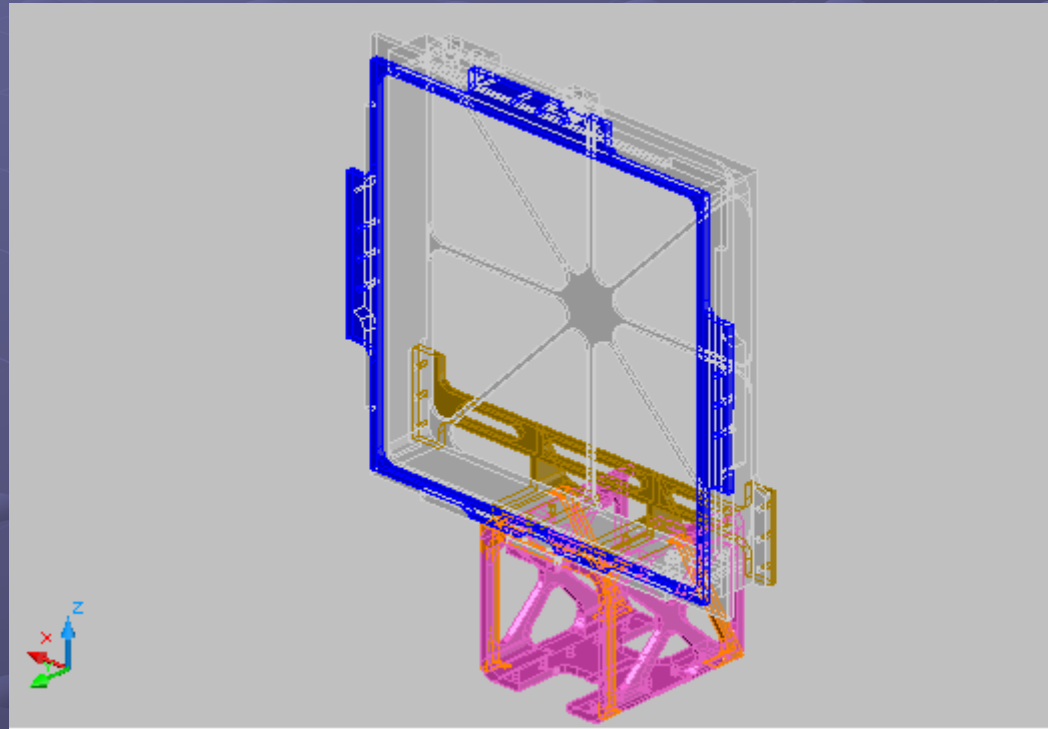


# IDENTIFYING AND CORRECTING INTRA-PIXEL VARIATIONS IN NEAR-INFRARED DETECTORS

*The Spots-O-Matic*

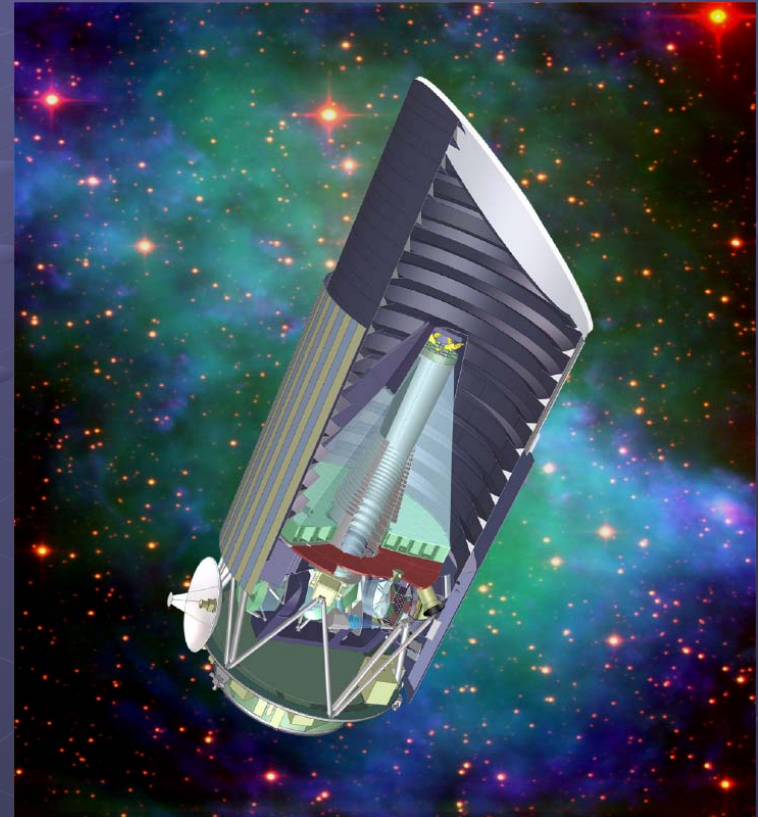
Mike Howe and Josh Larson  
supervised by Prof. Greg Tarlé

