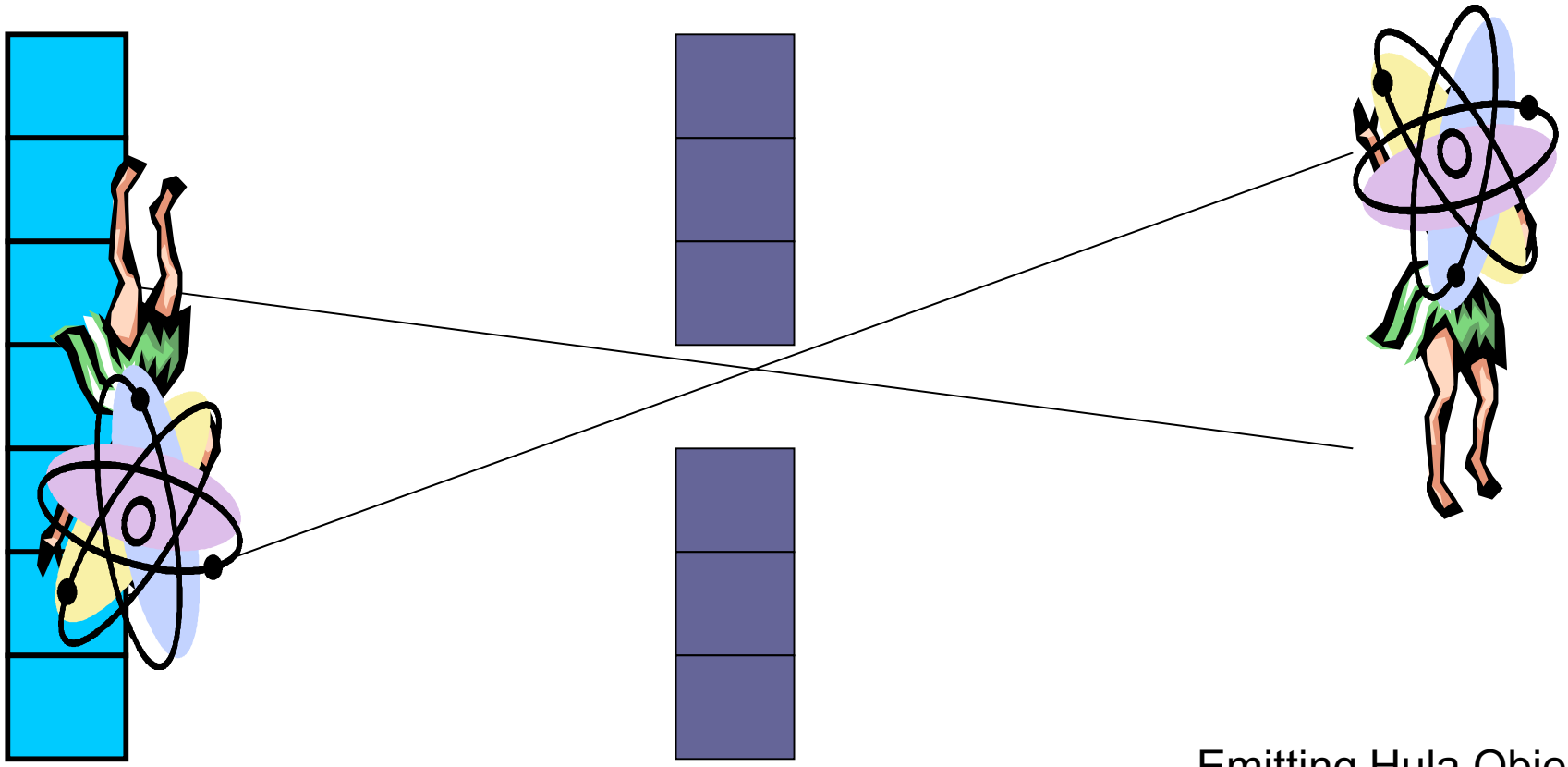


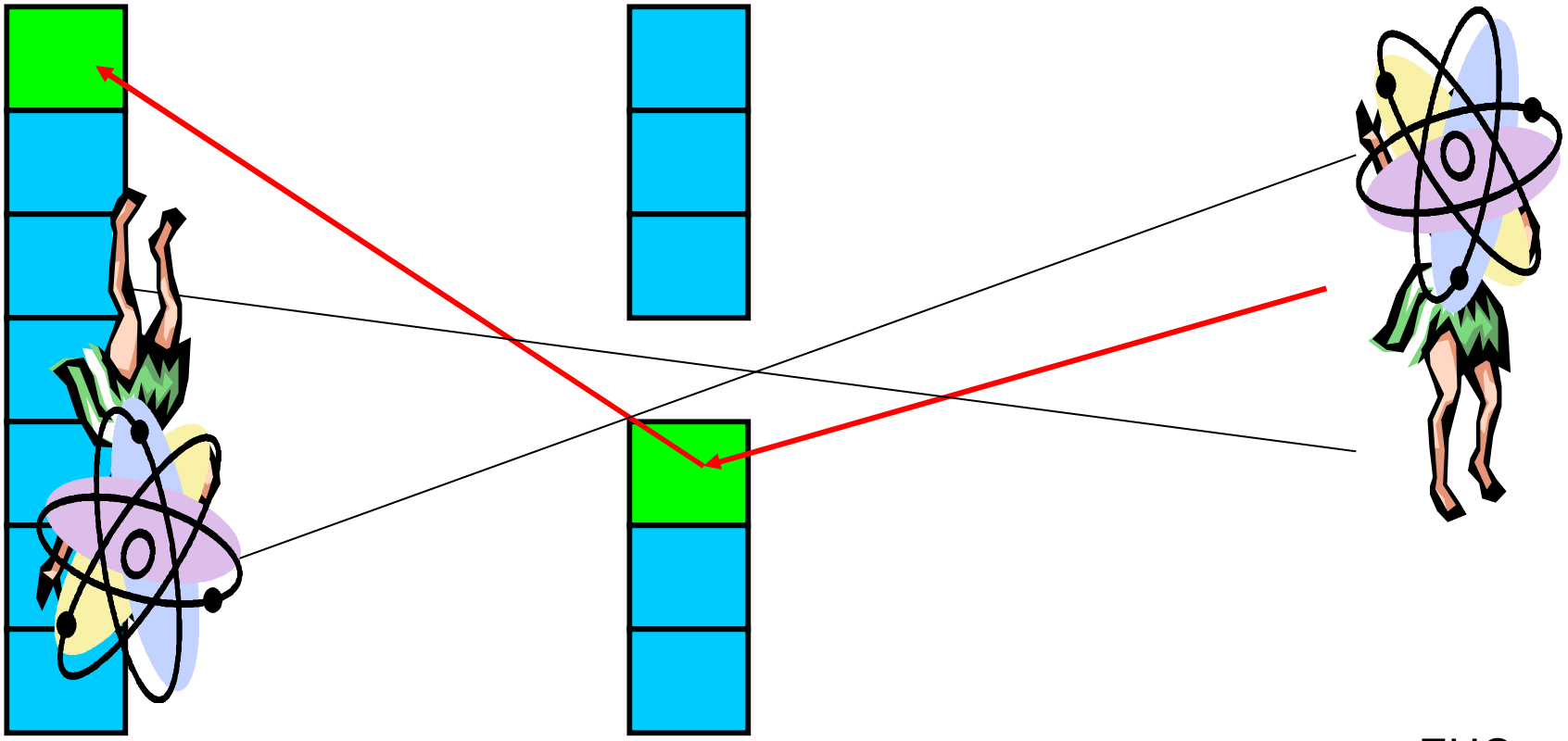
Image plane

Mask plane

Emitting Hula Object
(EHO)

