$1,2$

3

1

σ

$$\sigma = \frac{\mathrm{NEFD}\ \exp\left(A\,\tau_{\mathrm{zen}}\right)}{\sqrt{t_\sigma}},$$

NEFD

$$A \simeq 1/\sin(\mathrm{el})$$






ϵ_{tel}



$$\epsilon_{\mathrm{tel}}\, t_{\mathrm{tel}} = n_{\mathrm{source}}\, t_{\mathrm{source}} + n_{\mathrm{cal}}\, t_{\mathrm{cal}},$$

n_{cal}

$$t_{\mathrm{cal}} = \eta_{\mathrm{cal}} \left(t_{\mathrm{pointing}} + t_{\mathrm{focus}} + t_{\mathrm{skydips}} + t_{\mathrm{onoff}}^{\mathrm{cal}} \right),$$




t_{focus}



η_{cal}

(> 1)

d_{cal}

$$n_{\text{source}}\, t_{\text{source}} \leq n_{\text{cal}}\, d_{\text{cal}} \quad i.e. \quad \epsilon_{\text{tel}}\, t_{\text{tel}} \leq n_{\text{cal}}\, (d_{\text{cal}} + t_{\text{cal}}) \quad \text{or} \quad \frac{\epsilon_{\text{tel}}\, t_{\text{tel}}}{d_{\text{cal}} + t_{\text{cal}}} \leq n_{\text{cal}}.$$


t_{source}











n_{scan}



n_{scan}

$$\text{floor}\left(\frac{n_{\text{subscan}}^{\text{tot}}}{n_{\text{subscan}}^{\text{max}}}\right),$$



$$n_{\text{subscan}}^{\text{tot}} - n_{\text{scan}} n_{\text{subscan}}^{\max}.$$

$n_{\text{scan}} + 1$

$n_{\text{subscan}}^{\text{res}} \geq 1$

$n_{\text{subscan}}^{\text{res}} = 0$

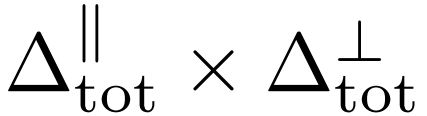


$$n_{\text{subscan}}^{\max}\left(t_{\text{subscan}}+t_{\text{subscan}}^{\text{overhead}}\right)+t_{\text{scan}}^{\text{overhead}},$$


t_{source}

$$n_{\text{scan}}\, t_{\text{scan}} + \left[n_{\text{subscan}}^{\text{res}} (t_{\text{subscan}} + t_{\text{subscan}}^{\text{overhead}}) + t_{\text{scan}}^{\text{overhead}} \right].$$

$$t_\sigma = n_{\text{subscan}}^{\text{tot}}\, t_{\text{subscan}}.$$







$$\Delta^{\parallel}_{\mathrm{sou}} + \Delta_{\mathrm{array}} + \Delta_{\mathrm{throw}} + \Delta_{\mathrm{base}},$$


Δ_{array}


Δ_{throw}


Δ_{base}

$v_{||}$



δ





$n_{\text{subscan}}^{\text{cover}}$

$$\Omega_{\mathrm{map}} = n_{\mathrm{subscan}}^{\mathrm{cover}}\, \delta\, \Delta_{\mathrm{tot}}^{\parallel} \quad \text{with} \quad n_{\mathrm{subscan}}^{\mathrm{cover}} = \mathrm{ceil}\left(\frac{\Delta_{\mathrm{tot}}^{\perp}}{\delta} + 1 \right);$$

$$\Delta_{\mathrm{tot}}^{\parallel} = v_{\parallel}\, t_{\mathrm{subscan}} \quad \text{and} \quad t_{\mathrm{cover}} = n_{\mathrm{subscan}}^{\mathrm{cover}}\, t_{\mathrm{subscan}};$$

$$\Omega_{\mathrm{map}} = t_{\mathrm{cover}}\, \delta\, v_{\parallel}.$$

$\Delta_{\mathrm{sou}}^{\parallel} < 0.5^{\circ}$





$d_{\mathrm{cal}}/d_{\mathrm{submap}}$

$$\Delta_{\text{edge}} = \Delta_{\text{array}} + \Delta_{\text{throw}} + \Delta_{\text{base}}$$