July 29, 2010



# SPOTS-O-MATIC

- **Joint Dark Energy Mission**
- Wide-field telescope
- The problem with undersampling



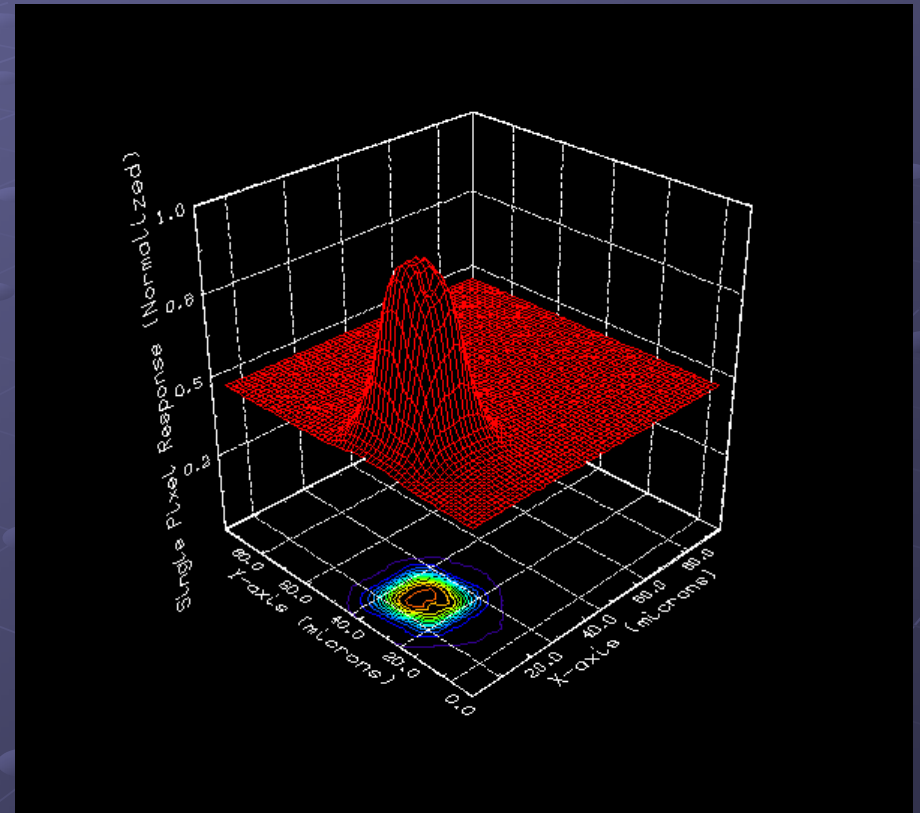
# SPOTS-O-MATIC

- Weak Lensing applications
- Precision photometry
- Necessity of an understanding of intra-pixel variations (Spot-o-Matic)



