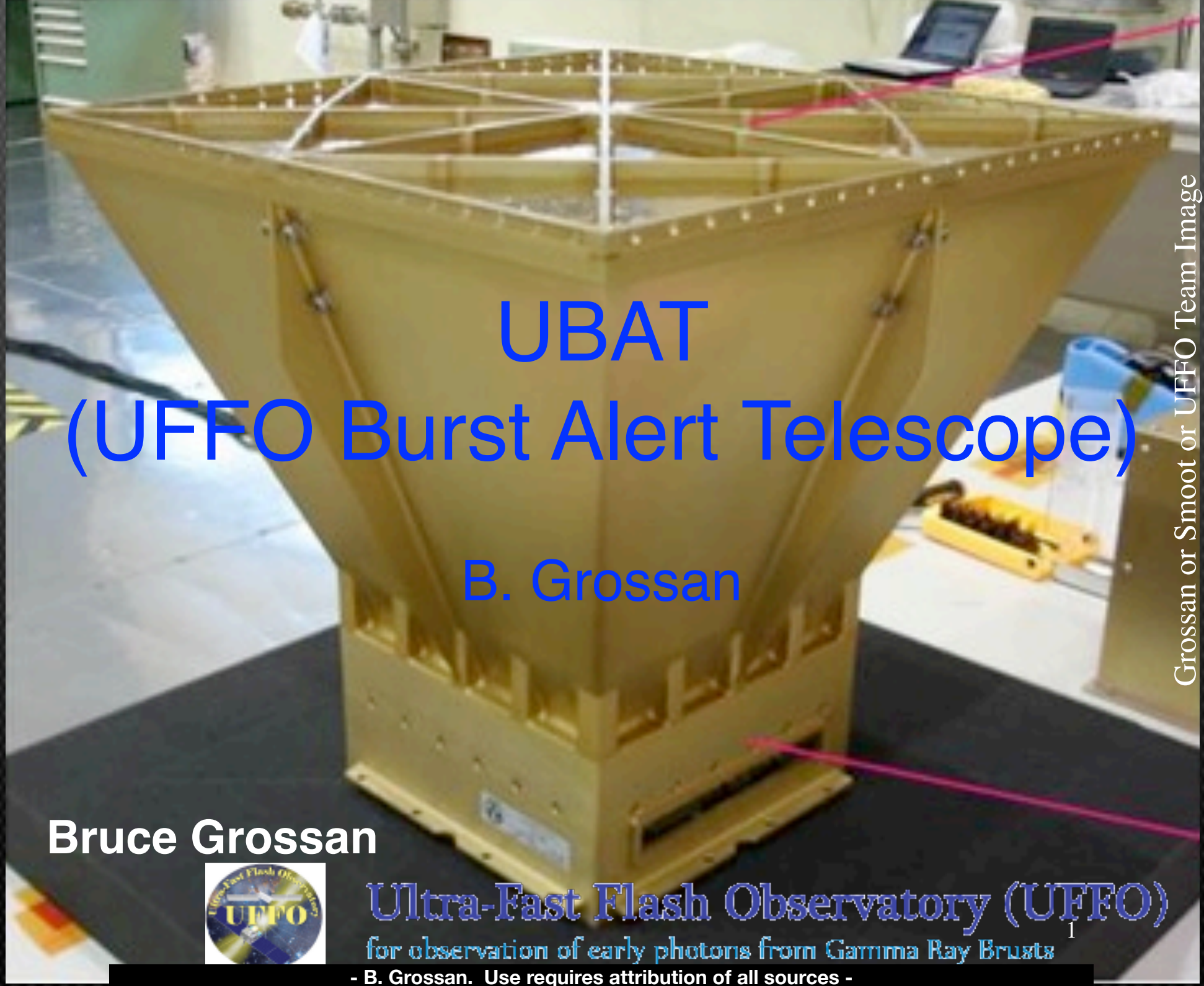

UBAT
(UFFO Burst Alert Telescope)

B. Grossan

Grossan or Smoot or UFFO Team Image

Bruce Grossan

Ultra-Fast Flash Observatory (UFFO)

for observation of early photons from Gamma Ray Brusts

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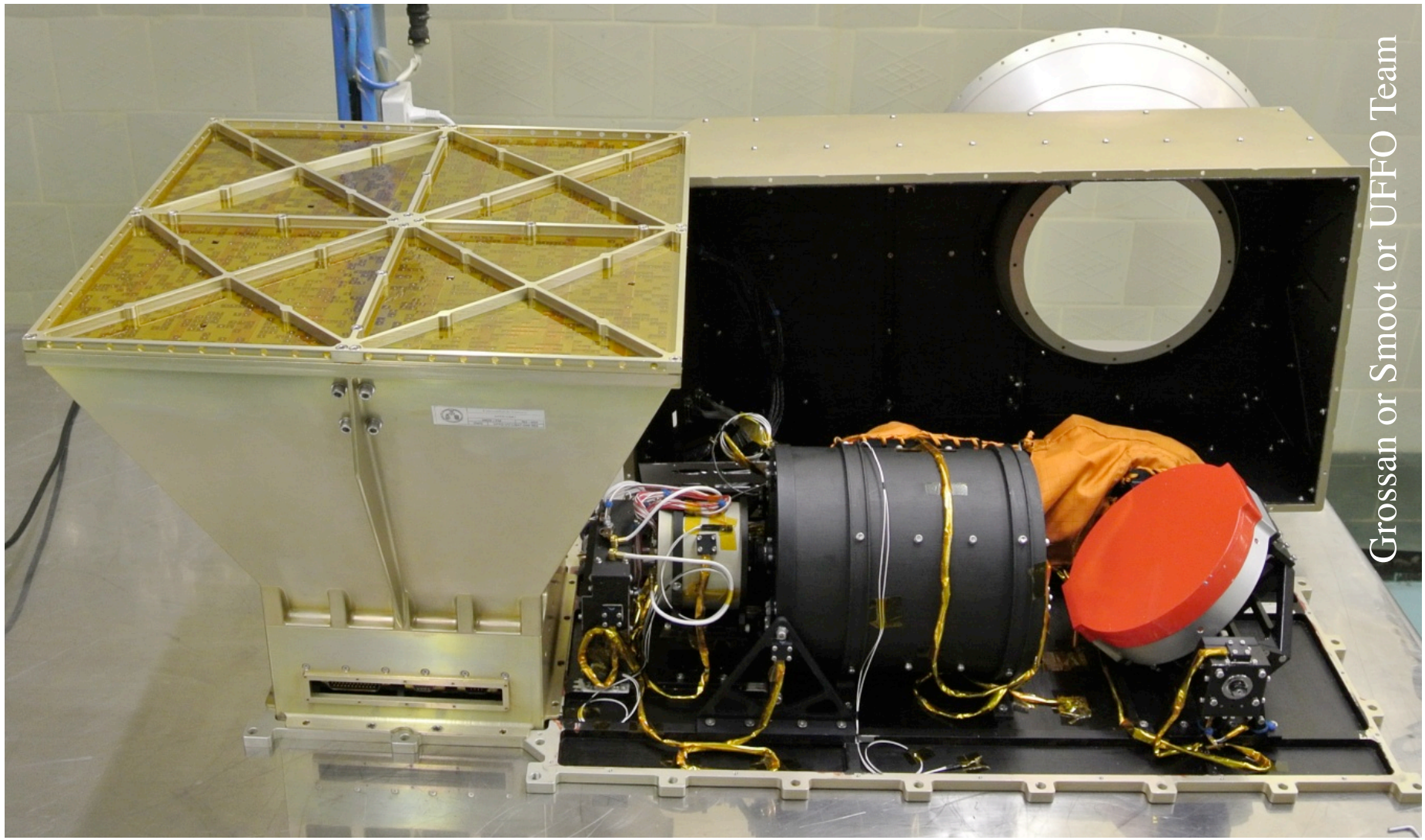
UBAT next to SMT



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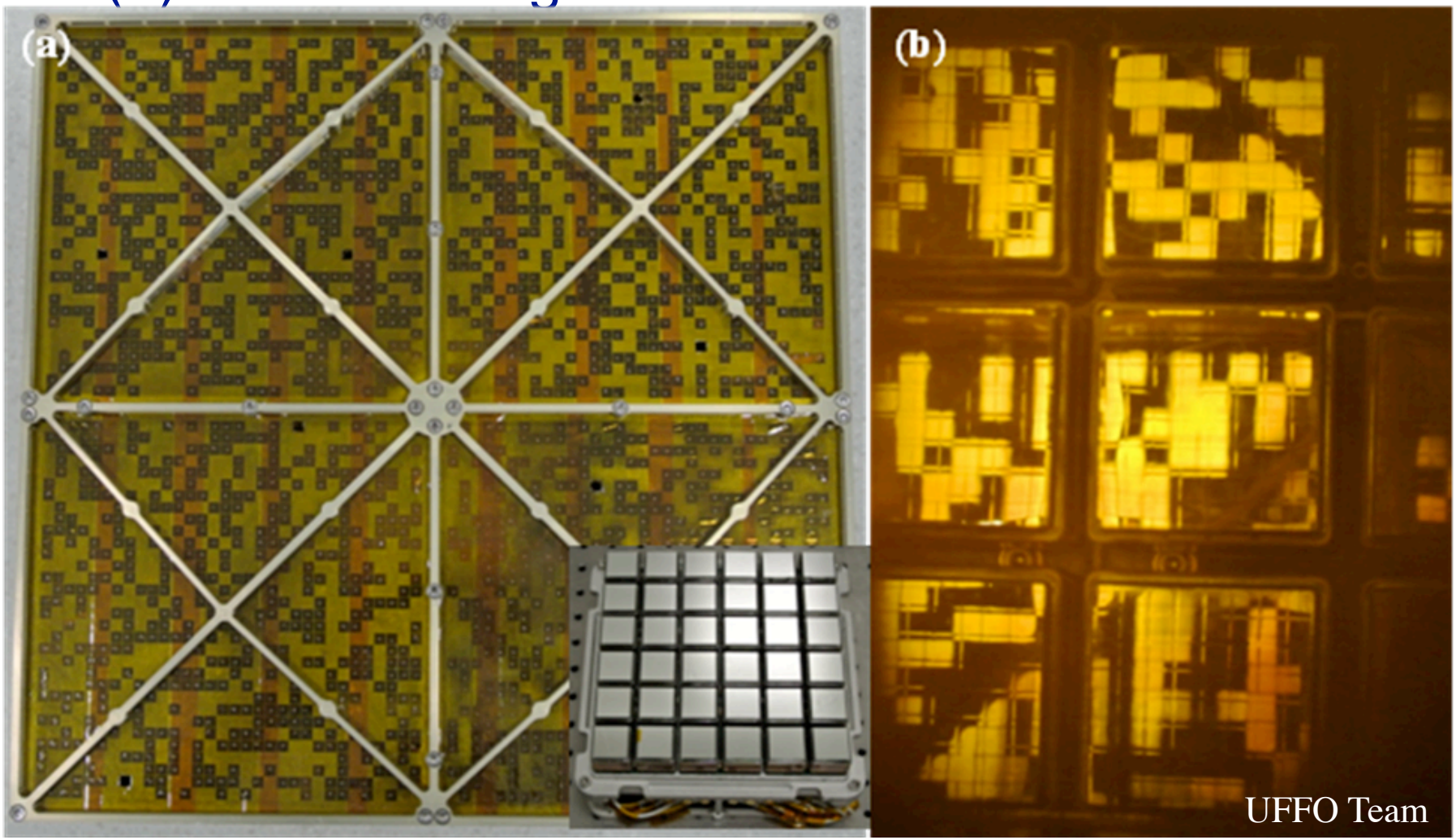
Mask

