

# Flat Fielding Experimental Data

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# Goals

- Examine noise versus signal for varying numbers of flats of varying signal strength being applied to a series images of plain backgrounds
- Determine if high or low signal-level flats work best

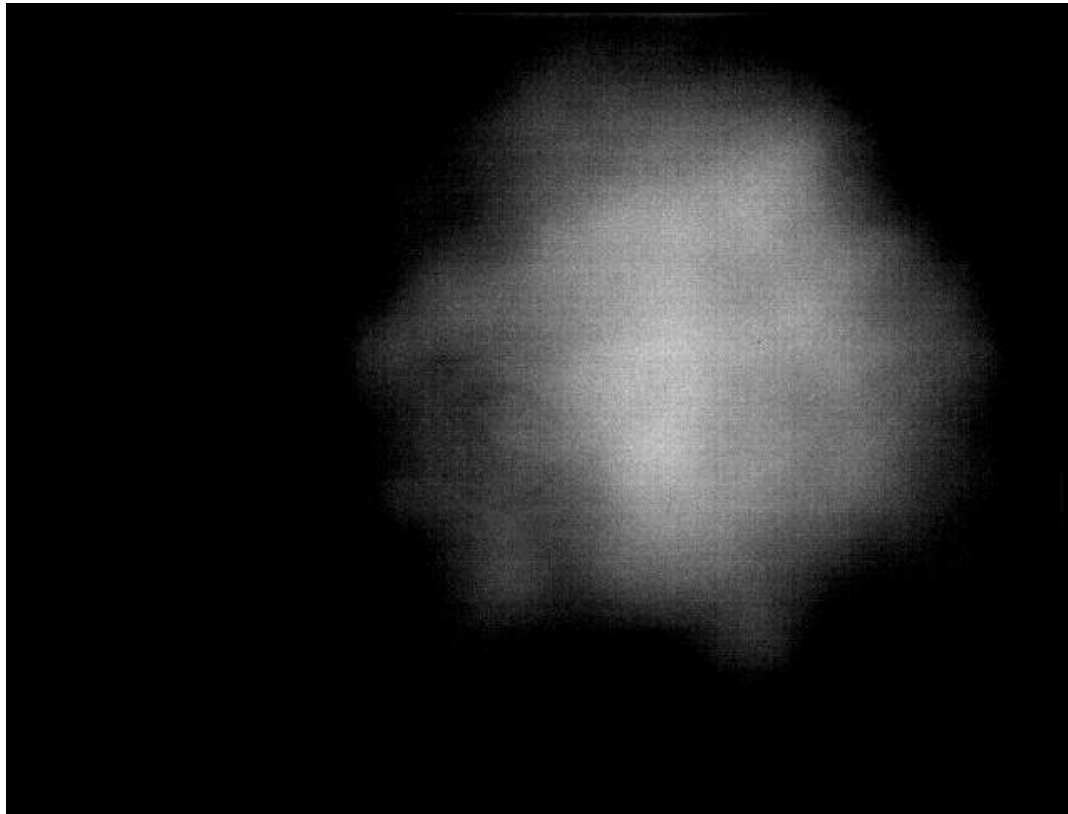
# Method

- Using a camera lens mounted to an ML8300 take a series of 30 flats each at 22.5%, 33% and 80% of full well (25.5K e-)
- Dark-subtract the raw flats and combine making the following master flats for each flat signal-level:
  - 1, 2, 3, 5, 10, 15, 20 and 30 flats
- Calibrate each image using darks and the flats from above
- Crop a 300 x 300 region from center and measure average signal level and standard deviation (noise)
- Plot the results