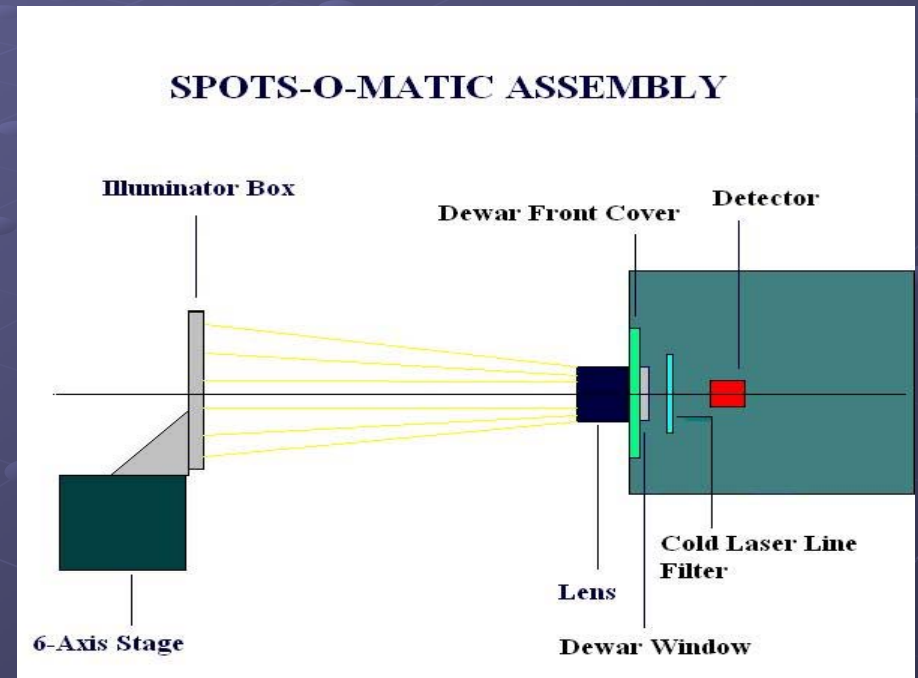
# SPOTS-O-MATIC

- The Spot-o-Matic
- Measuring the intra-pixel response for one pixel
- Limitations with this approach for an entire detector



