$1,2$

1

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

σ

t

$$d\nu$$

T_{sys}

ηspec

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

$$\sigma_{\mathrm{on}}$$

$$\sigma_{\mathrm{off}}$$

$$t_{\mathrm{on}}$$

$$t_{\mathrm{off}}$$

t_{sig}

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

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

Gim

$$F_{\mathrm{eff}}$$

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

τ_{S}

$$T_{\mathrm{atm}}$$

T_{cab}

T_{rec}

t_{tel}

t_{onoff}

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

η_{tel}

$$n_{\mathrm{pol}}$$

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

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

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

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

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

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

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

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

$$\sqrt{2}$$

A_{map}

$$A_{\text{beam}}$$

θ

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

ηgrid

$\theta/3$

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

$$n_{\mathrm{beam}}$$

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

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

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

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

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

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

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

$$v_{\text{linear}}$$

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

$$v_{\text{area}}$$

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

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

$$\Delta\theta$$

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

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

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

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

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

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

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

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

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

A_{submap}

n_{submap}

t_{stable}

$$t_{\text{submap}}$$

n_{cover}

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$n_{\text{submap}} = 1 + \texttt{int}(n_{\text{submap}}).$$

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

1.

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

2.

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

3.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\simeq 0.78$$

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

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

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

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

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

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

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

$$Trec = 95$$

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

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

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

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

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

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

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

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

α

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

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

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

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