1,2

$$\sigma = \frac{T_{\rm sys}}{\eta_{\rm spec}\sqrt{d\nu\, t}},$$

σ

t

$d\nu$

T_{sys}

η_{spec}

$$\sigma = \sqrt{\sigma_{\rm on}^2 + \sigma_{\rm off}^2} = \frac{T_{\rm sys}}{\eta_{\rm spec}\sqrt{d\nu\, t_{\rm sig}}} \quad \text{with} \quad t_{\rm sig} = \frac{t_{\rm on}\, t_{\rm off}}{t_{\rm on} + t_{\rm off}},$$

σ_{on}

σ_{off}

t_{on}

t_{off}

t_{sig}

$T_{\mathrm{a}}^{\star}$

$$T_{\mathrm{sys}} = \frac{(1+G_{\mathrm{im}})\exp\{\tau_{\mathrm{s}}\,A\}}{F_{\mathrm{eff}}}\left[F_{\mathrm{eff}}\,T_{\mathrm{atm}}\,\left(1-\exp\{-\tau_{\mathrm{s}}\,A\}\right)+\left(1-F_{\mathrm{eff}}\right)T_{\mathrm{cab}}+T_{\mathrm{rec}}\right],$$

G_{im}

F_{eff}

$$A = 1/\sin(\text{elevation})$$

τ_s

T_{atm}

T_{cab}

$T_{\rm rec}$

t_{tel}

t_{onoff}

$$t_{\mathrm{onoff}} = \eta_{\mathrm{tel}}\, t_{\mathrm{tel}},$$

η_{tel}

n_{pol}

$n_{\mathrm{pol}} = 2$

$$\sigma = \frac{T_{\rm sys}}{\eta_{\rm spec}\sqrt{d\nu \, n_{\rm pol} \, t_{\rm sig}}} \quad \text{with} \quad t_{\rm sig} = \frac{t_{\rm on} \, t_{\rm off}}{t_{\rm on} + t_{\rm off}}.$$

$$t_{\mathrm{onoff}} = t_{\mathrm{on}} = t_{\mathrm{off}},$$

$$t_{\rm sig} = \frac{t_{\rm on}}{2} = \frac{t_{\rm off}}{2} = \frac{t_{\rm onoff}}{2},$$

$$\sigma_{\mathrm{fsw}} = \frac{\sqrt{2}\,T_{\mathrm{sys}}}{\eta_{\mathrm{spec}}\sqrt{d\nu\, n_{\mathrm{pol}}\,\eta_{\mathrm{tel}}\,t_{\mathrm{tel}}}}.$$

$$t_{\text{on}} = t_{\text{off}} = \frac{t_{\text{onoff}}}{2},$$

$$t_{\mathrm{sig}} = \frac{t_{\mathrm{on}}}{2} = \frac{t_{\mathrm{off}}}{2} = \frac{t_{\mathrm{onoff}}}{4},$$

$$\sigma_{\mathrm{psw}} = \frac{2\,T_{\mathrm{sys}}}{\eta_{\mathrm{spec}}\sqrt{d\nu\,n_{\mathrm{pol}}\,\eta_{\mathrm{tel}}\,t_{\mathrm{tel}}}}.$$

$$\sqrt{2}$$

A_{map}

A_{beam}

θ

$$A_{\text{beam}} = \frac{\eta_{\text{grid}}\,\pi\,\theta^2}{4\,\ln(2)}$$

η_{grid}

$\theta/3$

$$\eta_{\text{grid}} = 1 + \frac{1}{9} \simeq 1.11.$$

n_{beam}

$$n_{\mathrm{beam}} = \frac{A_{\mathrm{map}}}{A_{\mathrm{beam}}}.$$

$t_{\mathrm{on}}^{\mathrm{beam}}$

$t_{\mathrm{off}}^{\mathrm{beam}}$

$t_{\mathrm{sig}}^{\mathrm{beam}}$

$$t_{\text{sig}}^{\text{beam}} = \frac{t_{\text{on}}^{\text{beam}}\, t_{\text{off}}^{\text{beam}}}{t_{\text{on}}^{\text{beam}} + t_{\text{off}}^{\text{beam}}}$$

$t_{\mathrm{on}}^{\mathrm{tot}}$

$t_{\mathrm{off}}^{\mathrm{tot}}$

v_{linear}

$$v_{\text{linear}}^{\max}$$

v_{area}

$v_{\text{area}}^{\max}$

$$v_{\text{area}} = v_{\text{linear}}\, \Delta\theta,$$

$\Delta\theta$

$$\Delta\theta = \frac{\theta}{2.5}.$$

$$t_{\text{onoff}} = t_{\text{on}}^{\text{tot}} = t_{\text{off}}^{\text{tot}},$$

$$t_{\mathrm{on}}^{\mathrm{beam}} = t_{\mathrm{off}}^{\mathrm{beam}} = \frac{t_{\mathrm{onoff}}}{n_{\mathrm{beam}}},$$

$$t_{\rm sig}^{\rm beam} = \frac{t_{\rm on}^{\rm beam}}{2} = \frac{t_{\rm off}^{\rm beam}}{2} = \frac{t_{\rm onoff}}{2 n_{\rm beam}},$$