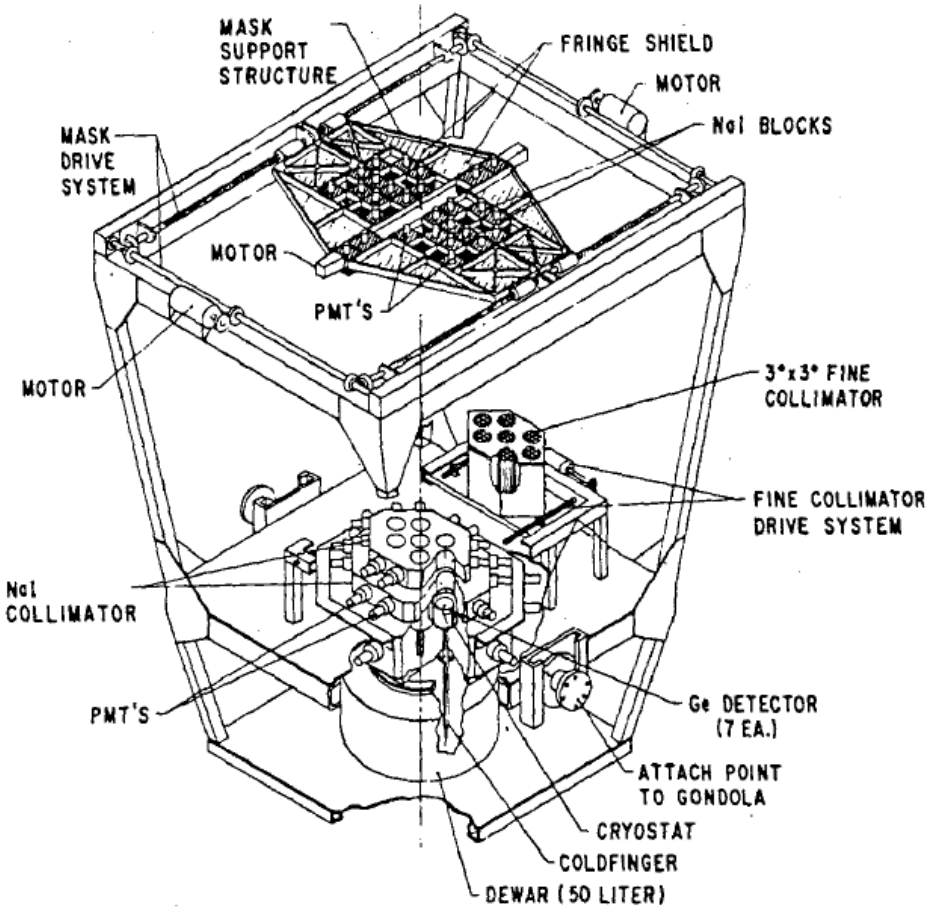
Sandia National Laboratories

# Imaging with an active aperture



# History

**Active coded aperture instruments have been designed and tested**




From: *Teegarden et al, Proc. 19th Cosmic Ray Conf. OG 9.2-4 (1985)*

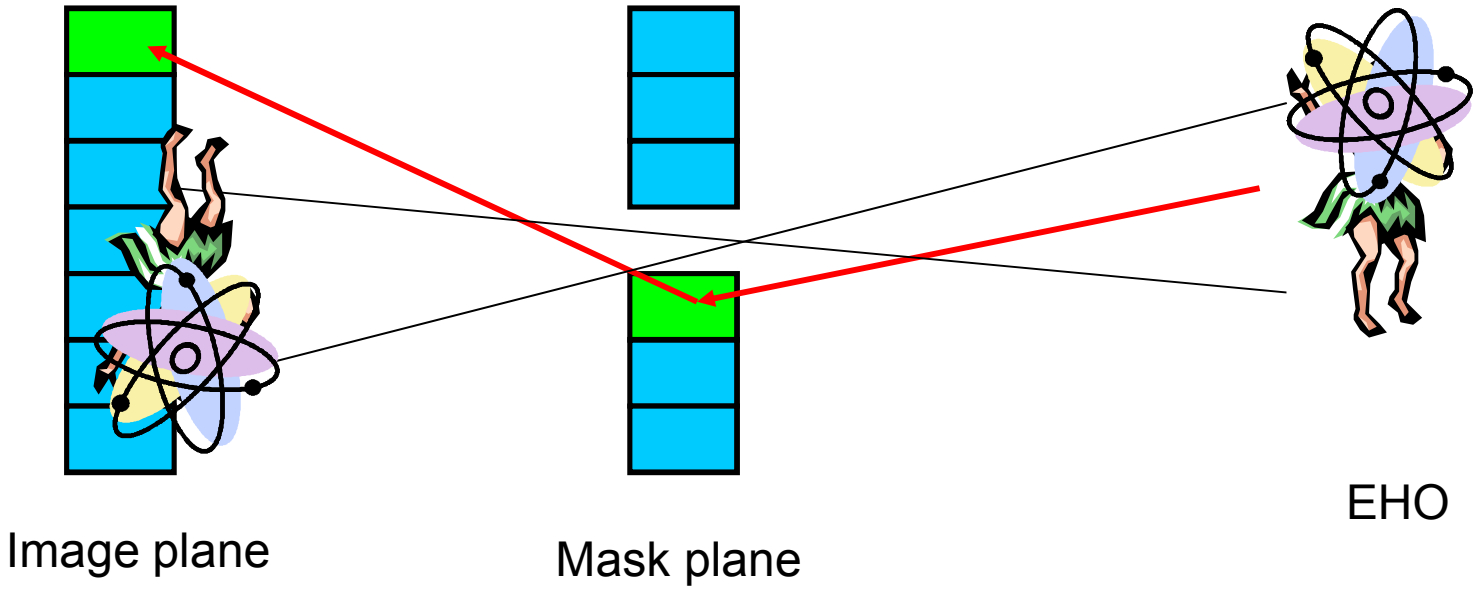