# Summary of Results

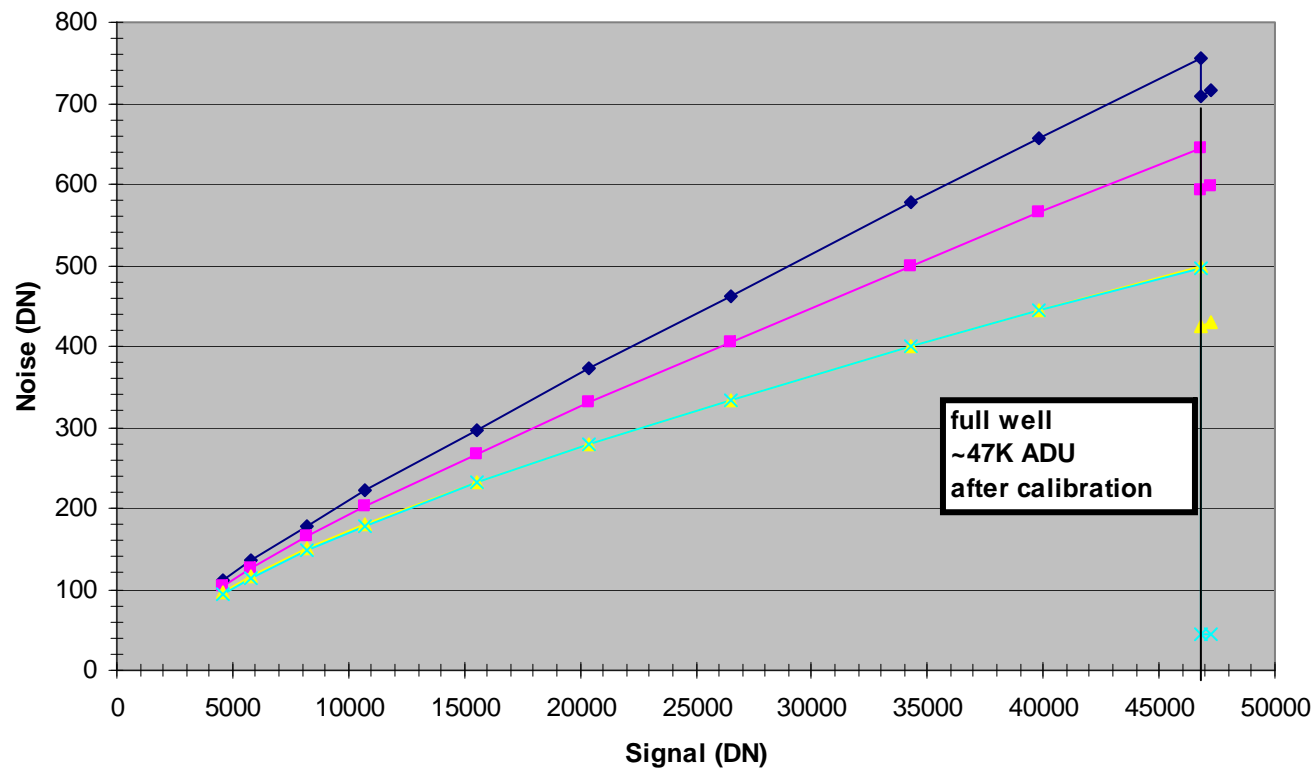
- Similar noise curves obtained using 10 of the 80% flats, versus 20 of the 33% flats versus 30 of the 22.5% signal level flats
- Calibration degraded the noise for low signal level flats when three or fewer flats were combined
- In all cases the 80% signal level flats did not degrade the noise in the calibrated images
- 10 flats at 80% full well equals the noise of 20 flats at 33% full well versus 30 flats of 22.5% full well

# Combined Flat Example



Bench flat, taken using camera lens and white toweling for diffusing/attenuating the light

