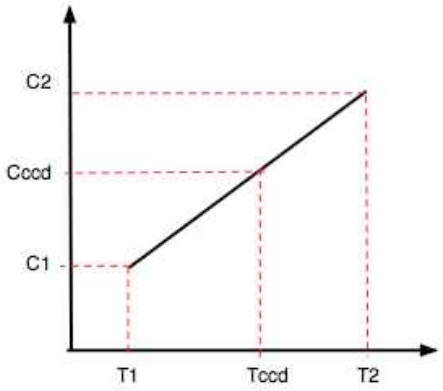
Derivation of Linear Interpolation Equations for Building LDARK.FITS



The graph shows the linear interpolation we wish to accomplish: calculate the dark counts C_{CCD} in the dark image we wish to construct, based on the known temperatures T_1 and T_2 and their respective dark counts, C_1 and C_2.

Let's revert to the good old equation of a line: $y = mx + b$. We can determine the slope (m=rise/run) from the extrema, and y-intercept by solving the equation for b:

$$m = \frac{C_2 - C_1}{T_2 - T_1} \quad \text{and} \quad b = y - mx = C_1 - \left(\frac{C_2 - C_1}{T_2 - T_1}\right)T_1$$

Let's put these back into $y = mx + b$ form, with $y = C_{CCD}$ and $x = T_{CCD}$

$$C_{CCD} = \left(\frac{C_2 - C_1}{T_2 - T_1}\right)T_{CCD} + \left[C_1 - \left(\frac{C_2 - C_1}{T_2 - T_1}\right)T_1\right]$$

multiply it out

$$C_{CCD} = \left(\frac{C_2T_{CCD} - C_1T_{CCD}}{T_2 - T_1}\right) + \left[C_1 - \left(\frac{C_2T_1 - C_1T_1}{T_2 - T_1}\right)\right]$$

merge terms with common denominator

$$C_{CCD} = \left(\frac{C_2T_{CCD} - C_1T_{CCD} - C_2T_1 + C_1T_1}{T_2 - T_1}\right) + C_1$$

collect like terms

$$C_{CCD} = \frac{C_2T_{CCD} - C_2T_1}{T_2 - T_1} + \frac{-C_1T_{CCD} + C_1T_1}{T_2 - T_1} + C_1$$

then factor them out

$$C_{CCD} = C_2\frac{T_{CCD} - T_1}{T_2 - T_1} + C_1\left[\frac{-T_{CCD} + T_1}{T_2 - T_1} + 1\right]$$

and substitute our definitions for f_1 and f_2

$$C_{CCD} = C_2f_1 + C_1[1 - f_1] = C_2f_1 + C_1f_2$$

So, you can see that linear interpolation in the original plot is mathematically equivalent to the equations we use to build LDark.fits: calculate f_1 and f_2 and multiply the hotter Dark image by f_1 and the cooler Dark image by f_2, then sum the resulting images. *QED, ACL 2010mar18*