Δ_{submap}

$$\Delta_{\text{submap}} \left(\Delta_{\text{submap}} + \Delta_{\text{edge}} \right) = d_{\text{submap}} \, \delta \, v_{\parallel} .$$

$$\Delta_{\text{submap}} = \frac{\sqrt{\Delta_{\text{edge}}^2 + 4 d_{\text{submap}}\, \delta\, v_{\parallel}} - \Delta_{\text{edge}}}{2}.$$

$$\Delta^{\parallel}_{\text{mos}}\,\Delta^{\perp}_{\text{mos}} \leq \Delta^{2}_{\text{submap}}$$

$\Delta_{\mathrm{mos}}^{\perp},$

$$\Delta_{\text{mos}}^{\parallel} + \Delta_{\text{array}} + \Delta_{\text{throw}} + \Delta_{\text{base}},$$



1.

Δ_{submap},

$$\Delta_{\text{submap}} + \Delta_{\text{array}} + \Delta_{\text{throw}} + \Delta_{\text{base}},$$

$$\frac{\Delta^{\parallel}_{\mathrm{mos}}\,\Delta^{\perp}_{\mathrm{mos}}}{\Delta^{2}_{\mathrm{submap}}}.$$



$$\sigma_{\mathrm{beam}} = \frac{\mathrm{NEFD}\,\exp\left(A\,\tau_{\mathrm{zen}}\right)}{\sqrt{t_{\mathrm{beam}}}} \quad \text{with} \quad t_{\mathrm{beam}} = \frac{n_{\mathrm{cover}}\,t_{\mathrm{cover}}}{n_{\mathrm{beam}}^{\mathrm{bol}}},$$



$$n_{\mathrm{beam}}^{\mathrm{bol}} = \frac{\Omega_{\mathrm{map}}}{n_{\mathrm{bol}}^{\mathrm{tot}}\,\Omega_{\mathrm{beam}}} \quad \text{with} \quad n_{\mathrm{bol}}^{\mathrm{tot}} = n_{\mathrm{bol}}^{\mathrm{max}} - n_{\mathrm{bol}}^{\mathrm{dead}} \quad \text{and} \quad \Omega_{\mathrm{beam}} = \frac{\eta_{\mathrm{grid}}\,\pi\,\theta^2}{4\,\ln(2)},$$


Ω_{beam}

η_{grid}

θ

$$\sigma_{\rm beam} = \frac{\rm NEFD}{\sqrt{n_{\rm bol}^{\rm tot}\,\Omega_{\rm beam}}}\,\exp\left(A\,\tau_{\rm zen}\right)\,\sqrt{\frac{\delta\,v_{\parallel}}{n_{\rm cover}}}.$$

$$\frac{\mathrm{NEFD}}{\sqrt{n_{\mathrm{bol}}^{\mathrm{tot}}\,\Omega_{\mathrm{beam}}}} \simeq 0.2\,(\mathrm{mJy/Beam})\,\sqrt{\mathrm{s}}\,/''.$$

$$\sigma_{\mathrm{actual}} = \alpha(\Delta^{\parallel}_{\mathrm{sou}})\ \exp\left(A\,\tau_{\mathrm{zen}}\right)\ \sqrt{\frac{\delta\, v_{\parallel}}{n_{\mathrm{cover}}}},$$

d_{scan}

$d_{\mathrm{cal}}/d_{\mathrm{scan}}$

$$n_{\text{subscan}}^{\max}\left(t_{\text{subscan}}+t_{\text{subscan}}^{\text{overhead}}\right)+t_{\text{scan}}^{\text{overhead}}\leq d_{\text{scan}}\quad\text{or}\quad n_{\text{subscan}}^{\max}\leq\frac{d_{\text{scan}}-t_{\text{scan}}^{\text{overhead}}}{t_{\text{subscan}}+t_{\text{subscan}}^{\text{overhead}}}.$$

sou

0.5°,

$$\Delta^{\parallel}_{\text{sou}} + \Delta_{\text{array}} + \Delta_{\text{throw}} + \Delta_{\text{base}}$$