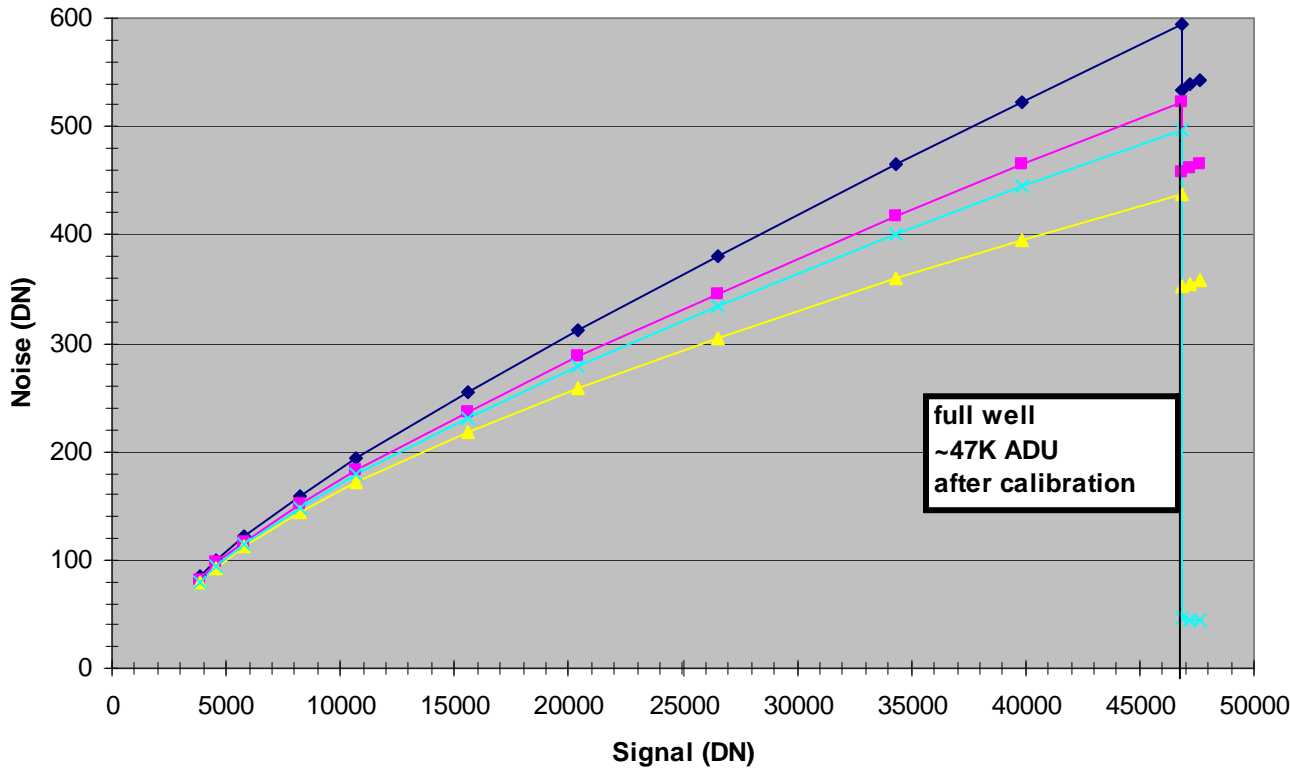
Noise vs Signal (calibrated data)  
1 flat applied



- 1 FLAT 10.6K ADU (22.5% full well)
- 1 Flat 15.9K ADU (33.8% full well)
- 1 FLAT 37.7K ADU (80.2% full well)
- No Flats

full well  
~47K ADU  
after calibration

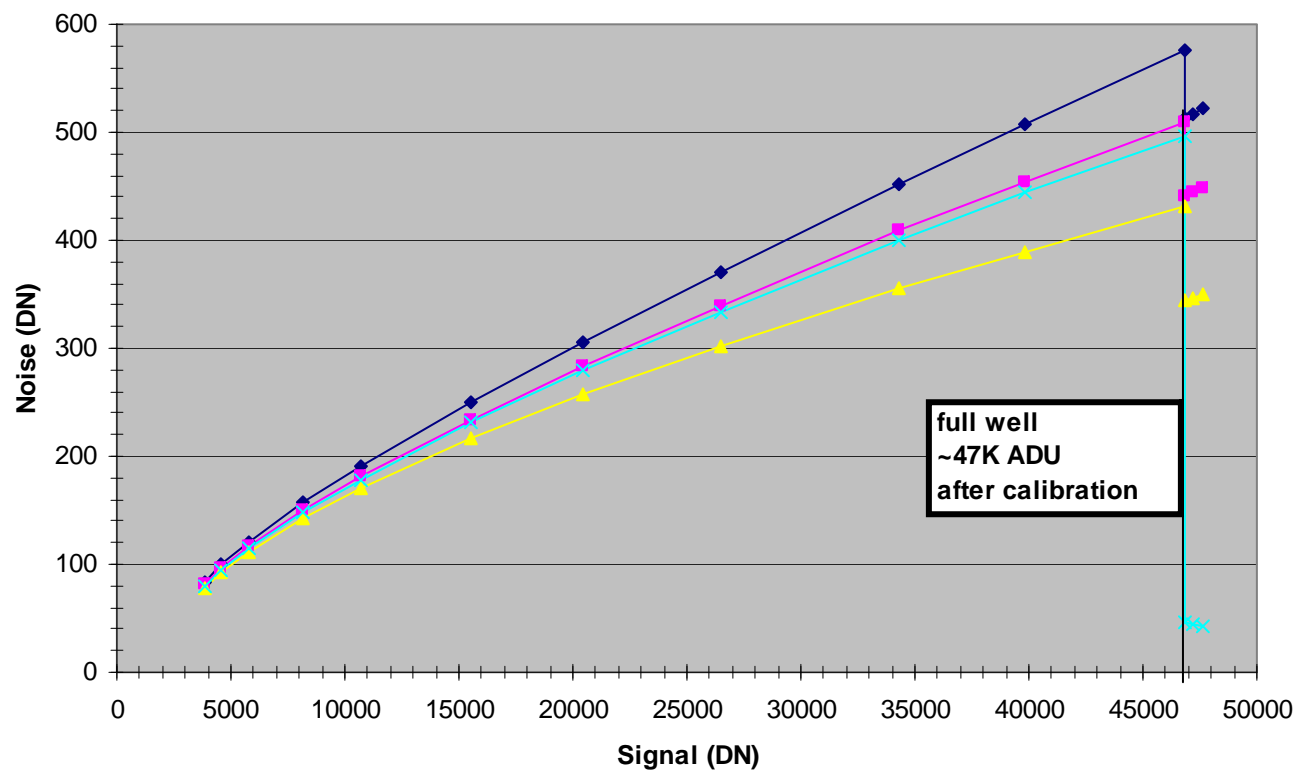
**Noise vs Signal (calibrated data)**  
**2 flats combined**