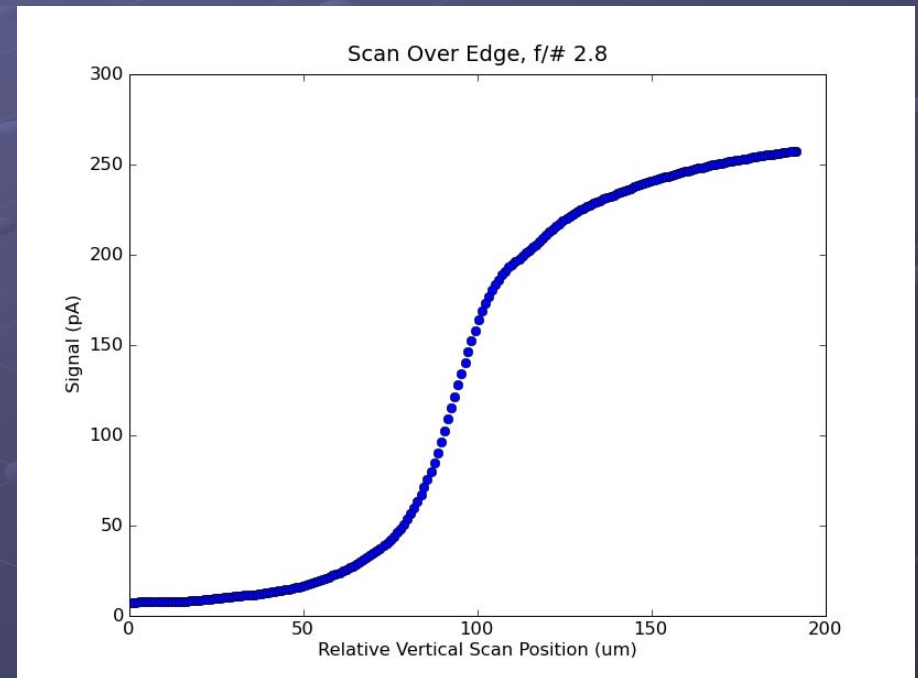
# SPOTS-O-MATIC

- Finding the PSF of our lens to ensure that variation in pixel response is possible
- Detector characteristics:
  - HgCdTe imager
  - 2048 x 2048 pixels
  - 18 x 18  $\mu\text{m}^2$  pixel
- In order to measure the intra-pixel variation we want a spot-size of, at most, 5 $\mu\text{m}$  in diameter



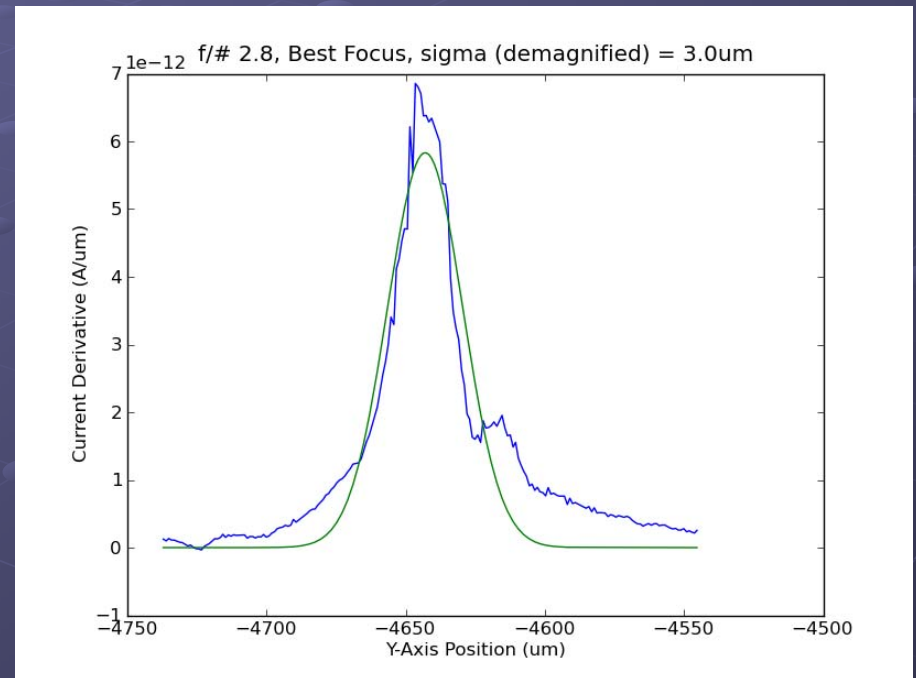
# SPOTS-O-MATIC

- Knife-Edge scan to determine the PSF of the lens
- Measuring the integrated signal response of the projected spot across the knife-edge