$$\sigma_{\mathrm{fsw}} = \frac{\sqrt{2\, n_{\mathrm{beam}}}\, T_{\mathrm{sys}}}{\eta_{\mathrm{spec}} \sqrt{d\nu\, n_{\mathrm{pol}}\, \eta_{\mathrm{tel}}\, t_{\mathrm{tel}}}}.$$

$$\frac{A_{\mathrm{map}}}{t_{\mathrm{onoff}}} \leq v_{\mathrm{area}}^{\max}.$$

$$t_{\text{off}}^{\text{optimal}} = \sqrt{n_{\text{on/off}}}\, t_{\text{on}}$$

$n_{\text{on/off}}$

$$t_{\rm sig} = \frac{t_{\rm on}}{1+\frac{1}{\sqrt{n_{\rm on/off}}}} \quad \text{and} \quad \sigma = \frac{T_{\rm sys}}{\eta_{\rm spec}\sqrt{d\nu\, n_{\rm pol}\, t_{\rm on}}}\sqrt{1+\frac{1}{\sqrt{n_{\rm on/off}}}}.$$

A_{submap}

n_{submap}

t_{stable}

t_{submap}

n_{cover}

$t_{\mathrm{on}}^{\mathrm{cover}}$

$t_{\mathrm{off}}^{\mathrm{cover}}$

$$n_{\mathrm{submap}} = \frac{A_{\mathrm{map}}}{A_{\mathrm{submap}}}.$$

$$n_{\mathrm{on/off}} = \frac{A_{\mathrm{submap}}}{A_{\mathrm{beam}}}.$$

$$n_{\text{beam}} = n_{\text{submap}}\, n_{\text{on/off}}.$$

$$A_{\text{submap}} = v_{\text{area}}\, t_{\text{submap}}.$$

$$t_{\mathrm{submap}} = n_{\mathrm{on/off}}\, t_{\mathrm{on}}^{\mathrm{cover}}.$$

$$t_{\rm on}^{\rm beam} = n_{\rm cover}\, t_{\rm on}^{\rm cover} \quad \text{and} \quad t_{\rm off}^{\rm beam} = n_{\rm cover}\, t_{\rm off}^{\rm cover} \quad \text{with} \quad t_{\rm off}^{\rm cover} = \sqrt{n_{\rm on/off}}\, t_{\rm on}^{\rm cover}.$$

$$t_{\mathrm{sig}}^{\mathrm{beam}} = n_{\mathrm{cover}}\, t_{\mathrm{sig}}^{\mathrm{cover}} = \frac{n_{\mathrm{cover}}\, t_{\mathrm{submap}}}{n_{\mathrm{on/off}} + \sqrt{n_{\mathrm{on/off}}}}.$$

$$t_{\text{onoff}} = n_{\text{cover}}\, n_{\text{submap}}\, (n_{\text{on/off}}\, t_{\text{on}}^{\text{cover}} + t_{\text{off}}^{\text{cover}}).$$

$$t_{\text{onoff}} = n_{\text{cover}}\, t_{\text{submap}}\, n_{\text{submap}} \left(1 + \frac{1}{\sqrt{n_{\text{on/off}}}}\right).$$

$n_{\text{cover}}\ t_{\text{submap}}$

$$t_{\mathrm{onoff}} = t_{\mathrm{sig}}^{\mathrm{beam}}\, n_{\mathrm{submap}} \,\left(1 + \sqrt{n_{\mathrm{on/off}}}\right)^2 .$$

$$t_{\text{onoff}} = t_{\text{sig}}^{\text{beam}} \left(\sqrt{n_{\text{submap}}} + \sqrt{n_{\text{beam}}}\right)^2 .$$

$$\sigma_{\mathrm{psw}} = \frac{\left(\sqrt{n_{\mathrm{beam}}} + \sqrt{n_{\mathrm{submap}}}\right)\, T_{\mathrm{sys}}}{\eta_{\mathrm{spec}}\, \sqrt{d\nu\, n_{\mathrm{pol}}\, \eta_{\mathrm{tel}}\, t_{\mathrm{tel}}}}.$$

$A_{\mathrm{map}}/A_{\mathrm{beam}}$

$$n_{\mathrm{submap}} = \frac{A_{\mathrm{map}}}{v_{\mathrm{area}}\, t_{\mathrm{submap}}}.$$

$$t_{\text{submap}} = t_{\text{stable}}$$

$$v_{\text{area}} = v_{\text{area}}^{\max}$$

$t_{\text{submap}}\ v_{\text{area}}$

$$n_{\mathrm{submap}} = 1 + \mathtt{int}(n_{\mathrm{submap}}).$$

$$t_{\text{submap}}\, v_{\text{area}} < t_{\text{stable}}\, v_{\text{area}}^{\max}$$

1.

$$t_{\rm sig}^{\rm beam} = \frac{T_{\rm sys}^2}{\eta_{\rm spec}^2\,\sigma^2\,d\nu\,n_{\rm pol}},$$

2.