Sandia National Laboratories

# Why bother to do Active Coded Aperture Imaging?

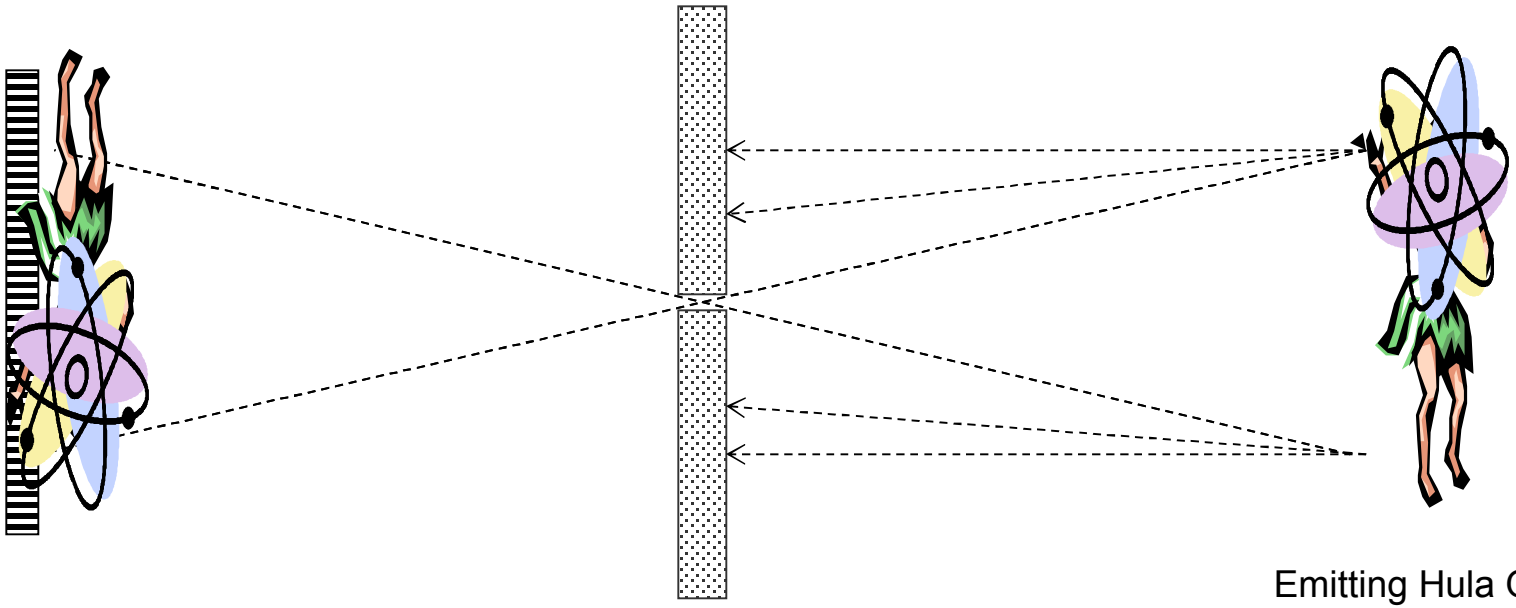
**Suppress scatter from mask**

**Combine with Compton scatter imaging**

**New imaging modalities!**



# New Imaging Modalities
## *The Virtual Aperture*



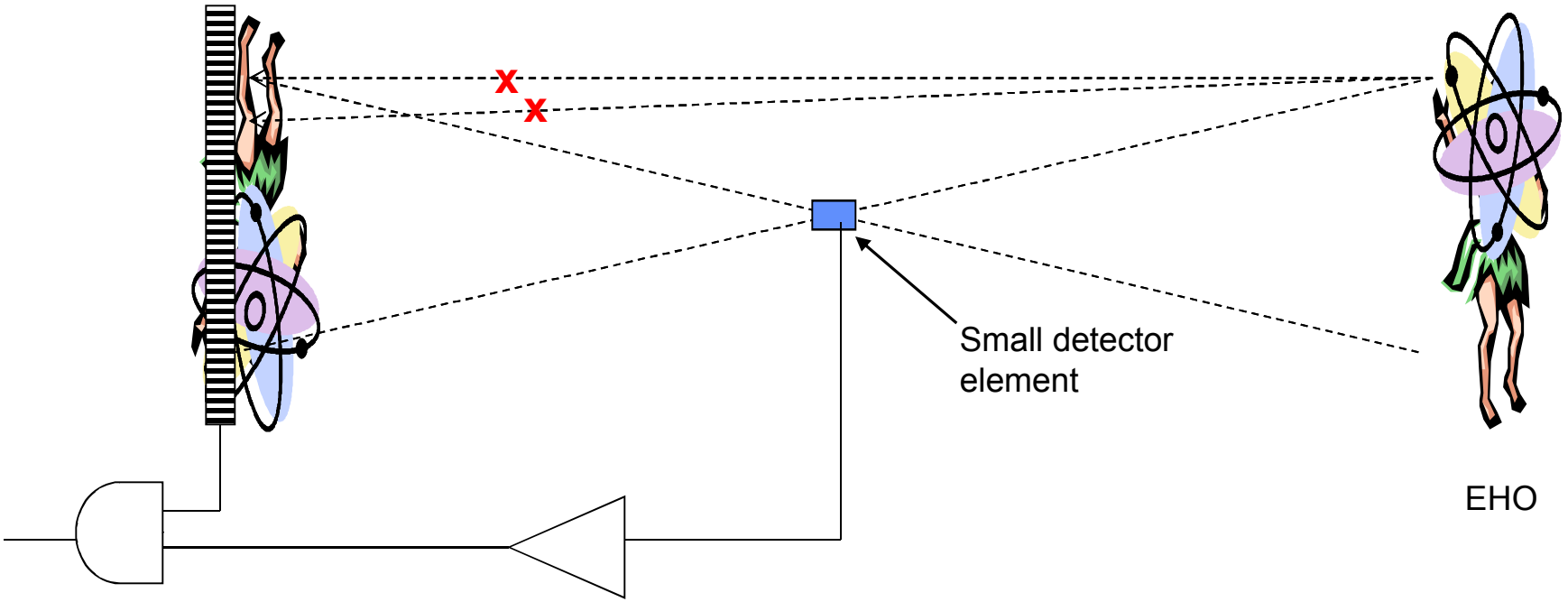
Position sensitive radiation detector

Opaque mask with "pinhole" aperture

Emitting Hula Object

Sandia National Laboratories

# New Imaging Modalities
## *The Virtual Aperture*




Position sensitive radiation detector is read out only if coincident with a low energy event in the aperture detector