- (a) mask
- (b) Shadow images of sources at different locations



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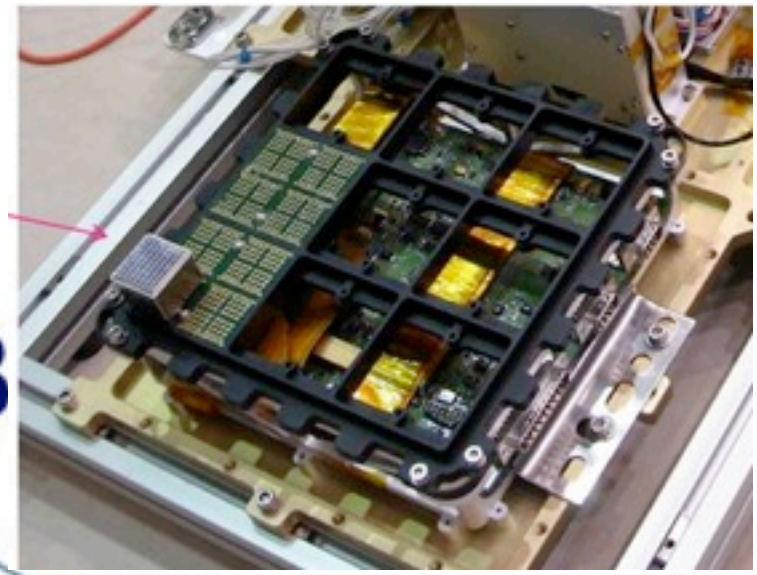
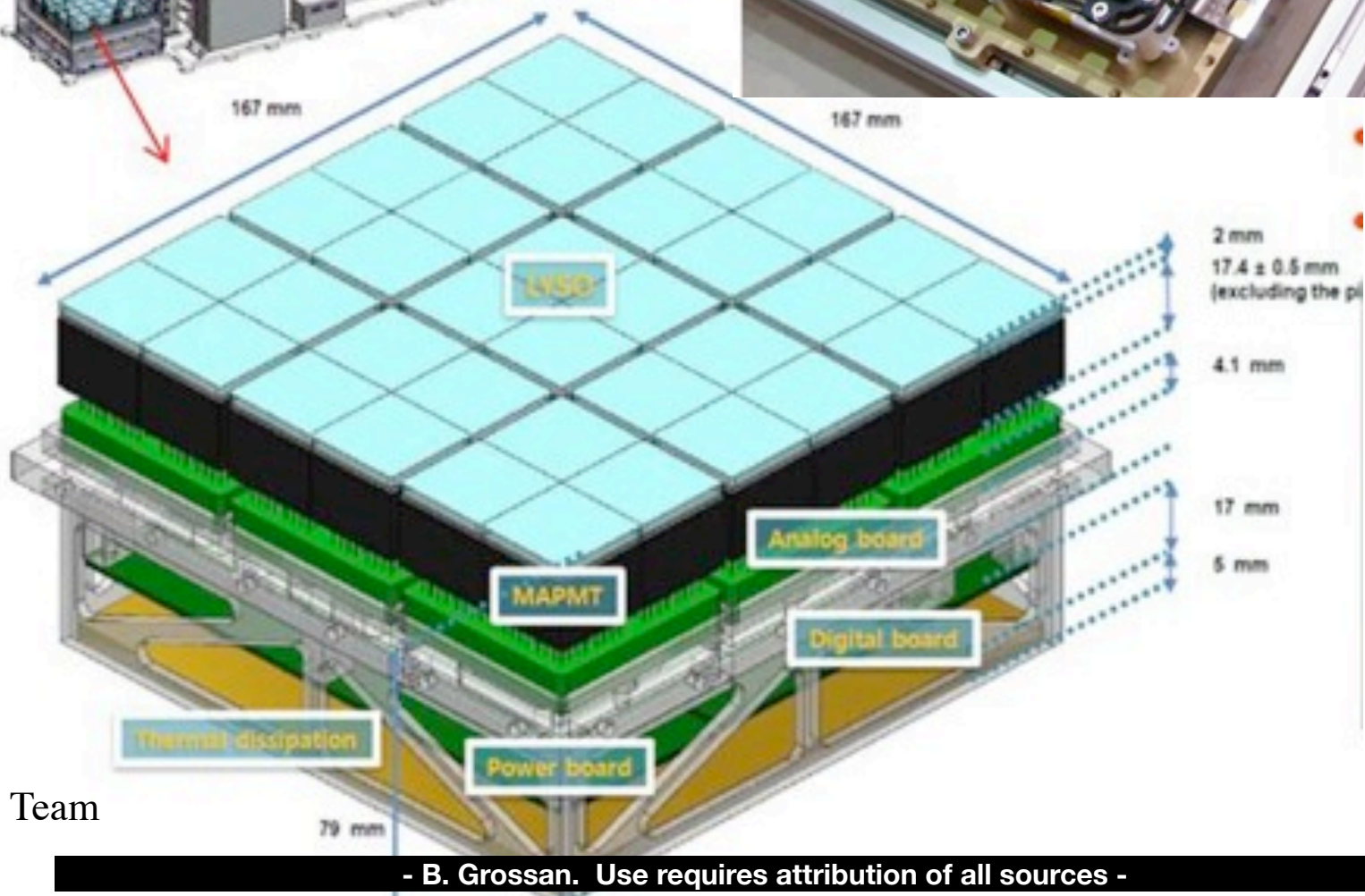
DM

- Detector Module (DM)
- Structure is as below

UB





UFFO Team

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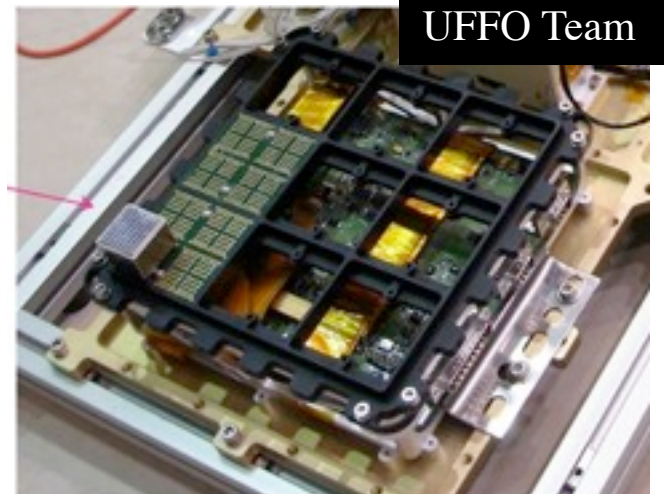
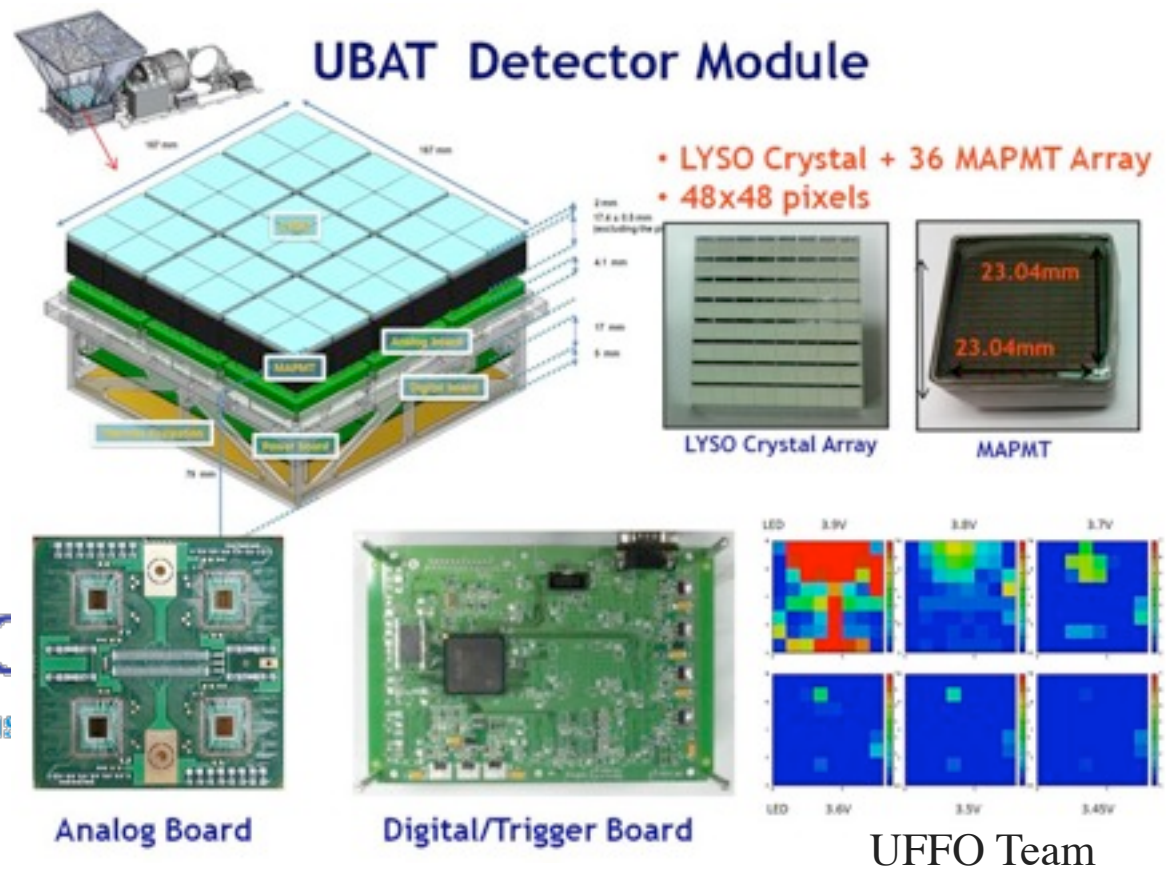
Detectors

