1,2

3

1

σ

t_σ

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

NEFD

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

τ_{zen}

t_{tel}

ϵ_{tel}

n_{source}

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

t_{cal}

n_{cal}

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

t_{pointing}

t_{focus}

t_{skydips}

$$t_{\text{onoff}}^{\text{cal}}$$

η_{cal}

(> 1)

d_{cal}

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

t_{source}

$n_{\mathrm{subscan}}^{\mathrm{tot}}$

t_{subscan}

$t_{\text{subscan}}^{\text{overhead}}$

$t_{\text{scan}}^{\text{overhead}}$

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

n_{scan}

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

n_{scan}

=

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

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

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

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

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

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

t_{scan}

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

t_{source}

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

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

$$\Delta_{\mathrm{sou}}^{\parallel} \times \Delta_{\mathrm{sou}}^{\perp}$$

$$\Delta_{\text{tot}}^{\parallel} \times \Delta_{\text{tot}}^{\perp}$$

$\Delta_{\text{tot}}^{\perp}$

$\Delta_{\text{sou}}^{\perp}$,

$$\Delta_{\mathrm{tot}}^{\parallel}$$

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

Δ_{array}

Δ_{throw}

Δ_{base}

$v_{\|}$

$$\Delta_{\text{tot}}^{\parallel}$$

δ

Ω_{map}

t_{cover}

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

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

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

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

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

$$\Delta_{\mathrm{mos}}^{\parallel} \times \Delta_{\mathrm{mos}}^{\perp}$$

d_{submap}

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

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

$$\Delta_{\text{submap}}$$

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

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

$$\Delta_{\mathrm{mos}}^{\parallel}\,\Delta_{\mathrm{mos}}^{\perp} \leq \Delta_{\mathrm{submap}}^{2}$$

$\Delta^{\perp}_{\mathrm{mos}},$

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

n_{source}

1.

Δ_{submap},

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

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

σ_{beam}

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

t_{beam}

n_{cover}

$n_{\mathrm{beam}}^{\mathrm{bol}}$

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

$n_{\mathrm{bol}}^{\mathrm{tot}}$

Ω_{beam}

η_{grid}

θ

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

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

$$\sigma_{\text{actual}} = \alpha(\Delta_{\text{sou}}^{\|})\ \exp\left(A\,\tau_{\text{zen}}\right)\ \sqrt{\frac{\delta\, v_{\|}}{n_{\text{cover}}}},$$

$\alpha(\Delta_{\mathrm{sou}}^{\parallel})$

d_{scan}

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

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

el

$$\Delta^{\parallel}_{\text{sou}}$$

$\leq$

$0.5^\circ,$

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

α

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

α

$$\Delta_{\mathrm{sou}}^{\parallel}$$

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

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

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

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

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

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

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

2.

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

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

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

t_{scan}

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

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

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

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

3.

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

4.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$\sqrt{S}$

≤ 0.10

≤ 0.30

≤ 0.50

≤ 0.20

≤ 0.35

-1

$n_{\mathrm{bol}}^{\max}$

$n_{\mathrm{bol}}^{\mathrm{dead}}$

$\alpha(40'')$

$$\sqrt{\sec}$$

$$\alpha(2')$$

n_{subscan}