- 2 FLATS 10.6K ADU (22.5% full well)
- 2 FLATS 15.9K ADU (33.8% full well)
- 2 FLATS 37.7K ADU (80.2% full well)
- No FLATS

full well  
~47K ADU  
after calibration

Noise vs Signal (calibrated data)  
3 flats combined

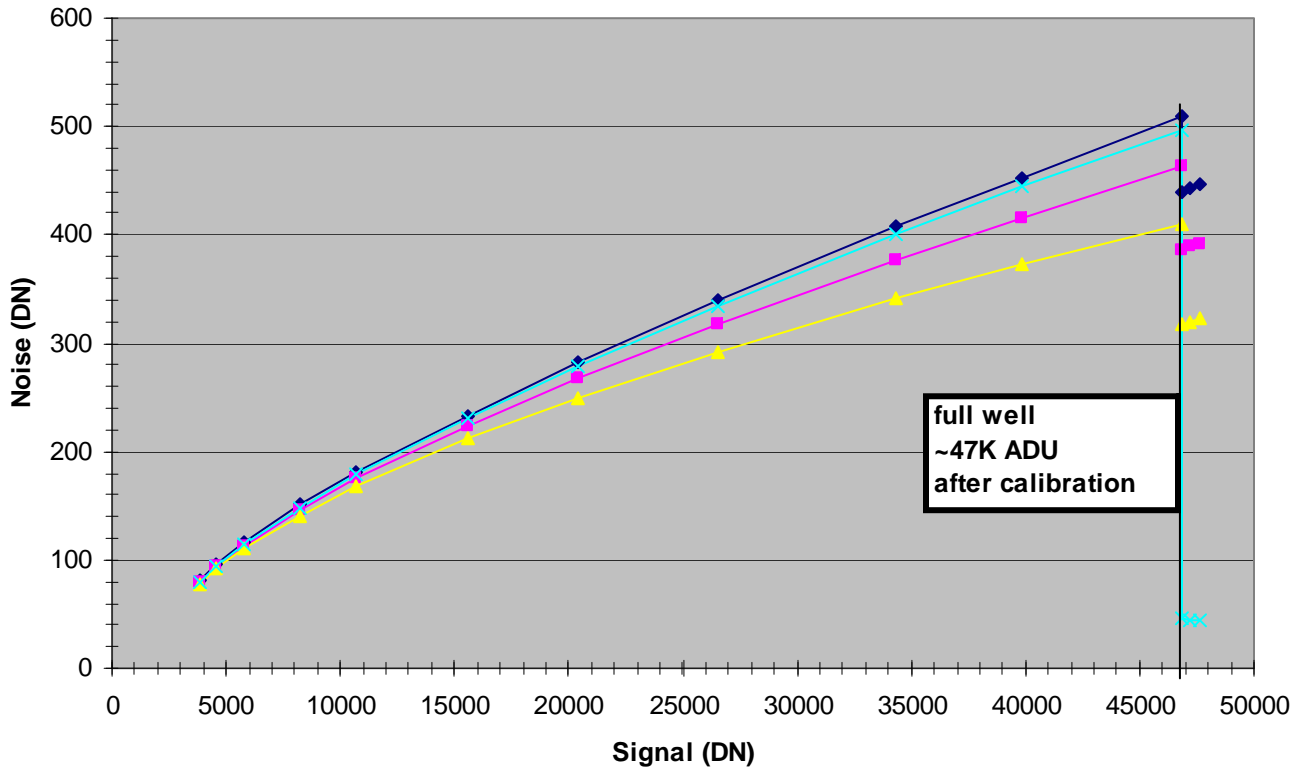


- 3 FLATS 10.6K ADU (22.5% full well)
- 3 FLATS 15.9K ADU (33.8% full well)
- 3 FLATS 37.7K ADU (80.2% full well)
- No FLATS