- Detection Medium is YSO crystals
- visible light Detector is MAPMT
  - PMTs are old fashioned high e- multiplicaiton type detectors.





Ultra-Fast Flash
for observation of early photons

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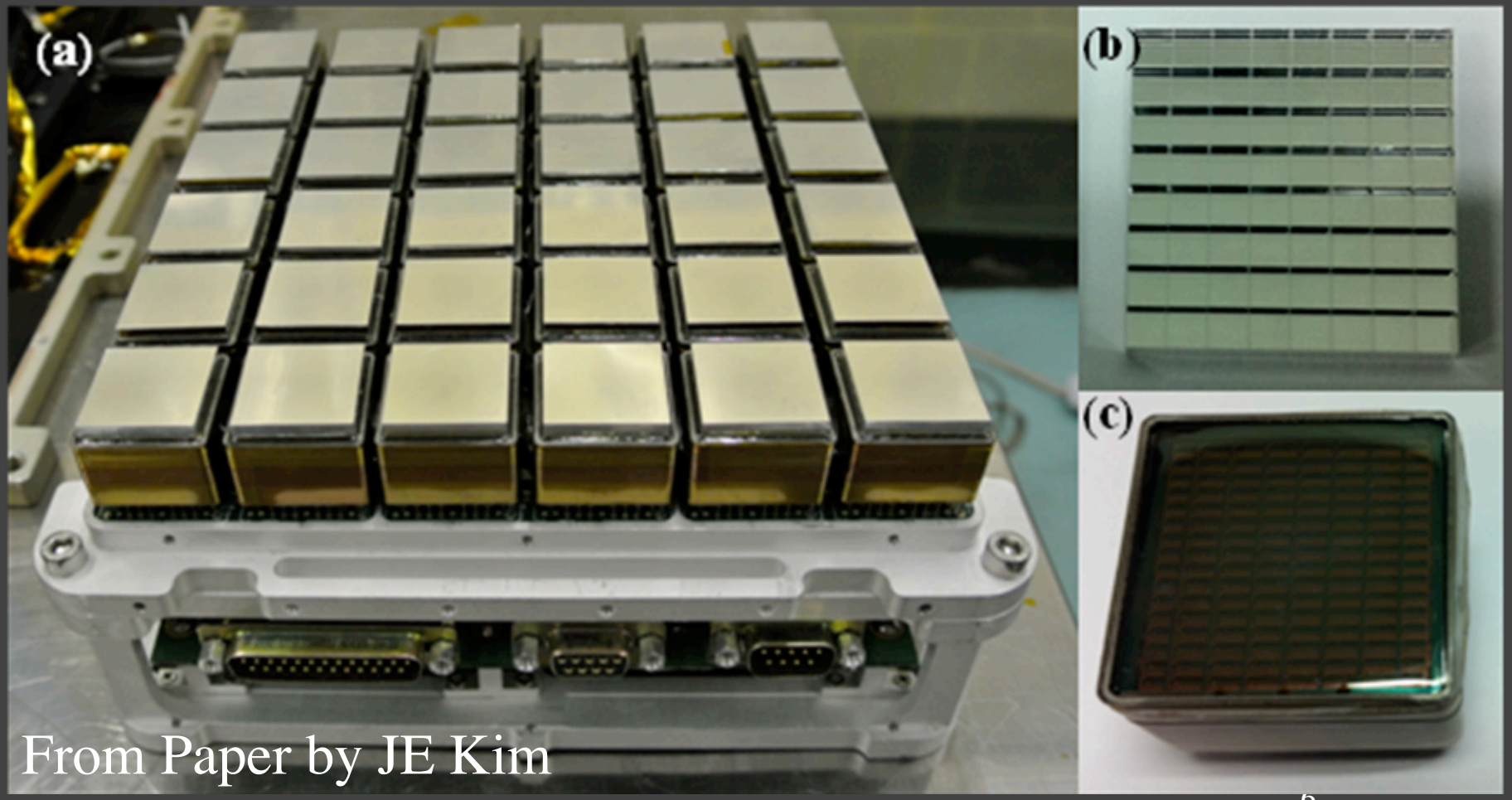
Close-up

- **(a) UBAT DM, (b) a YSO scintillator crystal array, (c) a MAPMT**



From Paper by JE Kim

How it Works

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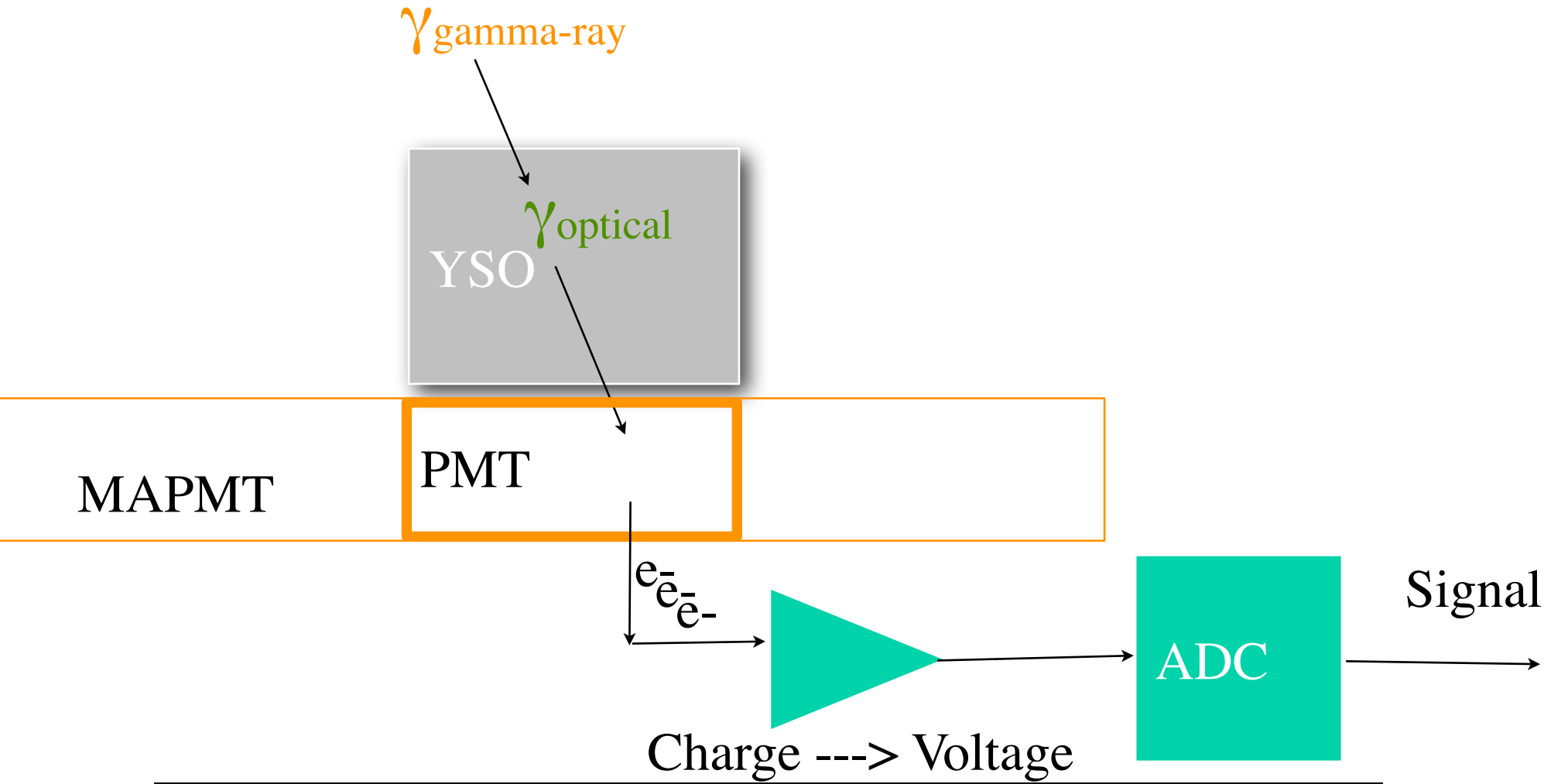

