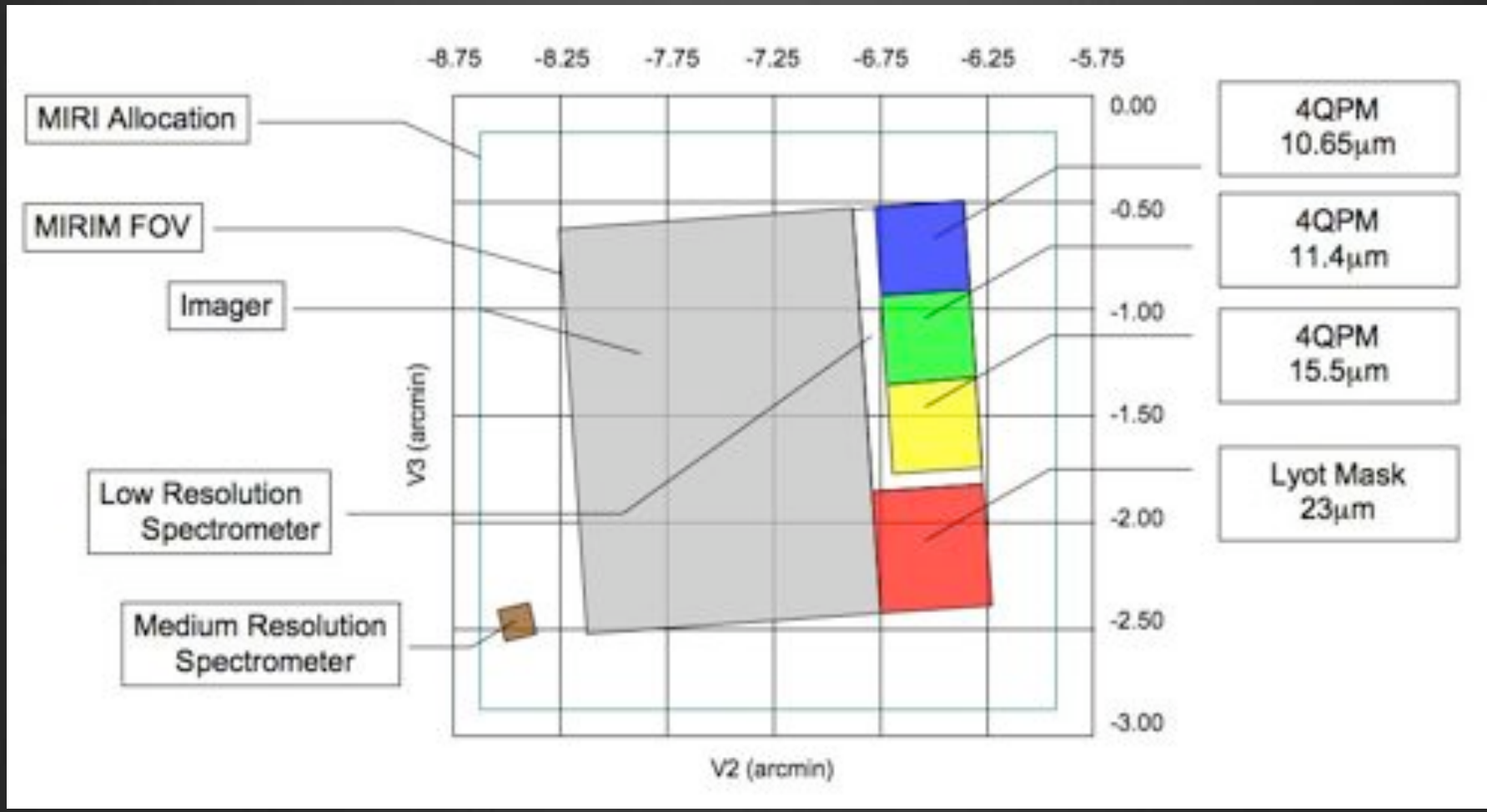
MIRI Detectors:
Using Reference Outputs and Reference Pixels

Version History:
2011: Rachel Anderson for RIAB Training
2009: Scott Friedman for JWST Detector Course