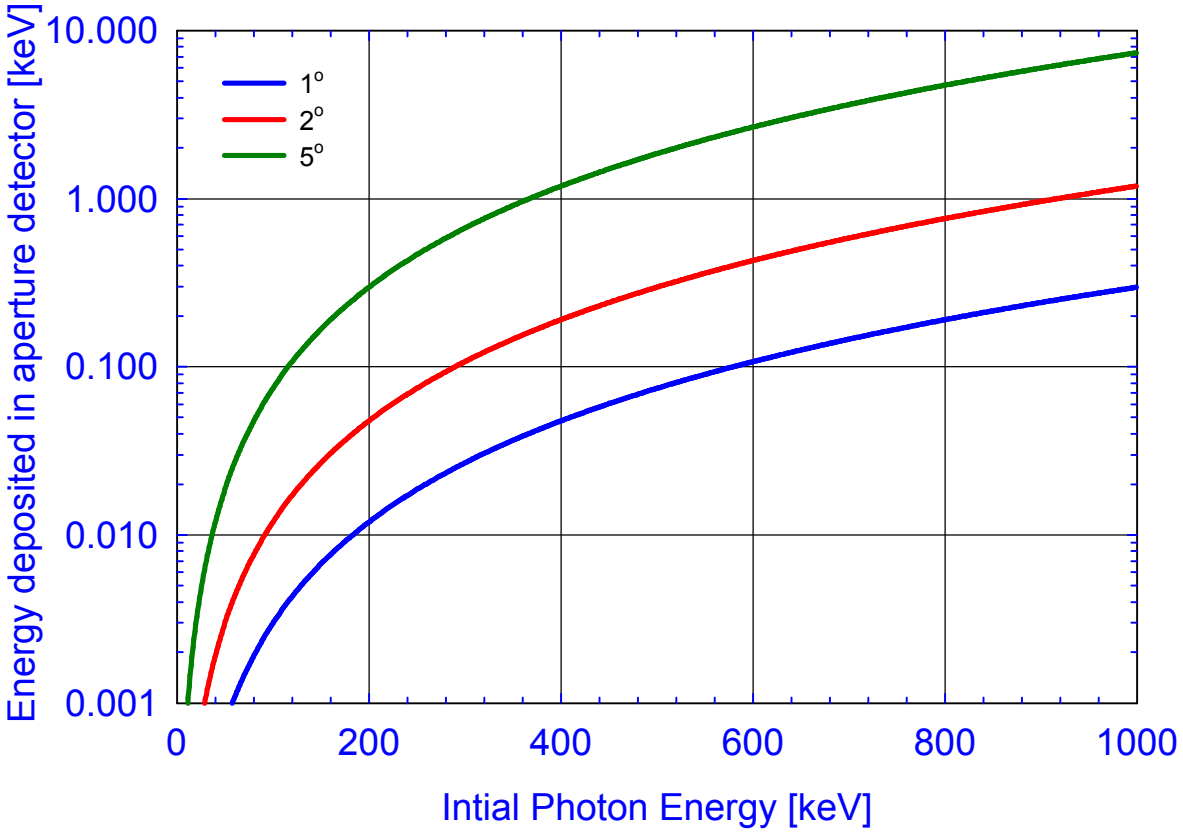
Comparator Output = true When:
$0<E_{detected}<E_{threshold}$

