MEMORANDUM

October 7, 1996

To: ASC Asp ect Systems, Mission Planning Groups

From: M. Garcia, P. Green

Subject: Incorporating Roll Error in the SSA FOM

File:

[AXAF Science Center]

Harvard-Smithsonian Center for Astrophysics
where $\{i/j\}$ is the position of star $i$ in CCD coordinates and the $x$ and $y$ are the weighted

\begin{align*}
\frac{\sigma_x}{\mu} & \sum = \mu_x \\
\frac{\sigma_y}{\mu} & \sum = \mu_y \\
\frac{\sigma_x}{\mu} & \sum = \mu_x \\
\frac{\sigma_y}{\mu} & \sum = \mu_y
\end{align*}

where the $\mu$ and $\sigma$ are as defined above and the $x$ and $y$ are the weighted average (weighted by the uncertainty of $\sigma$). $\mu_x$ is the position of star $j$ in CCD coordinates and the $x$ and $y$ are the weighted average.
where
\[ \frac{z^2}{\sigma^2} = n_{\text{rms}} \]

For the roll, this is
\[ \frac{z^2}{\sigma^2} = n_{\text{rms}} \]

The values of this FOV are used on Figure 1 for a few selected star sets. The position error for each star \( i \) = 1/5 pix. For the purposes of comparison, we also list all the quadrature sums of the individual star position and roll errors. For the X-axis variance this is
\[ \sum_{i=1}^{\text{num}} \left( \frac{x_{\text{rms}}}{\sigma} \right)^2 = \sum_{i=1}^{\text{num}} \left( \frac{y_{\text{rms}}}{\sigma} \right)^2 \]

or more generally,
\[ \sum_{i=1}^{\text{num}} \left( \frac{x_{\text{rms}}}{\sigma} \right)^2 = \sum_{i=1}^{\text{num}} \left( \frac{y_{\text{rms}}}{\sigma} \right)^2 \]

The factor would be 0.0145 for the error from the FOV error, and the roll error are both measured in radians, then the unscaled
\[ \sum_{i=1}^{\text{num}} \left( \frac{x_{\text{rms}}}{\sigma} \right)^2 = \sum_{i=1}^{\text{num}} \left( \frac{y_{\text{rms}}}{\sigma} \right)^2 \]
FOM, SSA V1.2 (no roll) = 1.125 pix^2
roll var at 5 arcmin = 0.10125 pix^2
FOM w/roll 5 arcmin arm = 1.22625 pix^2

Approx X-axis var=  1.125 pix^2
Approx roll var =  0.0253125 pix^2
roll var at 5 arcmin =  0.006328125 pix^2
FOM w/roll 5 arcmin arm =  1.1503125 pix^2

Approx X-axis var=  1.125 pix^2
Approx roll var =  0.006328125 pix^2
roll var at 5 arcmin =  0.0238235294117647 pix^2
FOM w/roll 5 arcmin arm =  1.131328125 pix^2

Approx X-axis var=  1.125 pix^2
Approx roll var =  0.02025 pix^2
roll var at 5 arcmin =  0.01265625 pix^2
FOM w/roll 5 arcmin arm =  1.17128125 pix^2

Approx X-axis var=  1.125 pix^2
Approx roll var =  0.0265625 pix^2