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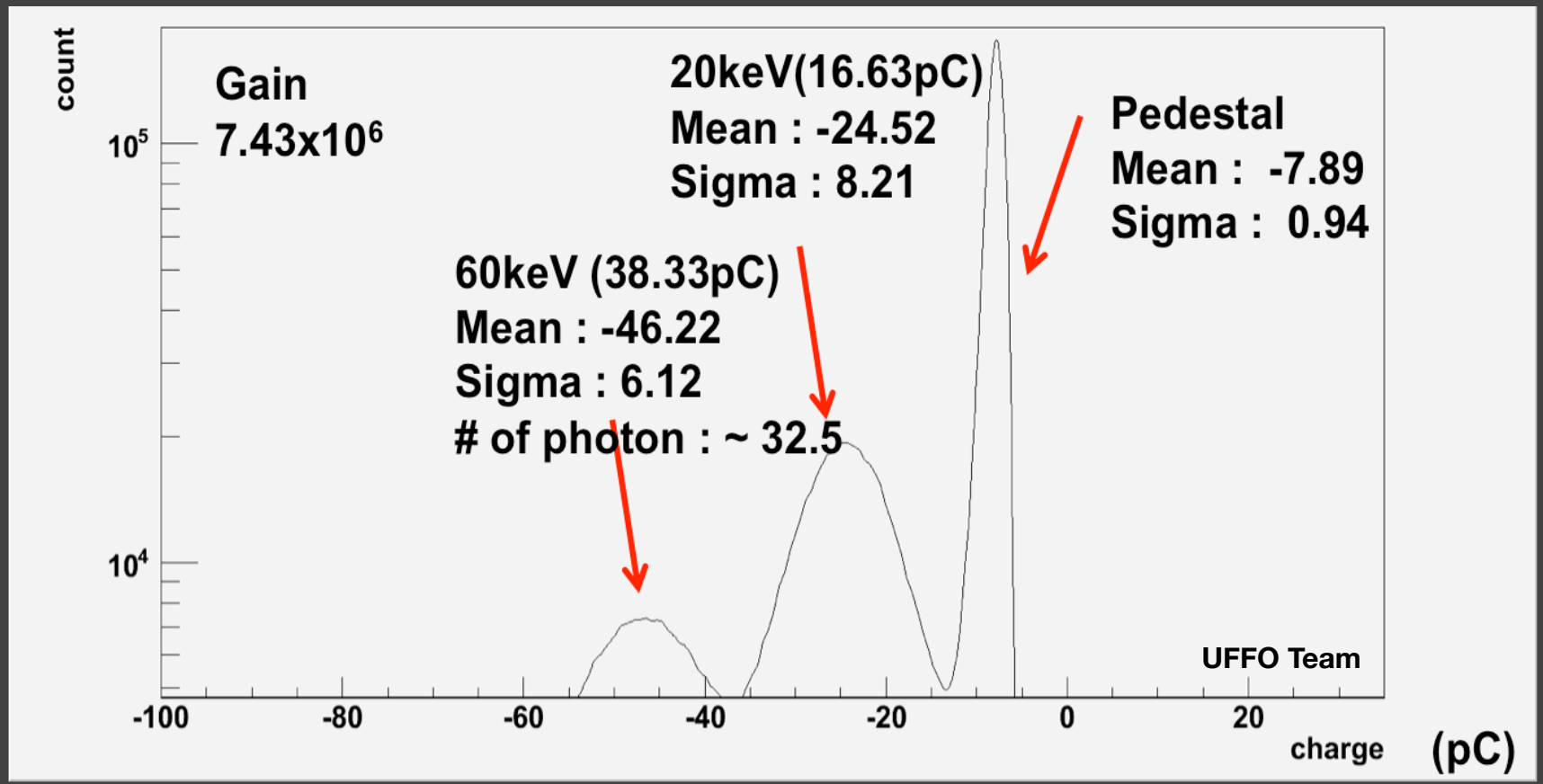
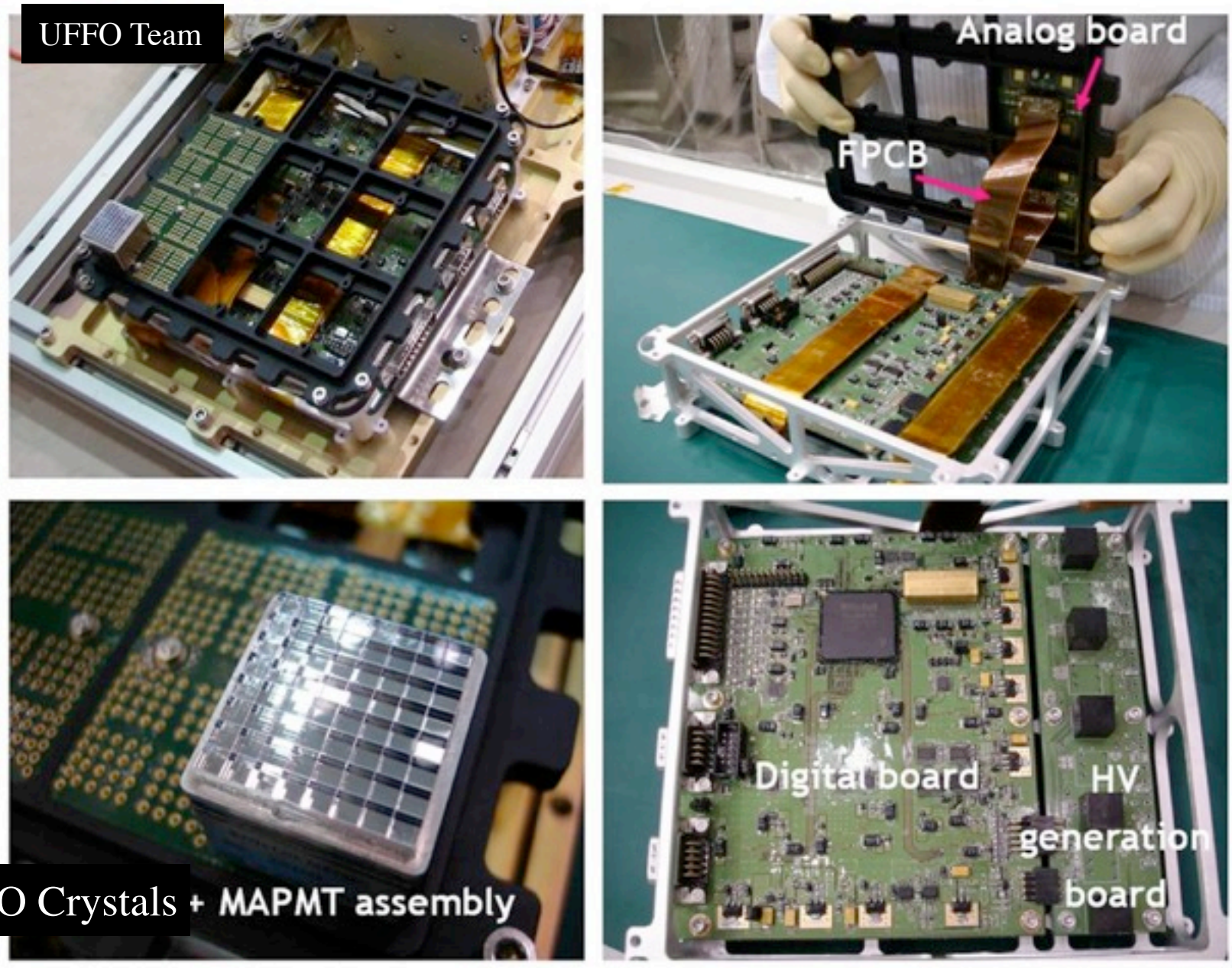
Charge Spectrum

- "Energy spectrum of the radiative source, Americium-241 (Am241) measured by YSO and MAPMT. There are two peaks; the low-energy peak, ~20 keV is measured to be 16.63 pC and the high-energy peak, ~60 keV is measured to be 38.33 pC using the charge-to-digital convertor (QDC)." - JE Kim, UBAT DM paper
-



Electronics



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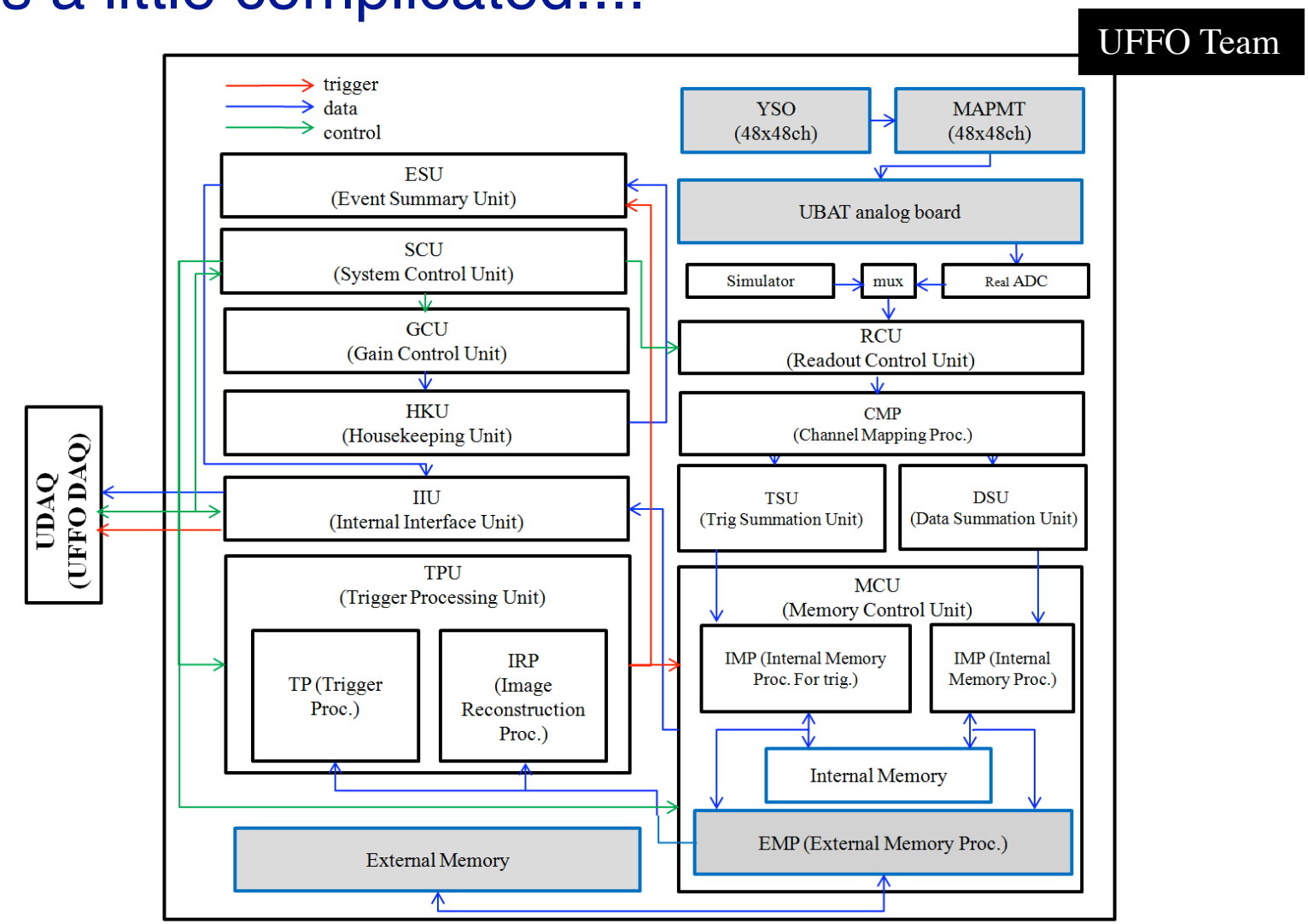
Electronic Block Diagram

