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:

$$G_{NET} = G_{PIXEL} \times G_{UC} \times G_{OUT} \times G_{AMP} \times G_{A/D}$$  \hspace{1cm} (D.1)

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

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**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)

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**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:**  
\[G_{UC}(V/V) = \frac{\Delta V_{OUT\ NOSE}}{\Delta V_{RESET} \times G_{ELEC}}\]  
\[G_{SF}(V/V) = \frac{\Delta V_{OUT\ SF}}{\Delta V_{RESET} \times G_{UC} \times G_{ELEC}}\]
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 $^{55}$Fe calibration.

**Provides:**
- $G_{ELEC}(V/ADU) = G_{AMP} \times G_{A/D}$ – 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:**
- $WellDepth \ (ADU)$
- $WellDepth \ (e^-) = WellDepth \ (ADU) \times G_{net}$