full well  
~47K ADU  
after calibration



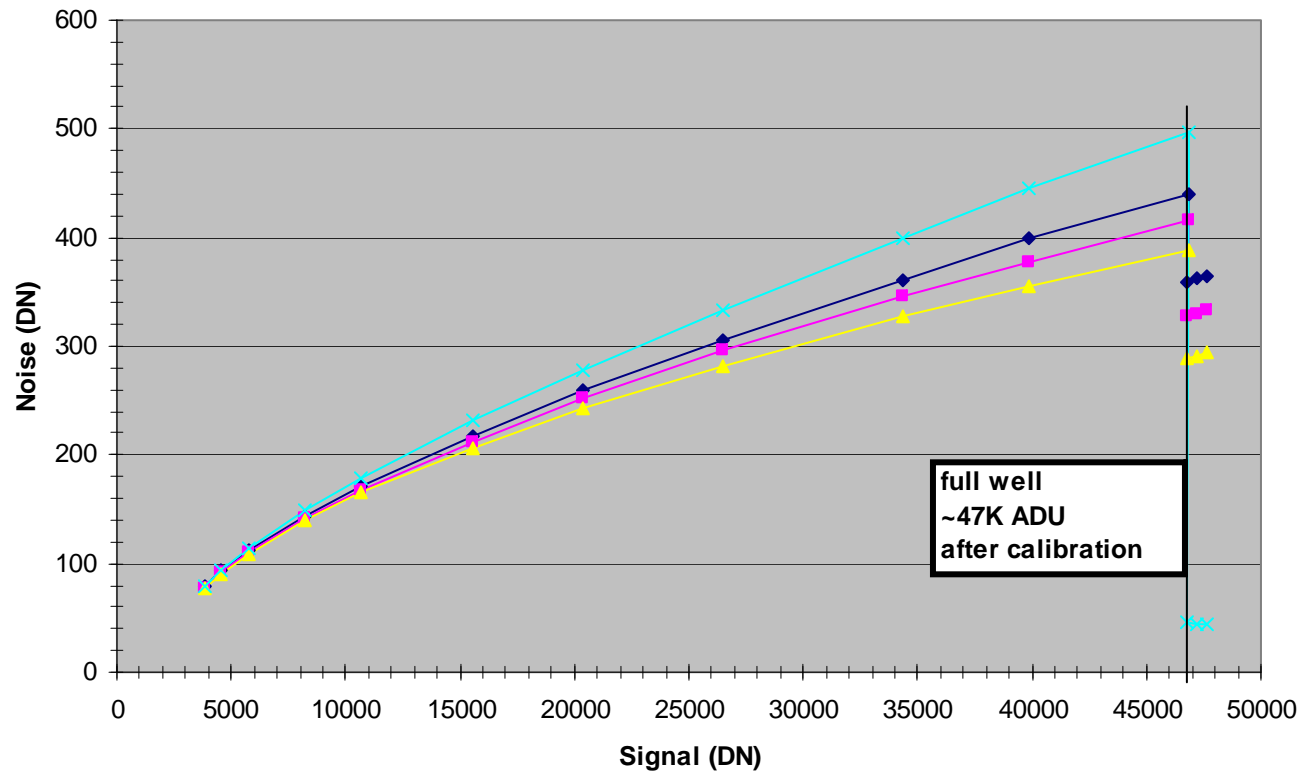
**Noise vs Signal (calibrated data)  
5 flats combined**



- 5 FLATS 10.6K ADU (22.5% full well)
- 5 FLATS 15.9K ADU (33.8% full well)
- 5 FLATS 37.7K ADU (80.2% full well)
- No FLATS