- Gets a little complicated....



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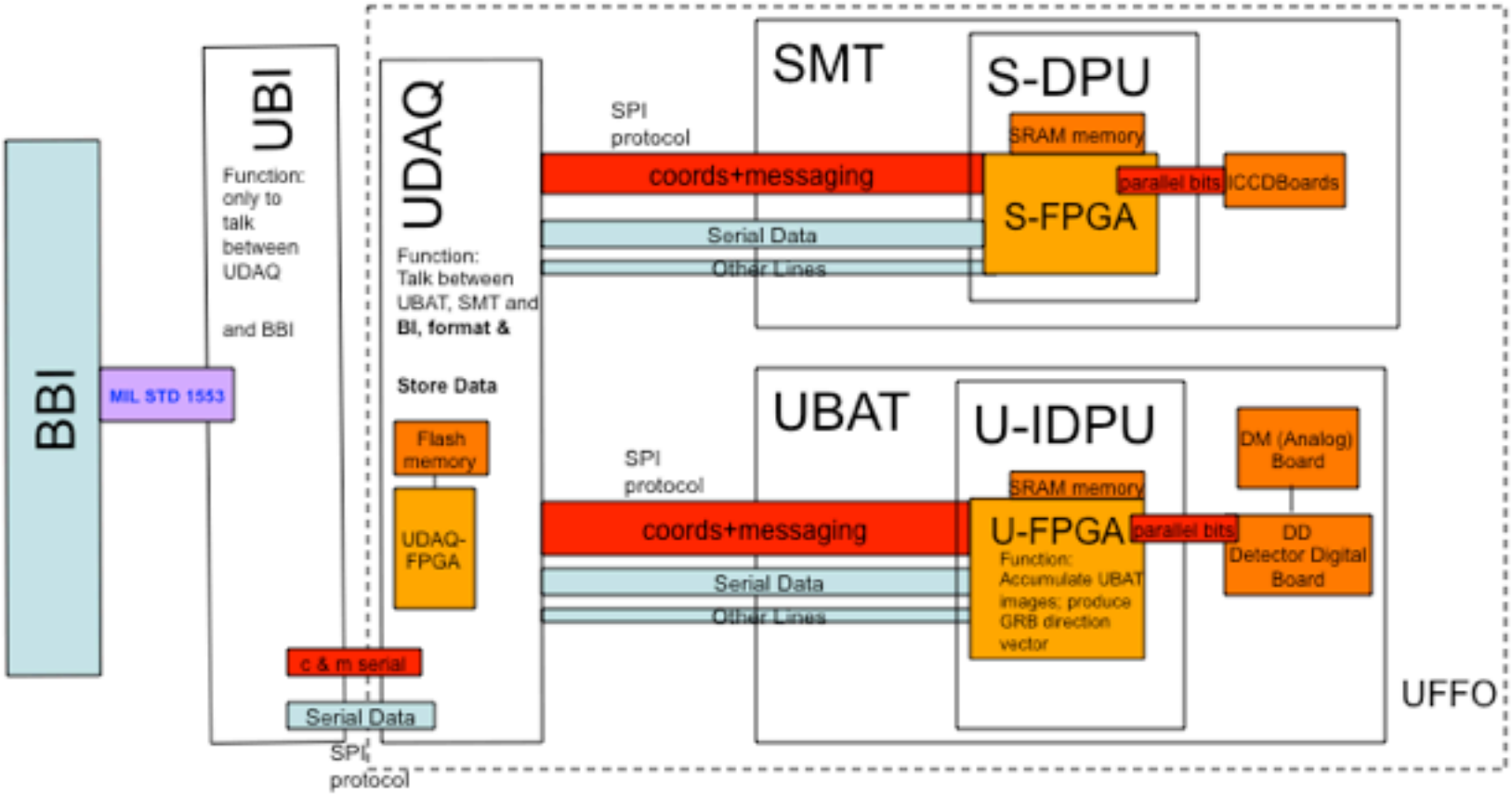
UFFO Data+MessagingV2 2011Oct12

This page by BG



Definitions:

IDPU = Image Data Processing Unit (Gowoon's FPGA thingy that does UBAT imaging.)

Coord & messaging = not instrument data; e.g. commands & coordinates Serial?

With Packets = 3X(4 byte bits) each element?

BBI = Nikolay's bus

UBI = UBAT internal bus (Provided by NV, logically outside of UFFO)

Note 1 - from p. 14 trigger_summary_gwna, only pre-formatted data go to UDAQ.

Re: data flow?

Answered: What does "UDAQ" include? Ans: FPGA, memory & supporting chips.

Where do you use parallel ribbon cables, where serial? Mostly serial; mostly many-line custom cables.

Separate FPGA in SMT, UDAQ, UBI, and UBAT-IDPU? Ans: Yes, indicated above.

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Trigger

- Analog Electronics --- Noise threshold (for noise, NOT background rejection)
  - PMT voltage drifts, has little noises, etc.

- Software - Monitor rate of FULL ARRAY, look for very large variations in countrate (e.g. 8 sigma)
  - Defines Trigger
  - On Trigger, want to keep all data, including long before trigger to measure background

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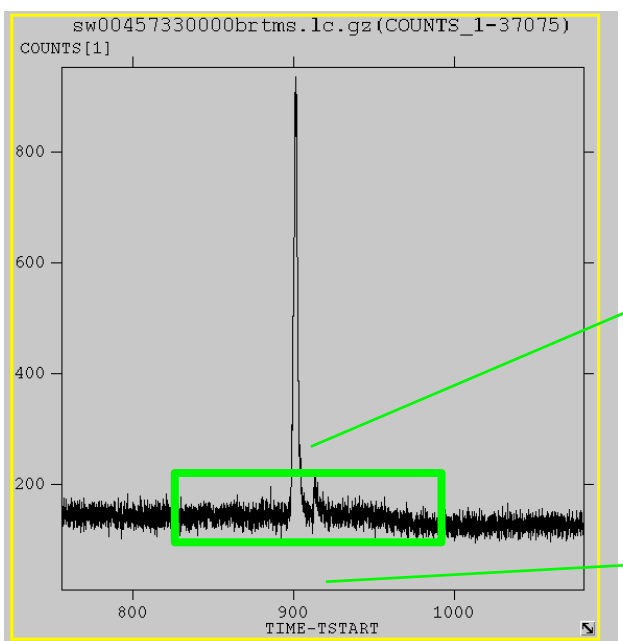
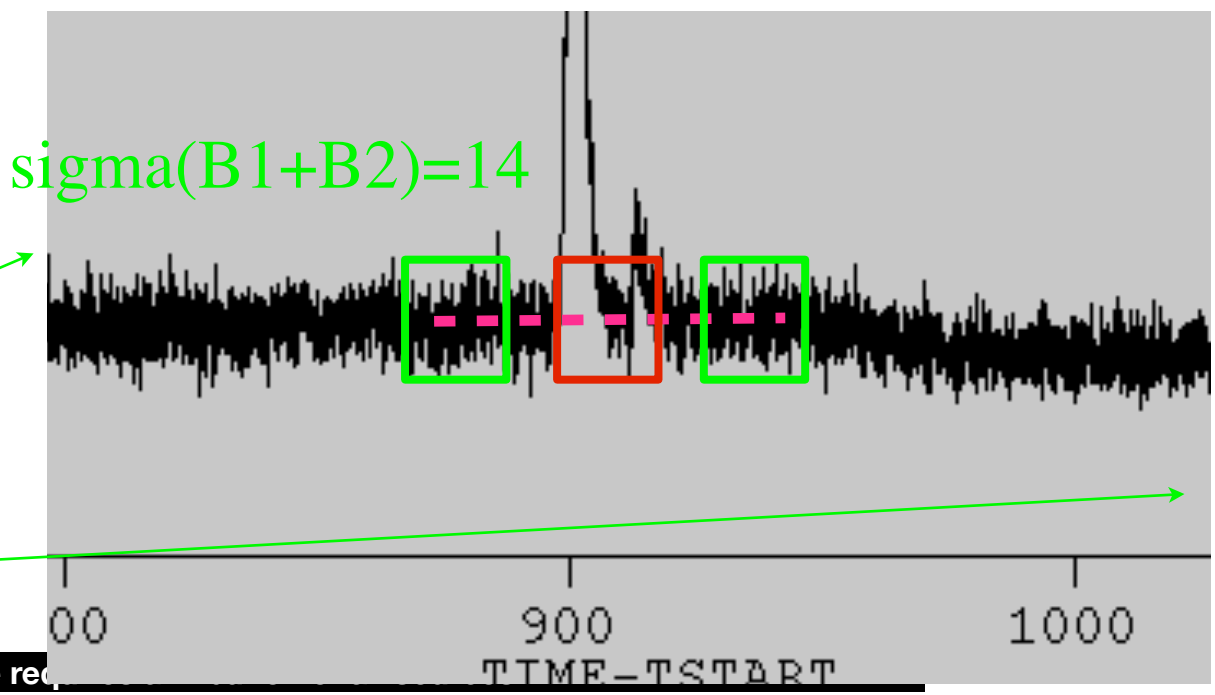
Trigger