$$t_{\text{onoff}} = t_{\text{sig}}^{\text{beam}} \left(\sqrt{n_{\text{submap}}} + \sqrt{n_{\text{beam}}}\right)^2 ,$$

3.

$$\eta_{\text{tel}}\, t_{\text{tel}} = t_{\text{onoff}}.$$

$$n_{\text{on/off}} = \frac{n_{\text{beam}}}{n_{\text{submap}}},$$

$$n_{\mathrm{cover}} = \frac{t_{\mathrm{sig}}^{\mathrm{beam}}}{t_{\mathrm{submap}}} \left(n_{\mathrm{on/off}} + \sqrt{n_{\mathrm{on/off}}}\right),$$

$$t_{\text{on}}^{\text{beam}} = \frac{n_{\text{cover}}\, t_{\text{submap}}}{n_{\text{on/off}}}$$

$$t_{\text{off}}^{\text{beam}} = t_{\text{on}}^{\text{beam}} \sqrt{n_{\text{on/off}}}.$$

$n_{\mathrm{cover}} < 1$

$$n_{\text{cover}} \geq 1$$

$$A_{\mathrm{submap}}(= v_{\mathrm{area}}\, t_{\mathrm{submap}})$$

$$v_{\text{area}} < v_{\text{area}}^{\max}$$

$$\sigma_{\mathrm{fsw}} = \frac{\sqrt{2\, n_{\mathrm{beam}}}\, T_{\mathrm{sys}}}{\eta_{\mathrm{spec}} \sqrt{d\nu\, n_{\mathrm{pol}}\, \eta_{\mathrm{tel}}\, t_{\mathrm{tel}}}},$$

$$\sigma_{\mathrm{psw}} = \frac{\left(\sqrt{n_{\mathrm{beam}}} + \sqrt{n_{\mathrm{submap}}}\right)\ T_{\mathrm{sys}}}{\eta_{\mathrm{spec}}\ \sqrt{d\nu\ n_{\mathrm{pol}}\ \eta_{\mathrm{tel}}\ t_{\mathrm{tel}}}}.$$

$$\frac{\sigma_{\mathrm{psw}}}{\sigma_{\mathrm{fsw}}} = \frac{1}{\sqrt{2}} \left(1 + \sqrt{\frac{n_{\mathrm{submap}}}{n_{\mathrm{beam}}}}\right).$$

$$\frac{n_{\mathrm{beam}}}{n_{\mathrm{submap}}} = n_{\mathrm{on/off}} \geq \frac{1}{3 - 2\sqrt{2}} \sim 6.$$

$$\sigma_{\rm psw}/\sigma_{\rm fsw} \simeq 0.84$$

$$n_{\text{on/off}} = 30$$

$\simeq 0.78$

$$n_{\mathrm{on/off}} = 100$$

$$n_{\mathrm{on/off}} = \frac{t_{\mathrm{stable}}}{A_{\mathrm{beam}}/v_{\mathrm{area}}^{\mathrm{max}}},$$

$$\eta_{\text{tel}} = 0.5.$$

$$T_{\mathrm{atm}} = 250$$

$$T_{\text{cab}} = 290$$

$$F_{\text{eff}} = 0.95$$

$$T_{\mathrm{rec}} = 75$$

$$Trec = 95$$

$$G_{\mathrm{im}} = 0.1$$

$$\eta_{\text{spec}} = 0.87$$

$$t_{\text{stable}} = 2$$

$$\theta = \frac{2460''}{\nu \, \mathrm{GHz}}$$

$$f_{\text{dump}} = 2$$

$$v_{\mathrm{linear}}^{\max} = f_{\mathrm{dump}} \frac{\theta}{4} \,\mathrm{arcsec/s}$$

$$v_{\mathrm{area}}^{\max} = f_{\mathrm{dump}} \, \frac{\theta}{2.5} \, \frac{\theta}{4} \, \mathrm{arcsec}^2/\mathrm{s} \quad \text{or} \quad v_{\mathrm{area}}^{\max} = f_{\mathrm{dump}} \, \frac{\theta^2}{10} \, \mathrm{arcsec}^2/\mathrm{s}$$

$$t_{\mathrm{off}} = \alpha\, t_{\mathrm{on}},$$

α

$$t_{\text{onoff}} = n_{\text{on/off}} t_{\text{on}} + t_{\text{off}} = \left(n_{\text{on/off}} + \alpha\right) t_{\text{on}}$$

$$t_{\rm onoff} = \frac{T_{\rm sys}^2}{\eta_{\rm spec}^2\, \sigma^2\, d\nu} \left(1 + n_{\rm on/off} + \alpha + \frac{n_{\rm on/off}}{\alpha}\right).$$

$$\frac{dt_{\mathrm{onoff}}}{d\alpha} \propto 1 - \frac{n_{\mathrm{on/off}}}{\alpha^2}$$

$$\alpha = \sqrt{n_{\mathrm{on/off}}} \quad \text{or} \quad t_{\mathrm{off}}^{\mathrm{optimal}} = \sqrt{n_{\mathrm{on/off}}}\, t_{\mathrm{on}}.$$