full well  
~47K ADU  
after calibration

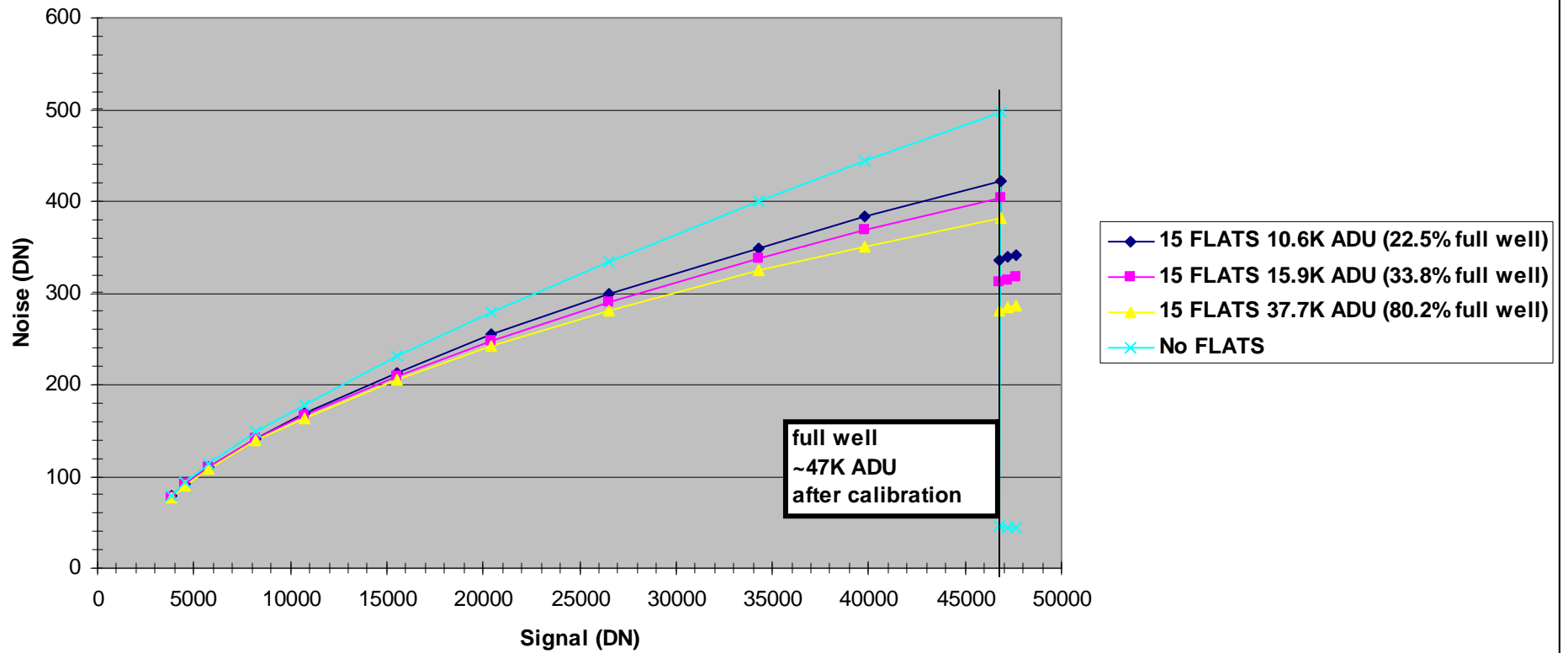
### Noise vs Signal (calibrated data) 10 flats combined



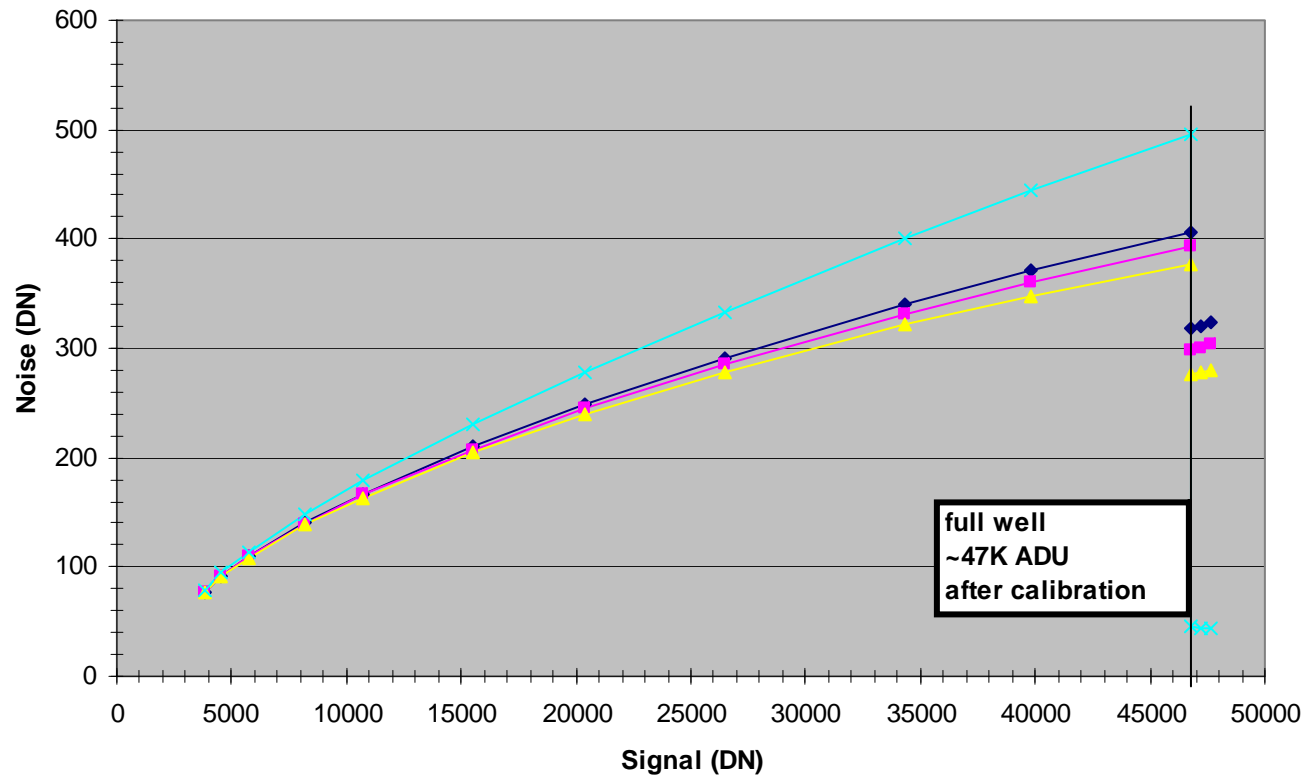
- 10 FLATS 10.6K ADU (22.5% full well)
- 10 FLATS 15.9K ADU (33.8% full well)
- 10 FLATS 37.7K ADU (80.2% full well)
- No FLATS