- look for large variations in countrate (e.g. 5 sigma)
  - Defines Trigger
  - On Trigger, want to keep all data, including long before trigger to measure background

- Calculate background sigma
- Calculate background, subtract for flux
- Test for trigger





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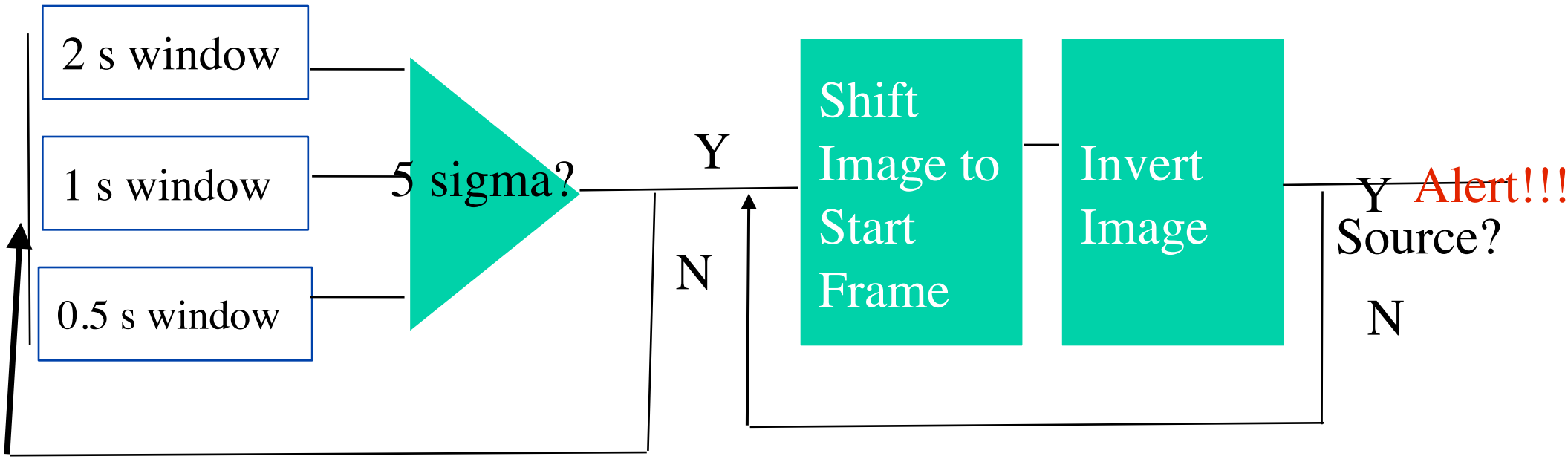
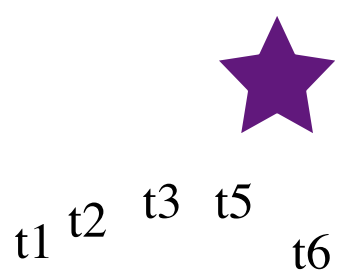
Imaging Software

- Rate Trigger





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Imaging Software

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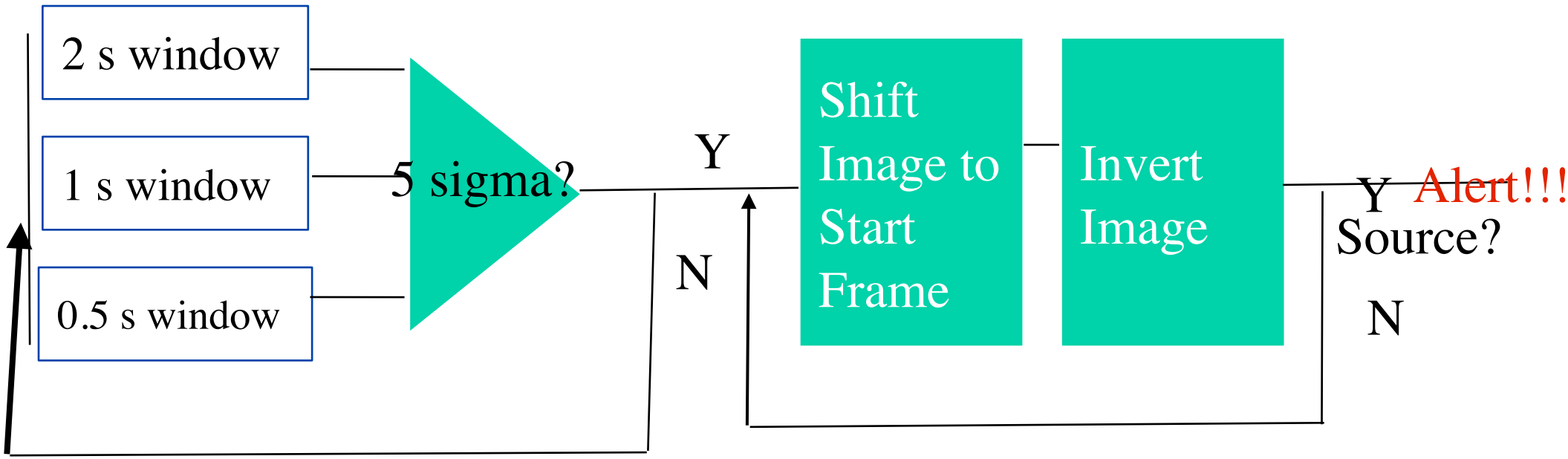
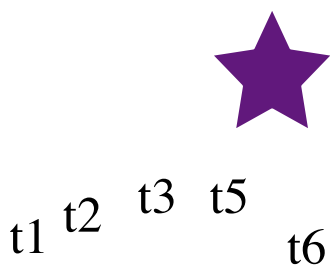


- Why Shift Frame????
  - *Frame is ALWAYS moving!*
  - *4 deg/minute orbital motion*
  - *Must shift pixels to same frame on sky to make image*



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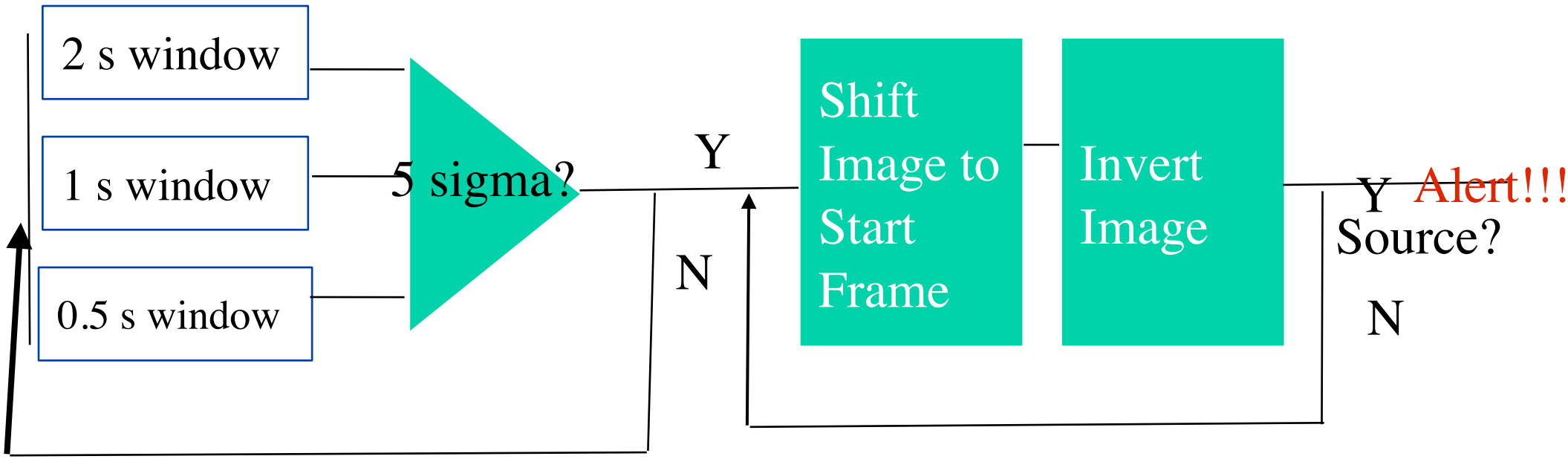

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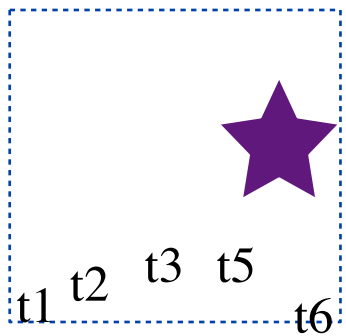