Where $E_{threshold}$ is small

Sandia National Laboratories

# Virtual apertures would present some challenges!

*Small angle scatters in the aperture detector deposit very little energy*

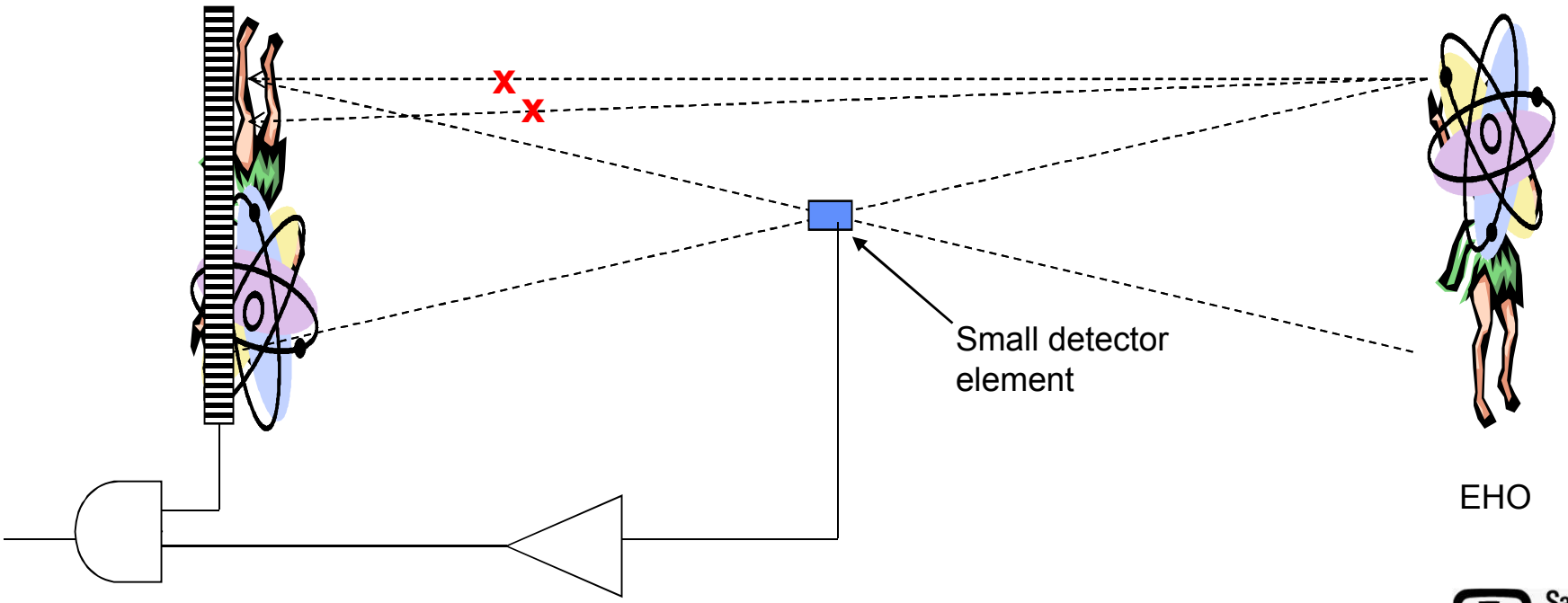



Sandia National Laboratories

# Virtual apertures would present some challenges!

**Would need to measure energy depositions of less than 1 keV in the aperture detector . Tough with a scintillator (NaI(Tl): 1 keV ~ 40 optical photons).**

**But only need to sense whether or not deposition occurred, no need for good amplitude estimate**

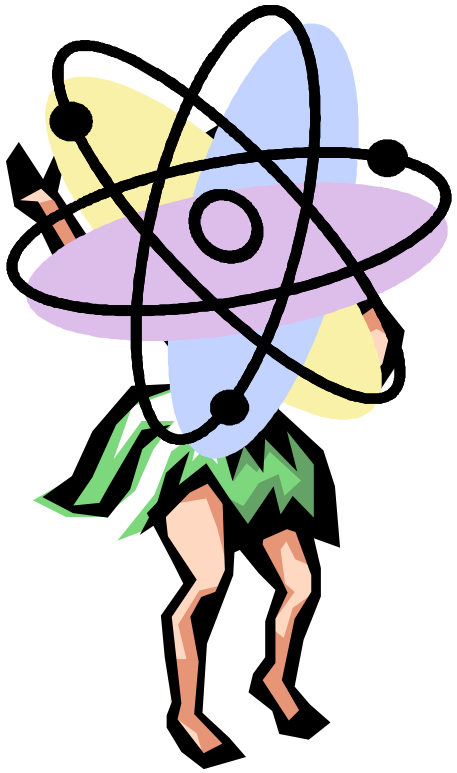



Sandia National Laboratories

# Summary

Active coded apertures- offer some attractive features:

- Reduced mask mass
- Combined operation with Compton Scatter modality



Sandia National Laboratories