full well  
~47K ADU  
after calibration

### Noise vs Signal (calibrated data) 15 flats combined



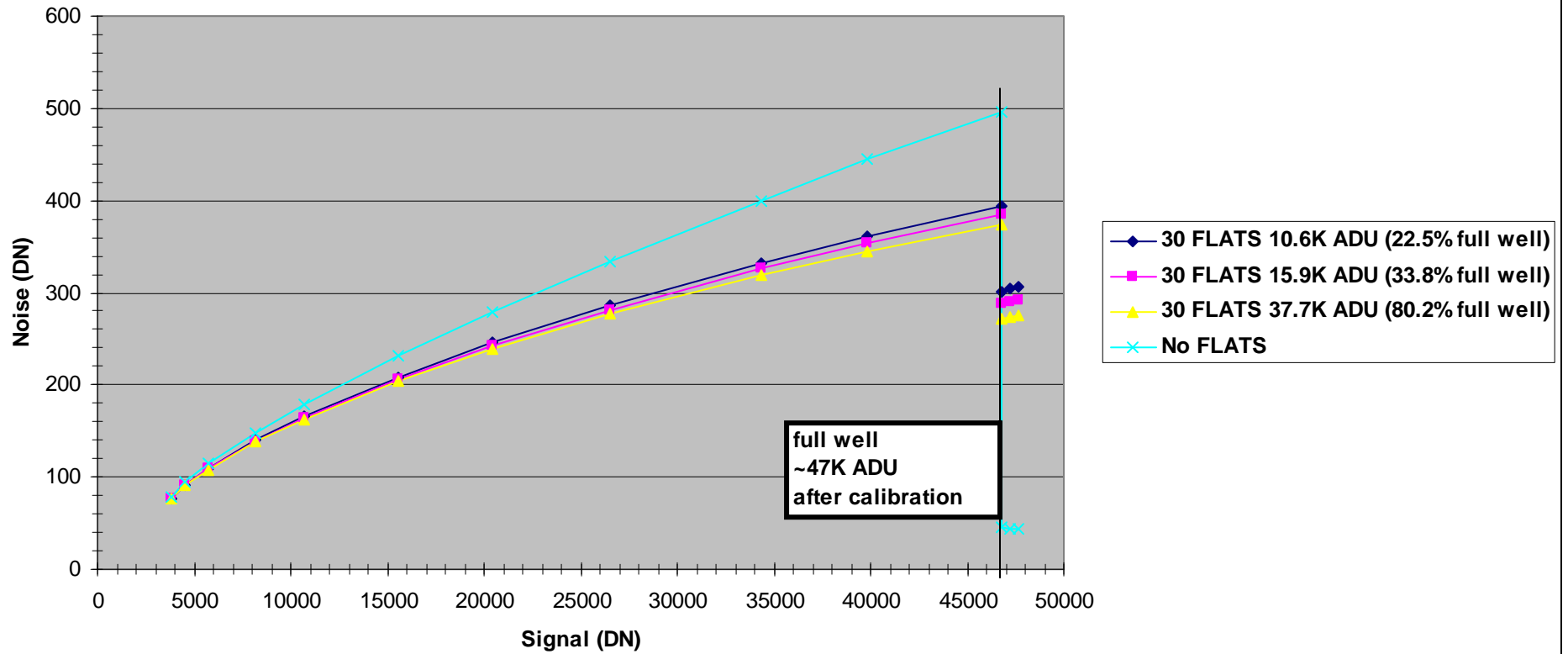
### Noise vs Signal (calibrated data) 20 flats combined