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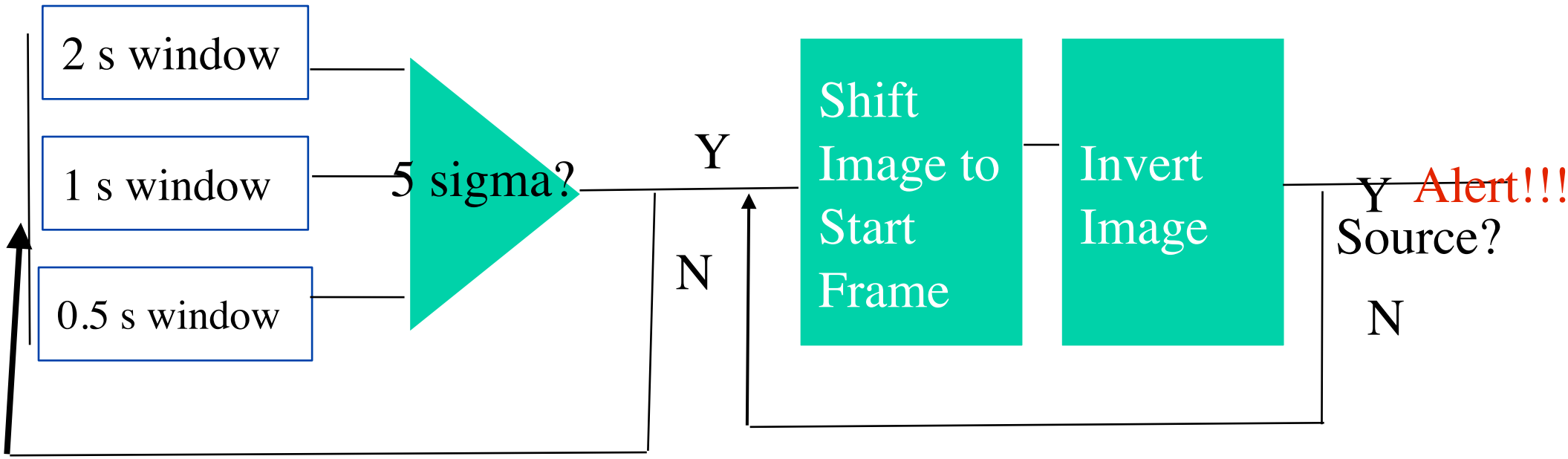

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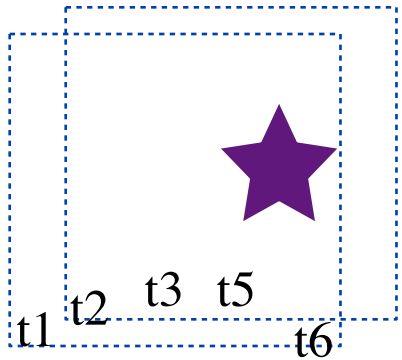

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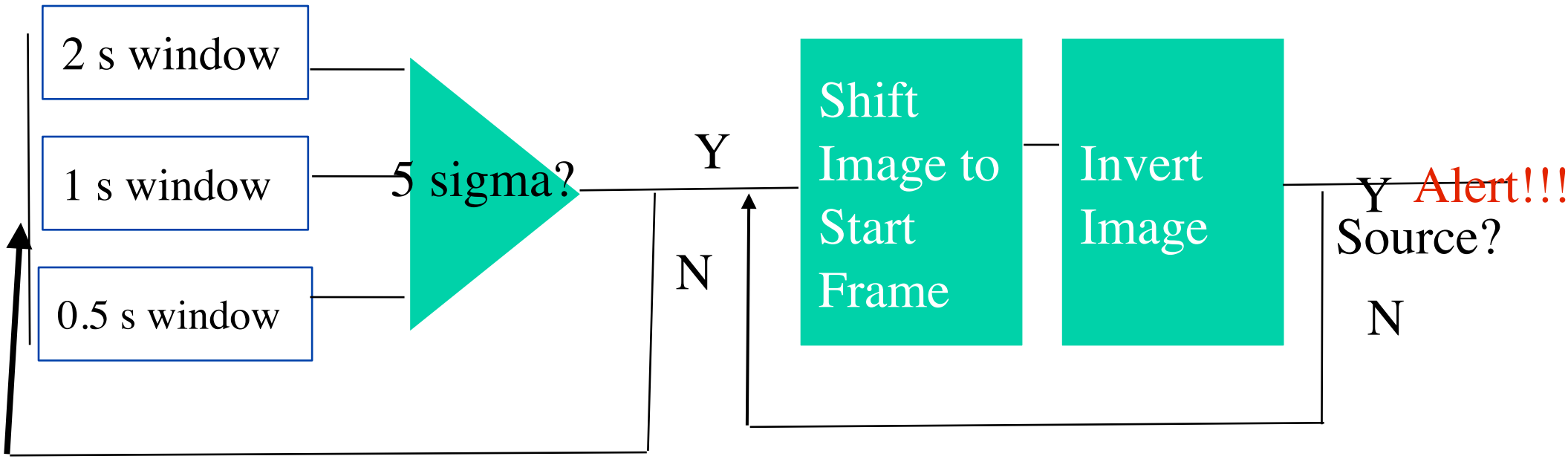

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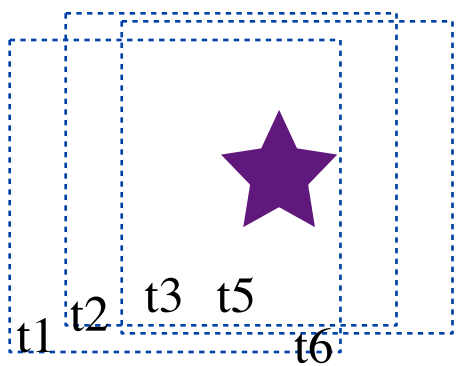

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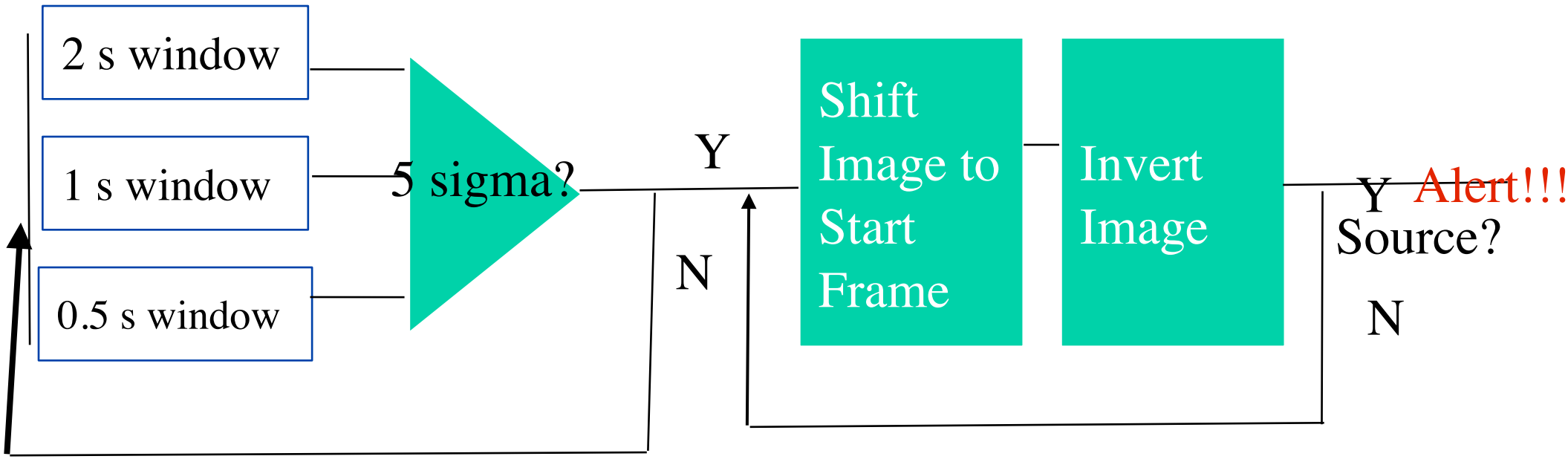

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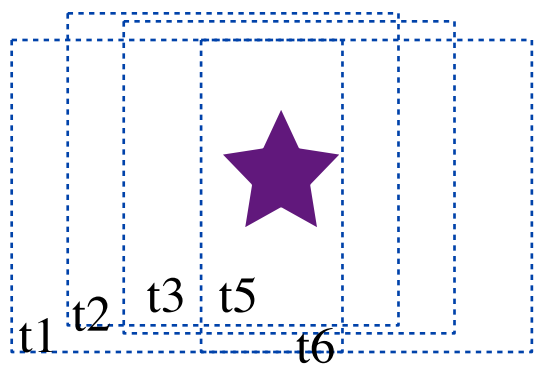

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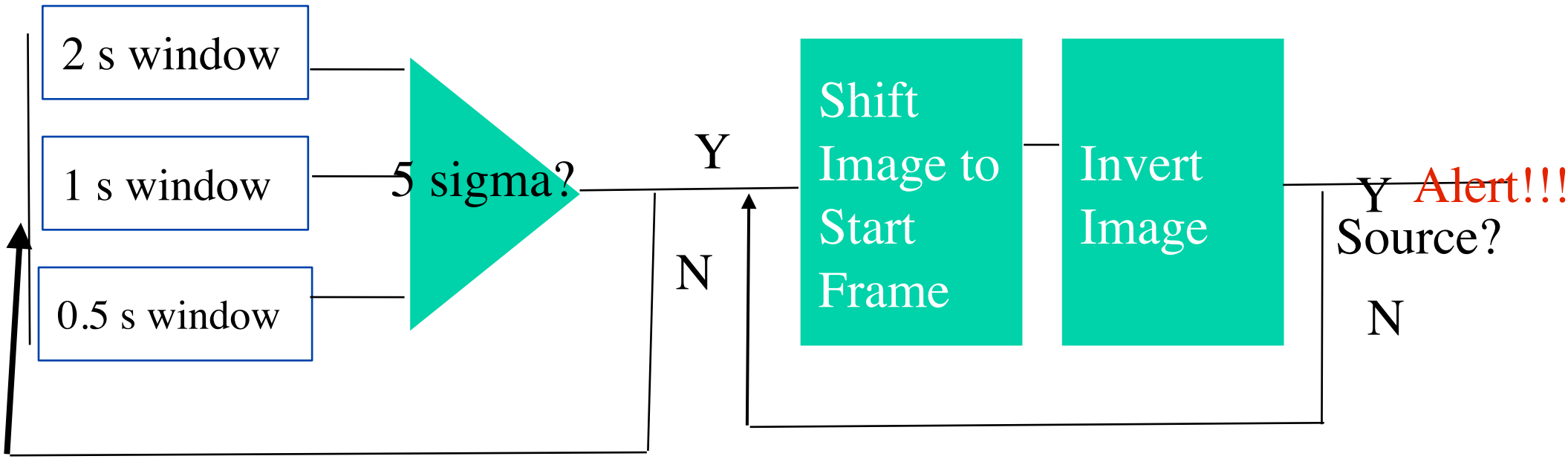

