$1,2$

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}

$$t_{\mathrm{tel}}$$

ϵ_{tel}

n_{source}

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

t_{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_{pointing}

t_{focus}

t_{skydips}

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

η_{cal}

$$(>1)$$

$$d_{\mathrm{cal}}$$

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

t_{source}

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

t_{subscan}

$$t^{\text{overhead}}_{\text{subscan}}$$

$$t^{\text{overhead}}_{\text{scan}}$$

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

n_{scan}

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

n_{scan}

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

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

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

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

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

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

$$t_{\mathrm{scan}}$$

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

t_{source}

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

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

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

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

$$\Delta^{\perp}_{\mathrm{tot}}$$

$\Delta^{\perp}$ sou,

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

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

Δ_{array}

Δ_{throw}

Δ_{base}

$v_{||}$

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

δ

$$\Omega_{\mathrm{map}}$$

t_{cover}

$$n^{\text{cover}}_{\text{subscan}}$$

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

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

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

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

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

$$d_{\mathrm{submap}}$$

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

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

Δ_{submap}

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

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

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

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

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

n_{source}

1.

$\Delta_{\mathrm{submap}},$

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

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

$$\sigma_{\mathrm{beam}}$$

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

$$t_{\mathrm{beam}}$$

n_{cover}

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

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

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

$$\Omega_{\mathrm{beam}}$$

ηgrid

θ

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

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

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

$$\alpha(\Delta^{\parallel}_{\mathrm{sou}})$$

$$d_{\mathrm{scan}}$$

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

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

el

sou

$<$

$0.5^\circ,$

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

α

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

α

sou

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

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

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

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

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

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

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

2.

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

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

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

$$t_{\mathrm{scan}}$$

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.

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

4.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\sqrt{S}$$

≤ 0.10

≤ 0.30

≤ 0.50

≤ 0.20

$$\leq 0.35$$

-1

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

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

$$\alpha(40'')$$

$$\sqrt{\sec}$$

$$\alpha(2')$$

n_{subscan}