CCD Non-Linearity Correction Procedure

Physical Setup

Affix a piece of plain white paper over the baffle in the center of the telescope primary mirror. Illuminate the paper with a stabilized light source. Vary the intensity of the lamp until an average pixel ADU of ~50,000 is obtained with an exposure time of 100 sec.

Data Collection process

1) Collect 5-10 bias frames.

2) FOR (i=2,3,...,39,40, 42,...108,110; next i);
    Take 2 s exposure (to calibrate the longer exposure to adjust for changes in lamp brightness).
    Take "i" sec exposure.
  END FOR

3) Collect 5-10 bias frames.

Data reduction process

1) Average, on an individual pixel basis, all bias frames to create the master bias image.

2) Bias subtract all of the exposures collected in step 2 above.

3) Define an image region to average over.
  Ex: the center ~2500x2500 pixels (use the exact same ones for each image).

4) Find the average ADU value in this region for each bias subtracted image
  (AIJ can be used to calculate the average for the entire stack of exposures at once).

5) Normalize the 2-sec exposure average ADU values.

6) FOR (all bias-subtracted exposures of exptime "i");
    Find the average of the normalized values of the two 2-sec exposures on either side of exposure "i".
    Divide the image "i" average ADU by the average normalized 2-sec exposures
    (to calibrate for lamp brightness fluctuations).
  END FOR

7) Plot the calibrated ADU on the x-axis and exposure time in seconds on the y-axis
  (The y-axis is proportional to "Photons" incident on pixel – modulo the gain).

8) Fit a second (or third) degree polynomial to this data, forced through the origin.

9) Multiply the exposure times on the y-axis by a constant.

10) Tweak this multiplier until the poly fit coefficient of the linear x term is identically "1" (=>$y = 0 + 1*x + c*x^2 + d*x^3$). The linear coefficient doesn't necessarily have to equal 1, but that puts the corrected ADU values in the range they would have been if there was no linearity.

11) In the AIJ DP module, enter 0, 1, c, d as the non-linearity coefficients.