MIRI Field of View



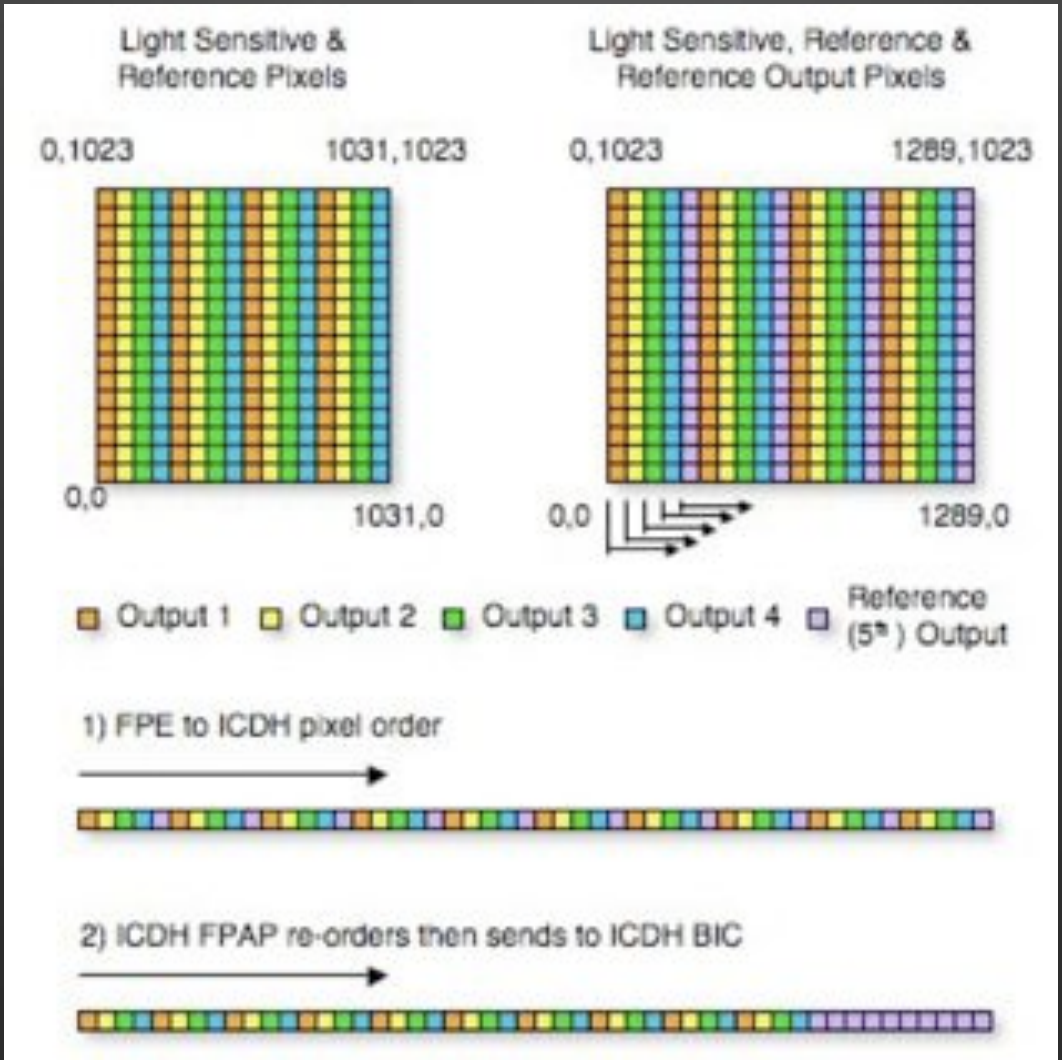
Detector Characteristics

- Ar-doped Si (Si:As) impurity band detector
- Manufactured by Raytheon Vision Systems (RVS)
- Heritage 256×256 Si:As arrays on Spitzer/IRAC
- Spectral range 5 - 28 μm
- 1024×1032 pixels
  - 4 left columns, 4 right columns reference pixels
  - 1024×1024 active pixels
  - 25 micron pixels
- 4 amplifiers - outputs are interleaved
  - 1 reference output read for each 4 amp reads
  - Full output format is 1280×1032

Detector Characteristics (cont.)

