$1,2$

1

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

$\sigma$

$t$

$d\nu$





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

$\sigma_{\mathrm{on}}$

$\sigma_{\text{off}}$



$t_{\mathrm{sig}}$



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

$F_{\text{eff}}$

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

$\tau_{\mathrm{S}}$

$T_{\mathrm{atm}}$

$T_{\mathrm{cab}}$

$T_{\text{rec}}$





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





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

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

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

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

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

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

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

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

$\sqrt{2}$




$A_{\mathrm{beam}}$

$\theta$

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

$\eta_{\text{grid}}$



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



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




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



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


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







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

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

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

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

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

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

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

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

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

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


$A_{\text{submap}}$

$n_{\text{submap}}$


$t_{\text{stable}}$

$t_{\text{submap}}$





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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



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

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

1.

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

2.

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

3.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$\simeq 0.78$

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

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

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

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

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

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

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

$Trec = 95$

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

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

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

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

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

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

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

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

$\alpha$

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

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

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

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