Rowfluxcorr "read2" Algorithm

F. Masci (1/7/04)

I am going to ignore all derivations here and go directly to the equations to code up. The SUR-mode *slope of a pixel*, corrected for the "read2" effect is given by:

$$m_{sur}(corr) = \left[f_1 - f_2(t_2 - t_0) \right] \Delta y + m_{sur}(obs) \qquad (1)$$

where $$f_1 = \frac{\sum_i (t_i - t_0)}{\left(\sum_i (t_i - t_0) \right)^2 - N_s \sum_i (t_i - t_0)^2}, \qquad f_2 = \frac{N_s}{\left(\sum_i (t_i - t_0) \right)^2 - N_s \sum_i (t_i - t_0)^2} \qquad (2)$$

$\Delta y =$ Correction factor from calibratio n image

$m_{sur}(obs) =$ Observed SUR - mode slope value for pixel (uncorrect ed)

$N_s = N_{end} - N_{start} + 1$ (Numer of samples in ramp; see below for N_{start} and N_{end})

$t_i = i *$ T_INT (Sampling time, where T_INT is value of FITS header keyword in science image)

The limits of the sums in Equation (2) (N_{start} £ i £ N_{end}) and the t_0 , t_2 parameters are computed as follows. These are determined from the following FITS header keywords: DCENUM, T_INT, IGN_FRM1, IGN_FRM2, DCE_FRMS and FRMFLYBK.

If DCENUM = 0:

N_{start} = *3 + IGN_FRM1,*

t_0 = 2*T_INT

t_2 = 4*T_INT

Otherwise, if DCENUM > 0:

N_{start} = *1 + IGN_FRM2,*
t_0 = 0
t_2 = 2*T_INT

The endpoint (last data sample in ramp) is always computed from:

N_{end} = *0.25* * (*DCE_FRMS* - *FRMFLYBK*)

The uncertainty in corrected slope computed using Equation (1) can be approximated from:

$$s_{corr} \approx \sqrt{\left[f_1 - f_2(t_2 - t_0) \right]^2 s^2_{\Delta y} + s^2_{obs}} \qquad (3)$$

where s_{obs} is the uncertainty on input (observed) slope and s_{Dy} is the uncertainty in the correction factor read from the accompanying input calibration uncertainty image. This is an approximation since it neglects possible correlation between *Dy* and $m_{sur}(obs)$. This is justified for typical integration times consisting of 8-20 samples where the derivative of observed slope with respect to offset in the "second" ramp sample is quite small:

$$\frac{dm_{obs}}{d\Delta y} = -\left[f_1 - f_2(t_2 - t_0) \right] << 1$$