- 2 flavors of detectors produced
  - Baseline: thick, highly doped active layer. Requires exceptional purity. Would meet all requirements.
  - Contingency: thinner, lower doped active region. Lower purity required. Would function as a "reasonable" detector.
- Separate anti-reflection coatings applied
  - Imager and SW arrays optimized for 5-10 μm (min at 6 μm)
  - LW array optimized for 12-20 μm (min at 16 μm)
- Well depth ~250,000 e^- (requirement is 100,000 e^-)
- Temperature controlled to 1 mK
- Readout patterns:
  - Fastmode: 10 μsec/pixel = 2.76 sec/frame
  - Slowmode: 100 μsec/pixel = 27.6 sec/frame

Reference Pixel & Output Format

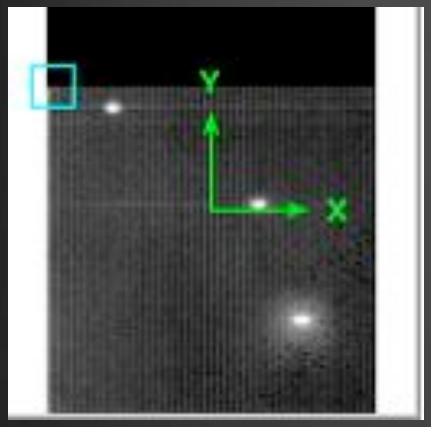


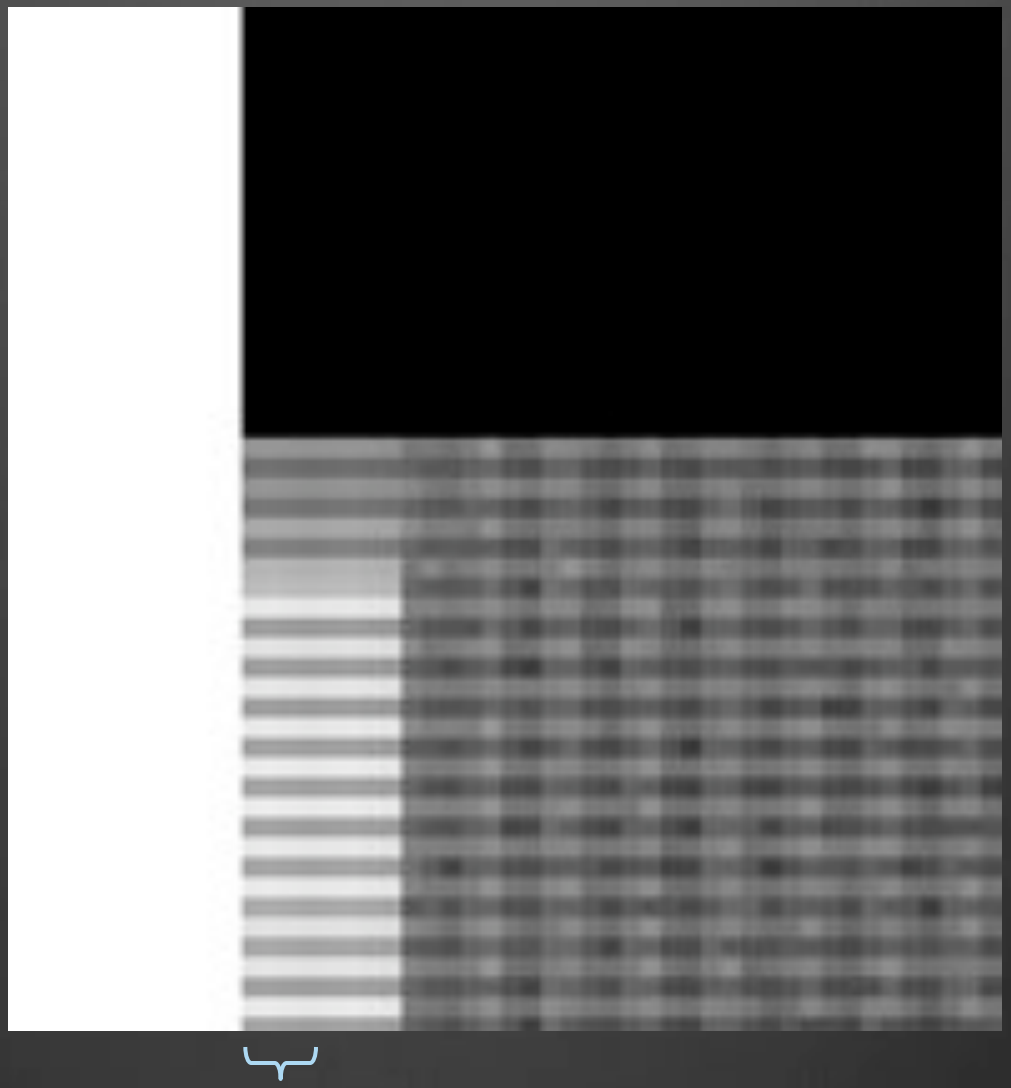
Sample Image from MIRI VM1

- Imager exposure
- Test IMG_RAD_01 (dark exposure)
- 300 frames in 1 integration (755 MB file!)
- Fastmode readout
- Contamination control cover closed, internal light sources off
- MIRI_VM1T00000584_1_IM_S_2008-01-09T16h31m21.fits (called MIRI_VM1_0584.fits for short)

Reference outputs reassembled at top of image to improve data compression

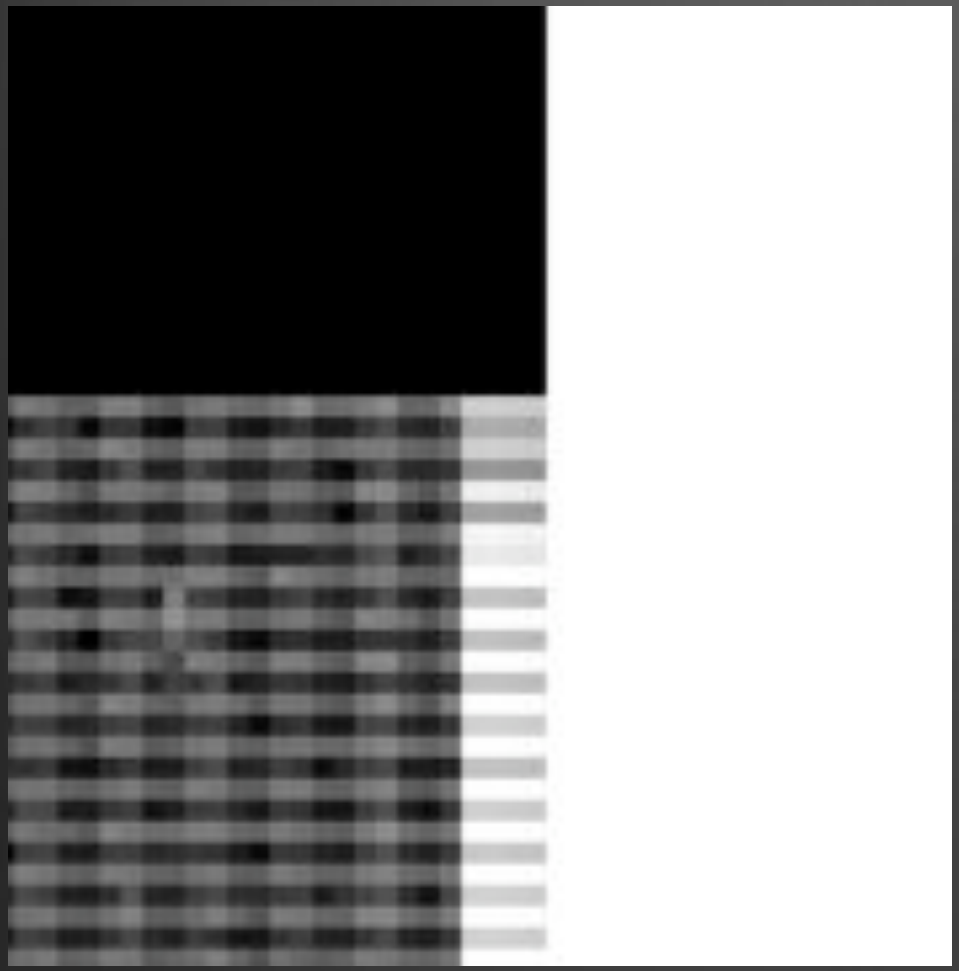
MIRI_VM1T00000584_1_IM_S_2008-01-09T16h31m21.fits

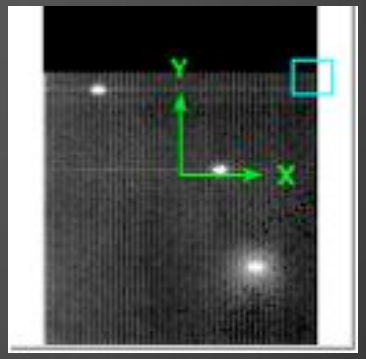




- 4 columns of reference pixels on left side (also 4 columns on right side).