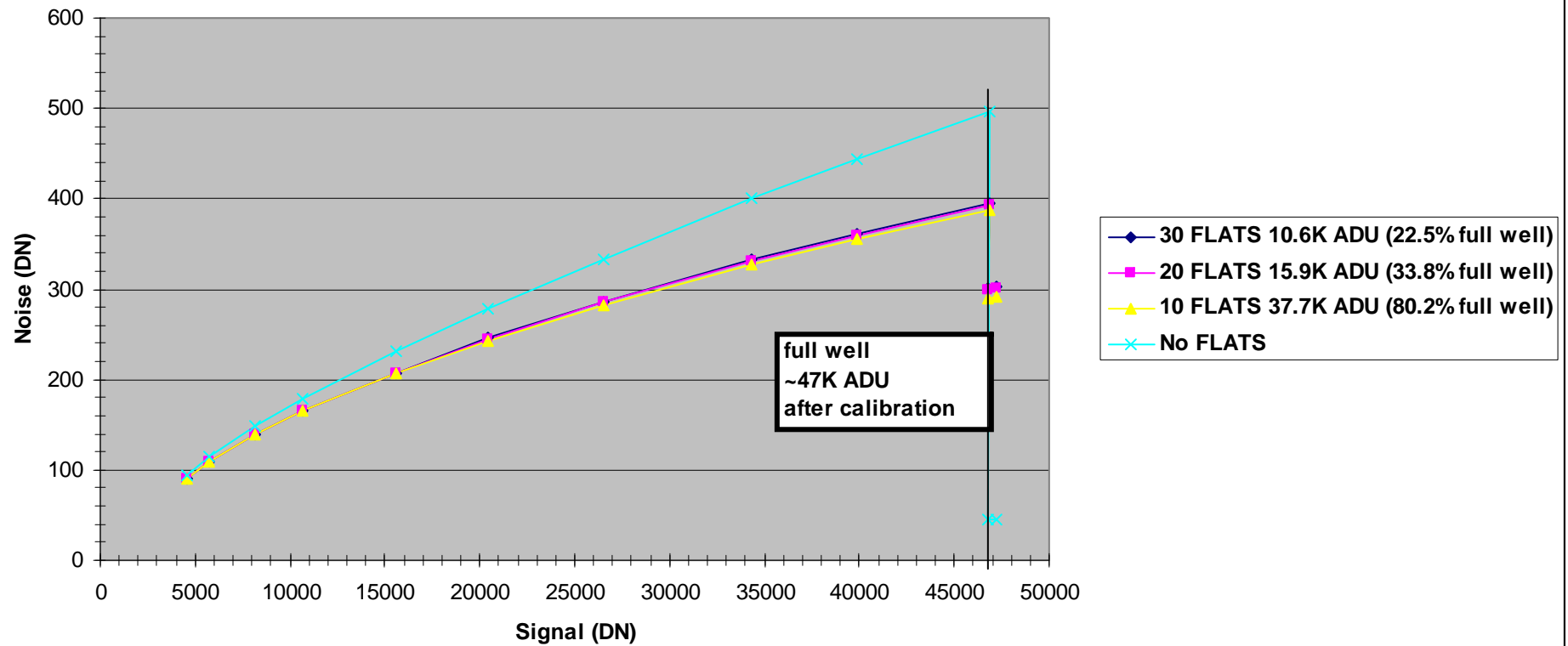
- 20 FLATS 10.6K ADU (22.5% full well)
- 20 FLATS 15.9K ADU (33.8% full well)
- 20 FLATS 37.7K ADU (80.2% full well)
- No FLATS

full well  
~47K ADU  
after calibration

**Noise vs Signal (calibrated data)  
30 flats combined**



**Noise vs Signal (calibrated data)**  
**# flats adjusted to yield similar noise curves**



Kadc vs signal (gain linearity)  
FLI ML8300 with Standard Grade KAF8300  
8 Megasample/sec readout

◆ Kadc vs signal (linearity)  
■ Kadc delta (percent)