α

an empirical increasing function of $\Delta^{\parallel}_{\mathrm{sou}}$.

α


sou

$$\Delta_{\text{submap}} = 0.5 \left(\sqrt{\Delta_{\text{edge}}^2 + 4 d_{\text{submap}} \, \delta \, v_{\parallel}} - \Delta_{\text{edge}} \right)$$

$$\Delta_{\text{edge}} = \Delta_{\text{array}} + \Delta_{\text{throw}} + \Delta_{\text{base}}$$

$$\Delta^{\parallel}_{\text{mos}}\,\Delta^{\perp}_{\text{mos}} \leq \Delta^{2}_{\text{submap}}$$

$$\Delta_{\text{mos}}^{\parallel} + \Delta_{\text{array}} + \Delta_{\text{throw}} + \Delta_{\text{base}},$$

$$\Delta_{\text{submap}} + \Delta_{\text{array}} + \Delta_{\text{throw}} + \Delta_{\text{base}},$$

$$\frac{\Delta^{\parallel}_{\mathrm{mos}}\,\Delta^{\perp}_{\mathrm{mos}}}{\Delta^{2}_{\mathrm{submap}}}.$$

$$n_{\mathrm{cal}} = \mathrm{ceil}\left(\frac{\epsilon_{\mathrm{tel}}\, t_{\mathrm{tel}}}{d_{\mathrm{cal}} + t_{\mathrm{cal}}}\right),$$

2.

$$t_{\mathrm{source}} = \frac{\epsilon_{\mathrm{tel}}\, t_{\mathrm{tel}} - n_{\mathrm{cal}}\, t_{\mathrm{cal}}}{n_{\mathrm{source}}}.$$

$t_{\text{source}} < 0$

$t_{\mathrm{cal}}/\epsilon_{\mathrm{tel}}$



t_{subscan} and $n_{\text{subscan}}^{\max}$ are fixed,

$$t_{\text{scan}} = n_{\text{subscan}}^{\max} \left(t_{\text{subscan}} + t_{\text{subscan}}^{\text{overhead}} \right) + t_{\text{scan}}^{\text{overhead}}.$$

$$t_{\mathrm{subscan}} = \frac{\Delta_{\mathrm{tot}}^{\parallel}}{v_{\parallel}},$$

$$n_{\text{subscan}}^{\max} = \text{floor}\left(\frac{d_{\text{scan}} - t_{\text{scan}}^{\text{overhead}}}{t_{\text{subscan}} + t_{\text{subscan}}^{\text{overhead}}}\right),$$

3.

if $n_{\text{subscan}}^{\max} < 1$, then send an error message advising to increase d_{scan},

4.

$$t_{\text{scan}} = n_{\text{subscan}}^{\max} \left(t_{\text{subscan}} + t_{\text{subscan}}^{\text{overhead}} \right) + t_{\text{scan}}^{\text{overhead}}.$$

$$n_{\text{scan}} = \text{floor}\left(\frac{t_{\text{source}}}{t_{\text{scan}}}\right),$$

$$n_{\mathrm{subscan}}^{\mathrm{res}} = \mathrm{floor}\left(\frac{t_{\mathrm{source}} - n_{\mathrm{scan}} t_{\mathrm{scan}} - t_{\mathrm{scan}}^{\mathrm{overhead}}}{t_{\mathrm{subscan}} + t_{\mathrm{subscan}}^{\mathrm{overhead}}}\right),$$