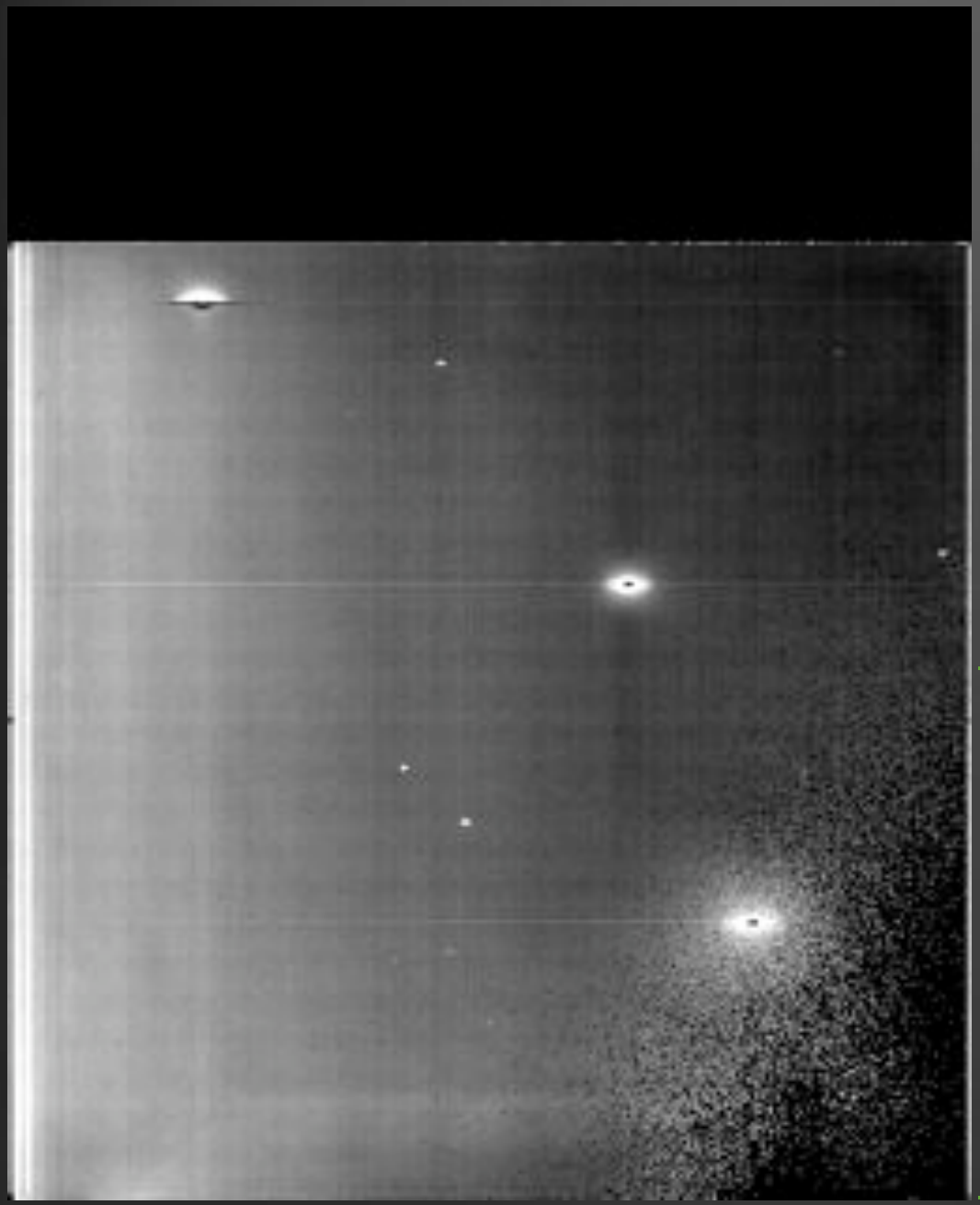
- An electronics problem caused there to be 8 reference pixels on the left, but use only the 4 leftmost pixels for the homework. This has been fixed in the flight electronics.





