Appendix D

Conversion Gain Reference Sheet

The equation relating the number of electrons (e^-) in a pixel to the recorded data number (DN or ADU) goes as:

$$G_{NET} = G_{PIXEL} * G_{UC} * G_{OUT} * G_{AMP} * G_{A/D} \tag{D.1}$$

Below is a short reference sheet of the experiments and what each yields.

Fe^{55} Calibration:

Method: Collect set of exposures that record Fe^{55} hits in the detector.
Histogram the hit values in ADU. The peak corresponds to 1660 e^-.
Notes: Value will depend on the gain of the control of A/D converter, G_{AMP}.
Provides: G_{net} (e^-/ADU)

Electronic Gain with V_{RESET}:

Method: Program set of voltages for V_{RESET}. Read detector output while reset switch is closed. Plot DN vs. V_{RESET} and obtain slope.
Provides: $G_{UC}(V/V) = \Delta V_{OUT\ NOSF}/(\Delta V_{RESET} * G_{ELEC})$
$G_{SF}(V/V) = \Delta V_{OUT\ SF}/(\Delta V_{RESET} * G_{UC} * G_{ELEC})$

A/D or Control Electronics Calibration:

Method: Use a set of known voltages as input to the A/D converter in control electronics.

Notes: G_{AMP} used here should correspond to G_{AMP} used in the Fe^{55} calibration.

Provides: $G_{ELEC}(V/ADU) = G_{AMP} * G_{A/D}$ – If amplification stages are included
$G_{A/D}$ (V/ADU) – If amplification stages are bypassed
G_{AMP} (V/V)

Well Depth from Saturated Images

Method: Use an exposure or set of saturated exposures to find the full range of the pixels in ADU.

Notes: The full range is the average taken over all pixels of the quantity $FR = I_{max} - I_{min}$, where I_{min} is the pixel value immediately after reset and I_{max} is the pixel value before the output becomes nonlinear and saturates.

Provides: $WellDepth$ (ADU)
$WellDepth$ $(e^-) = WellDepth$ (ADU) $* G_{net}$