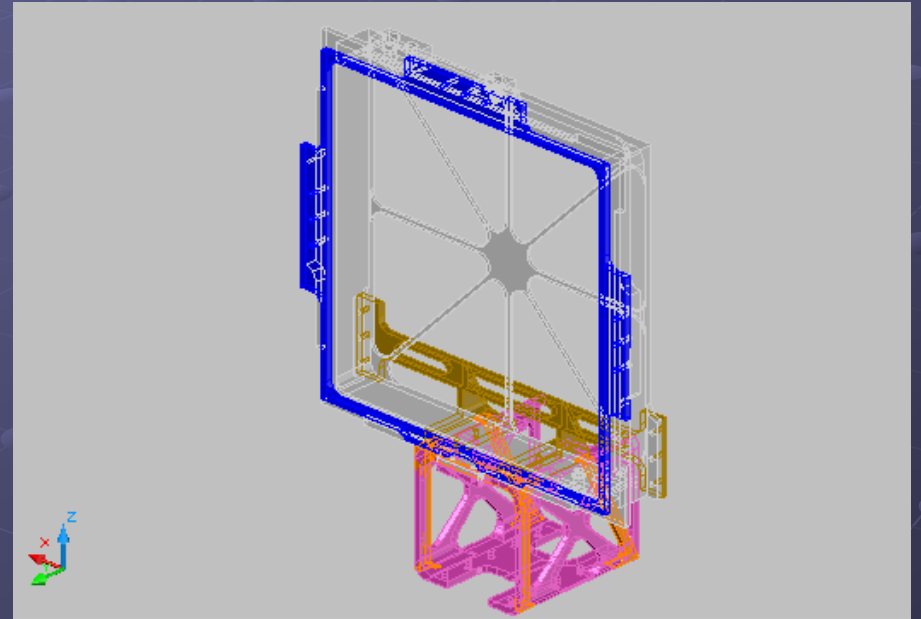
# SPOTS-O-MATIC

- Taking a “derivative” to find a 1-dimensional Gaussian fit
- A fit sigma of  $3\mu$  would be small enough to scan the intra-pixel variations of the HgCdTe detectors



# SPOTS-O-MATIC

- Future of the project
  - Fabrication of all the necessary components
  - Software development (more in a minute...)





# SPOTS-O-MATIC

## Software

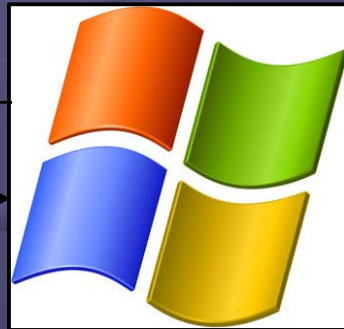
- Four Separate Components
  - Hardware Control
  - Calibration
  - Data Collection
  - Analysis



# SPOTS-O-MATIC

## Software

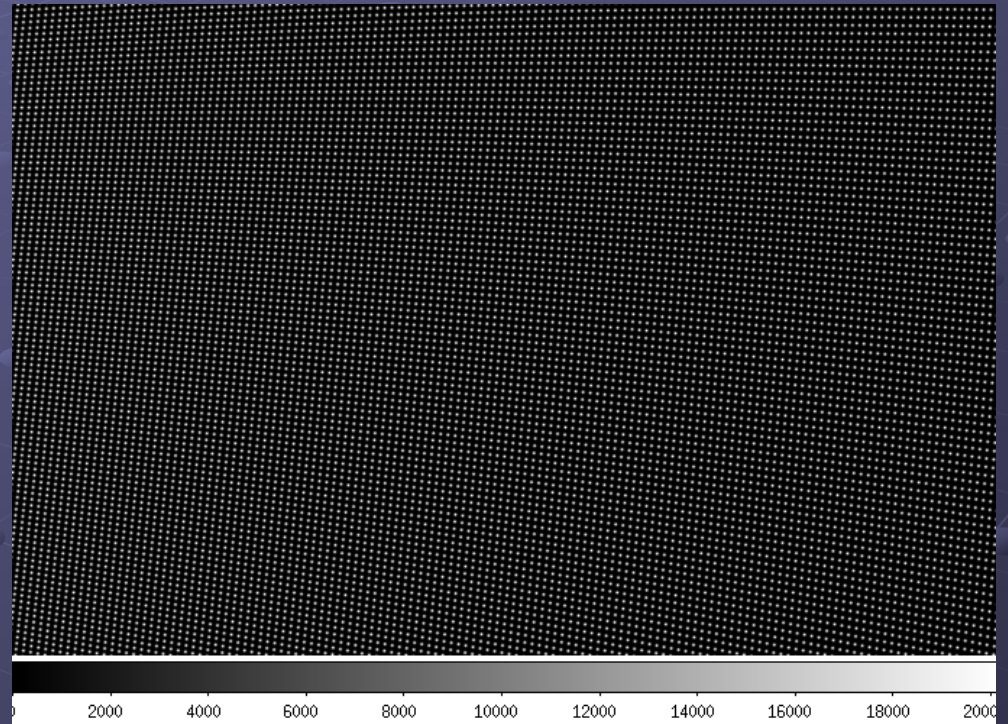
- Hardware Control
  - Image Acquisition
  - Stage Motion