$$n_{\text{subscan}}^{\text{tot}} = n_{\text{scan}} n_{\text{subscan}}^{\max} + n_{\text{subscan}}^{\text{res}}.$$

$$n_{\text{subscan}}^{\text{cover}} = \text{ceil}\left(\frac{\Delta_{\text{tot}}^{\perp}}{\delta} + 1\right),$$

$$n_{\mathrm{cover}} = \mathrm{floor}\left(\frac{n_{\mathrm{subscan}}^{\mathrm{tot}}}{n_{\mathrm{subscan}}^{\mathrm{cover}}}\right),$$

if $n_{\text{cover}} < 1$, then send an error message advising to increase t_{tel},

$$n_{\mathrm{subscan}}^{\mathrm{tot}} = n_{\mathrm{cover}}\, n_{\mathrm{subscan}}^{\mathrm{cover}}.$$

$$n_{\mathrm{scan}} = \mathrm{floor}\left(\frac{n_{\mathrm{subscan}}^{\mathrm{tot}}}{n_{\mathrm{subscan}}^{\mathrm{max}}}\right),$$

$$n_{\text{subscan}}^{\text{res}} = n_{\text{subscan}}^{\text{tot}} - n_{\text{scan}} n_{\text{subscan}}^{\text{max}}.$$

$$t_\sigma = \left(n_{\mathrm{scan}}\, n_{\mathrm{subscan}}^{\mathrm{max}} + n_{\mathrm{subscan}}^{\mathrm{res}}\right) t_{\mathrm{subscan}},$$

$$\sigma = \frac{\mathrm{NEFD}\ \exp\left(A\,\tau_{\mathrm{zen}}\right)}{\sqrt{t_\sigma}}.$$

$$\sigma = \alpha \, \exp\left(A \, \tau_{\mathrm{zen}}\right) \, \sqrt{\frac{\delta \, v_{\parallel}}{n_{\mathrm{cover}}}},$$

$$t_{\text{source}} = n_{\text{scan}}\, t_{\text{scan}} + \left[n_{\text{subscan}}^{\text{res}} (t_{\text{subscan}} + t_{\text{subscan}}^{\text{overhead}}) + t_{\text{scan}}^{\text{overhead}} \right],$$

$$n_{\mathrm{cal}} = \mathrm{ceil}\left(\frac{n_{\mathrm{source}}\, t_{\mathrm{source}}}{d_{\mathrm{cal}}}\right),$$

$$t_{\mathrm{tel}} = \frac{n_{\mathrm{source}}\, t_{\mathrm{source}} + n_{\mathrm{cal}}\, t_{\mathrm{cal}}}{\epsilon_{\mathrm{tel}}}.$$

$$t_\sigma = \left[\frac{\mathrm{NEFD}\ \exp\left(A\,\tau_{\mathrm{zen}}\right)}{\sigma} \right]^2 ,$$

$$n_{\mathrm{subscan}}^{\mathrm{tot}} = \mathrm{ceil}\left(\frac{t_\sigma}{t_{\mathrm{subscan}}}\right).$$

$$n_{\mathrm{cover}} = \mathrm{floor}\left\{ \delta\, v_{\parallel} \left[\frac{\alpha\, \exp(A\, \tau_{\mathrm{zen}})}{\sigma} \right]^2 \right\},$$

if $n_{\text{cover}} < 1$, then send an error message advising to decrease σ,

$$n_{\text{subscan}}^{\text{cover}} = \text{ceil}\left(\frac{\Delta_{\text{tot}}^{\perp}}{\delta} + 1\right),$$

$$n_{\text{subscan}}^{\text{tot}} = n_{\text{cover}} n_{\text{subscan}}^{\text{cover}}.$$

≤ 0.10

≤ 0.30

≤ 0.50

≤ 0.20

≤ 0.35

-1