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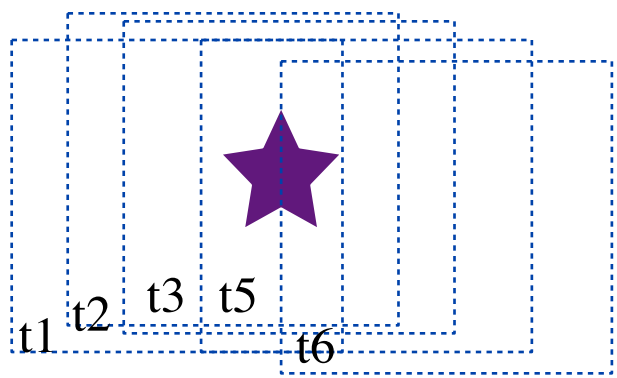

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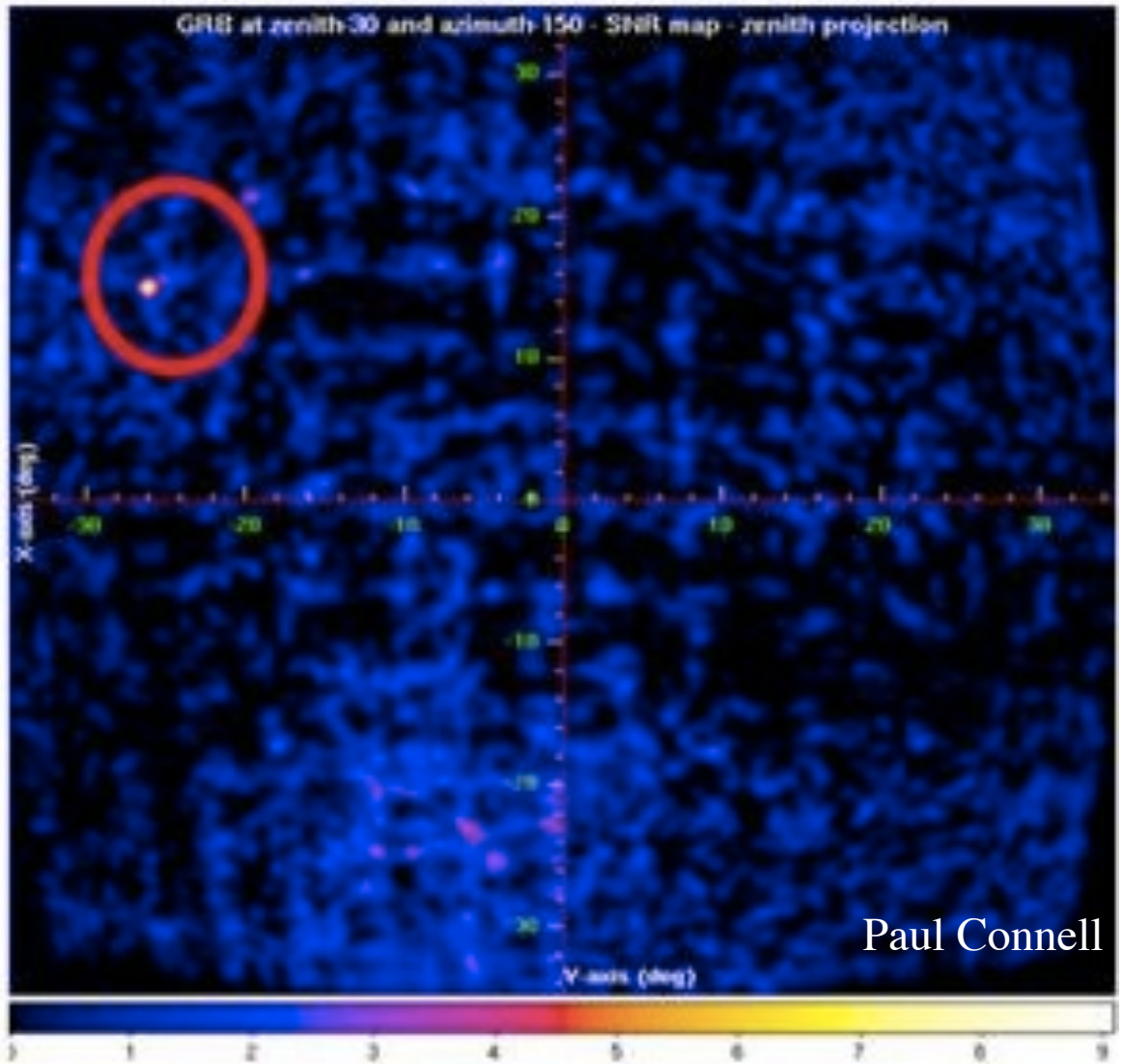
Image

- Is source > 5 sigma?



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Alert

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- SEND POSITION TO SMT optical telescope!!

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- Now, SMT does its job. Stay tuned for SMT lecture..

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Summary

- UBAT is a coded mask X-ray camera
- Light shines through a mask and the shadow position gives source location
- Scintillating crystals make light when hit by X-rays...
- PMTs convert light to e^-s; electronics converts e^-s into counts...
- Trigger looks for big (e.g. SNR>8) counts...
- Images made by software deconvolving shadow pattern on detector array.
- Source location steers mirror for optical measurement.

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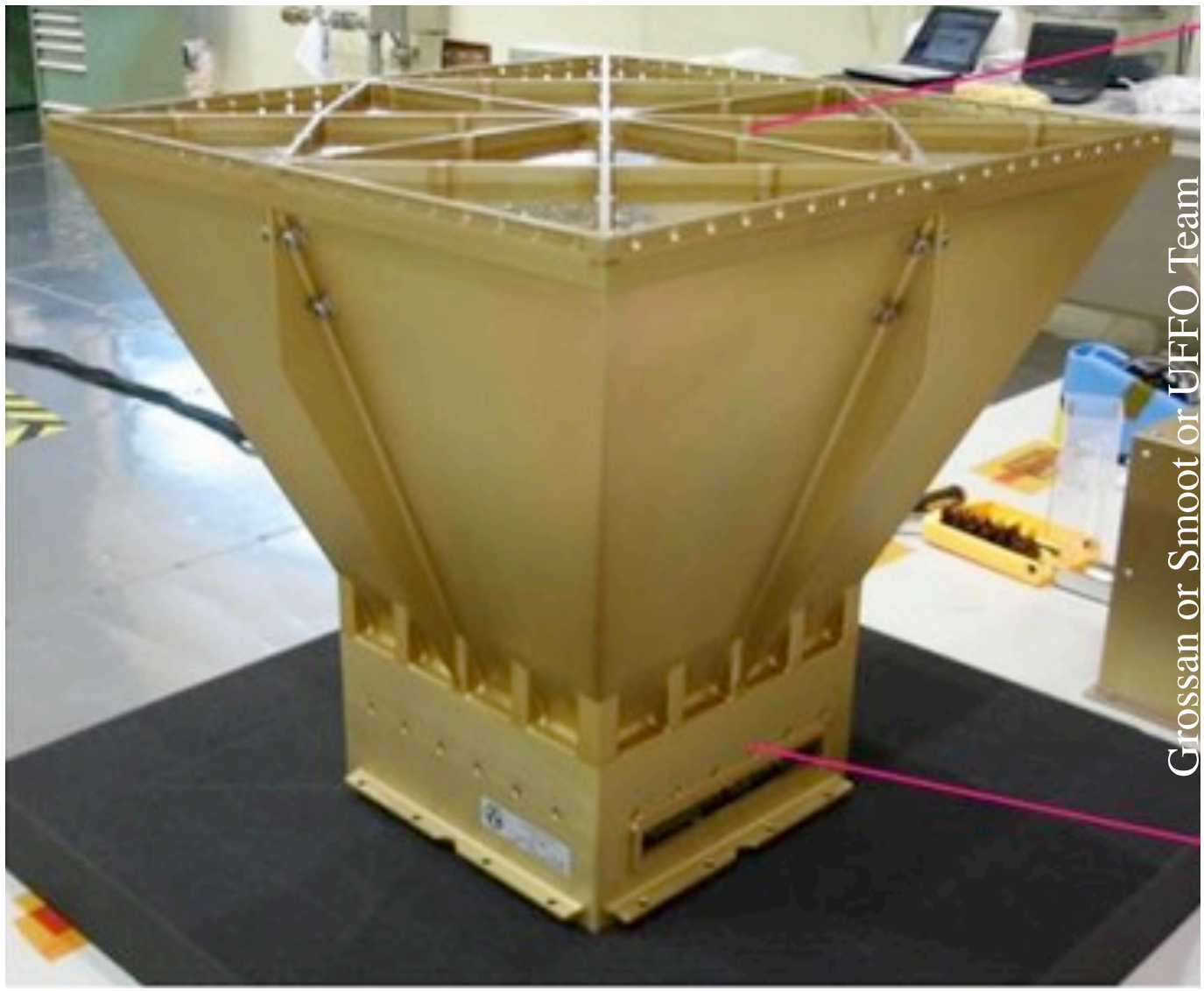
Thank you



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