- 4 columns of reference pixels on right side

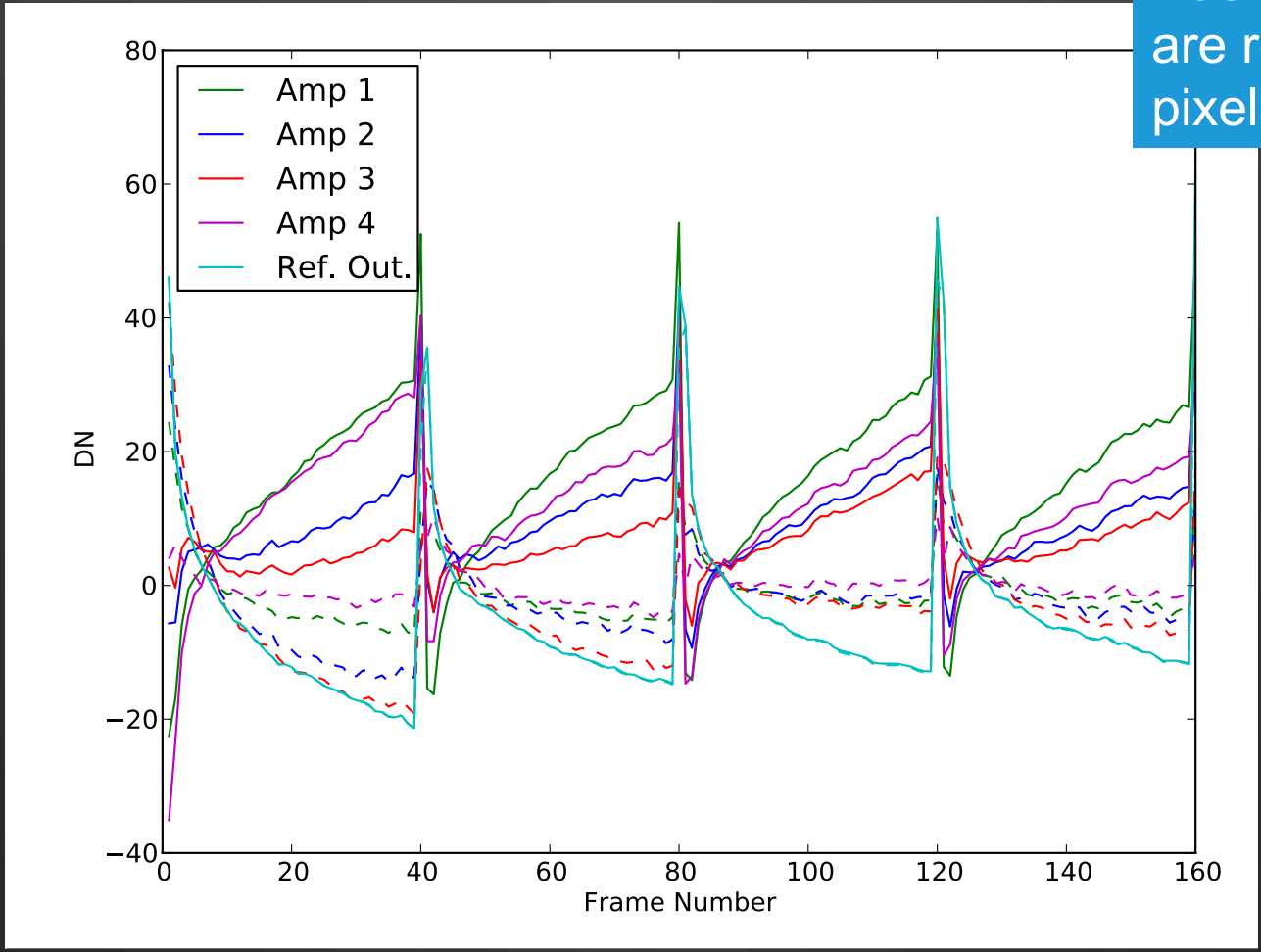
Frame 300



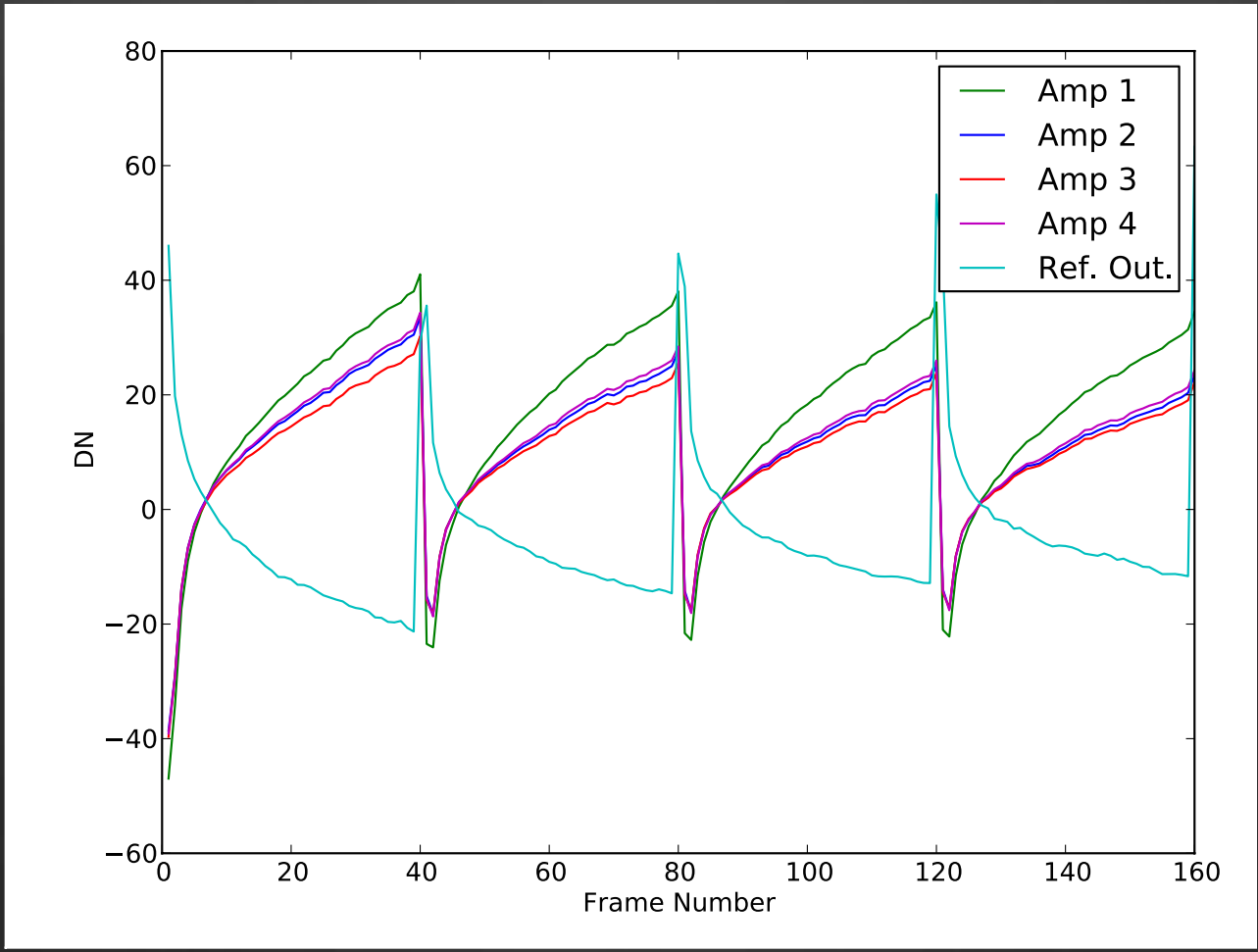
Hybridization problem - detector not properly bonded to multiplexer

Bias Subtracted, …

Dashed lines are reference pixels.



Bias Subtracted, Ref. Pixels Subtracted, …



Bias Subtracted, Ref. Pixels Subtracted, Reference Output added.