# SPOTS-O-MATIC

## Software

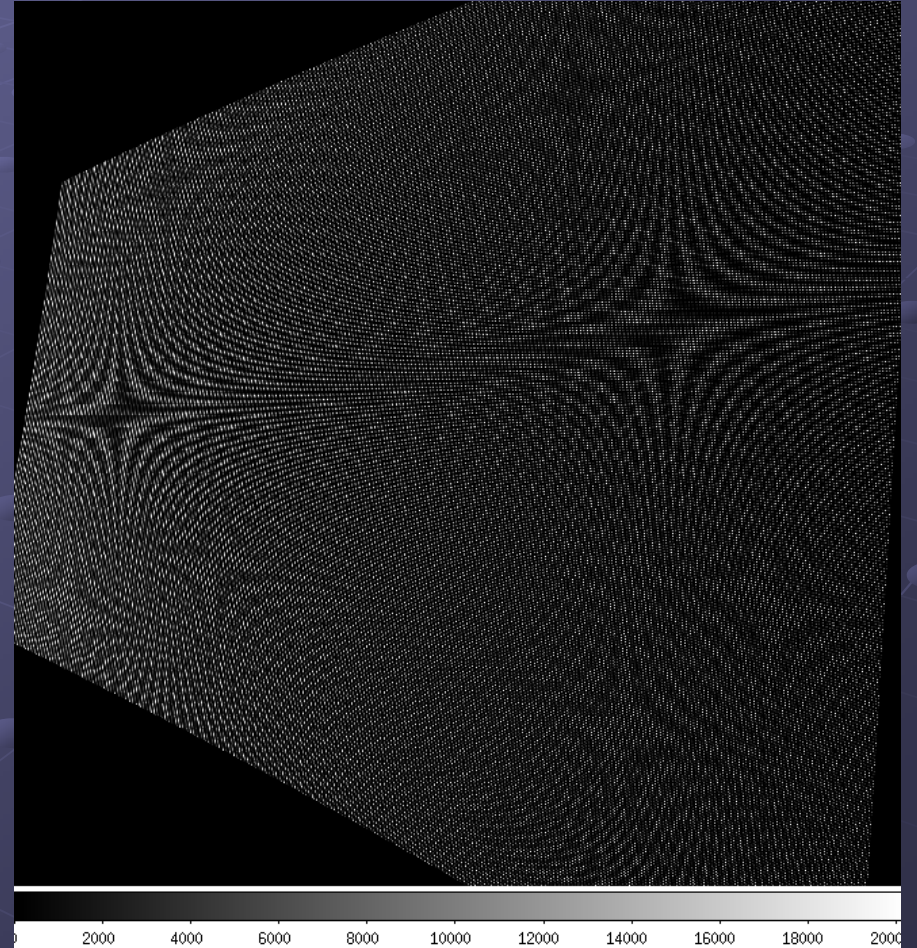
- Calibration
  - Aligning and focusing the stage
  - Currently being tested with simulated data



# SPOTS-O-MATIC

## Software

- Simulations will not usually be this extreme.



# SPOTS-O-MATIC

## Software

- Future Plans
  - Collection of actual data
  - Analysis
  - This will all be done through simulations first



# SPOTS-O-MATIC

## Thank You!

- Greg Tarlé
- Michael Schubnell
- Wolfgang Lorenzon
- Curtis Weaverdyck
- Tomasz Biesiadzinski
  - Ben Landes
  - Joel Xu

# SPOTS-O-MATIC

Questions?

