$1,2$

1

th

n_{freq}

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

$2d\nu$

$d\nu$

T_{sys}

Δt

$$2d\nu\,\Delta t$$

σ_{K}

$$\sigma_{\mathrm{K}} = \frac{T_{\mathrm{sys}}}{\sqrt{2\, d\nu\, \Delta t}}.$$

i

j

$$T^{ij}_{\text{sys}}$$

$$T_{\rm sys}^{ij} = \sqrt{T_{\rm sys}^{i}\, T_{\rm sys}^{j}},$$

$$T^{i}_{\text{sys}}$$

$$T^j_{\text{sys}}$$

$(\eta_{\text{spec}} \leq 1.0)$

$$\sigma_{\mathrm{K}} = \frac{T_{\mathrm{sys}}}{\eta_{\mathrm{spec}} \sqrt{2\, d\nu\, \Delta t}}.$$

F

$$F = J_{\mathrm{ant}}^{\mathrm{sd}} T_{\mathrm{A}}^{\star}$$

$$J_{\mathrm{ant}}^{\mathrm{sd}} = \frac{2k\,F_{\mathrm{eff}}}{A_{\mathrm{eff}}},$$

k

A_{eff}

$$J^{\mathrm{sd}}_{\mathrm{ant}}$$

$$\sigma_{\mathrm{Jy}} = \frac{J_{\mathrm{ant}}^{\mathrm{sd}}\, T_{\mathrm{sys}}}{\eta_{\mathrm{spec}} \sqrt{2\, d\nu\, \Delta t}}.$$

$$J_{\mathrm{ant}}^{\mathrm{sd,ij}}$$

$$J_{\mathrm{ant}}^{\mathrm{sd,ij}} = \sqrt{J_{\mathrm{ant}}^{\mathrm{sd,i}}\, J_{\mathrm{ant}}^{\mathrm{sd,j}}},$$

$$J_{\text{ant}}^{\text{sd,i}}$$

$$J_{\mathrm{ant}}^{\mathrm{sd,j}}$$

$$n_{\mathrm{ant}}\left(n_{\mathrm{ant}}-1\right)/2$$

n_{ant}

$$\sigma_{\mathrm{Jy}} = \frac{\left\langle J_{\mathrm{ant}}^{\mathrm{sd}}\, T_{\mathrm{sys}} \right\rangle}{\eta_{\mathrm{spec}} \sqrt{n_{\mathrm{ant}} \left(n_{\mathrm{ant}} - 1\right) d\nu\, \Delta t}},$$

$$\left\langle J_{\mathrm{ant}}^{\mathrm{sd}}\, T_{\mathrm{sys}} \right\rangle$$

η_{atm}

$$\eta_{\mathrm{atm}} \leq 1.0$$

$J^{\text{int}}_{\text{ant}}$

$$J_{\mathrm{ant}}^{\mathrm{int}} = \frac{J_{\mathrm{ant}}^{\mathrm{sd}}}{\eta_{\mathrm{atm}}}$$

$$J_{\text{ant}}^{\text{int}} \geq J_{\text{ant}}^{\text{sd}}.$$

ϕ_{rms}

$$\eta_{\mathrm{atm}} = e^{-\frac{\phi_{\mathrm{rms}}^2}{2}} \leq 1.0.$$

$$\sigma_{\mathrm{Jy}} = \frac{\left\langle J_{\mathrm{ant}}^{\mathrm{int}}\, T_{\mathrm{sys}} \right\rangle}{\eta_{\mathrm{spec}} \sqrt{n_{\mathrm{ant}} \left(n_{\mathrm{ant}} - 1\right) d\nu\, \Delta t}}.$$

$$\sigma_{\rm Jy} = \frac{\left\langle J_{\rm ant}^{\rm int}\, T_{\rm sys} \right\rangle}{\eta_{\rm spec}\, \sqrt{n_{\rm ant}\,(n_{\rm ant}-1)\, d\nu\, \Delta t}}, \quad \text{with} \quad J_{\rm ant}^{\rm int} = \frac{J_{\rm ant}^{\rm sd}}{\eta_{\rm atm}} \quad \text{and} \quad \eta_{\rm atm} = e^{-\frac{\phi_{\rm rms}^2}{2}} \leq 1.0,$$

σ_{Jy}

$$J_{\text{ant}}^{\text{int}} T_{\text{sys}}$$

uv

λ/FWHM

Ω_{ant}

λ

$$\Omega_{\mathrm{ant}}\, A_{\mathrm{eff}} = \lambda^2.$$

$$F = J_{\mathrm{ant}} T_{\mathrm{A}}^{\star}$$

$$J_{\mathrm{ant}} = \frac{2k\,\Omega_{\mathrm{ant}}\,F_{\mathrm{eff}}}{\lambda^2}.$$

$$\Omega_{\mathrm{prim}}$$

$$J_{\rm ant}^{\rm int} = \frac{J_{\rm ant}^{\rm sd}}{\eta_{\rm atm}} = \frac{1}{\eta_{\rm atm}} \frac{F_{\rm eff}}{B_{\rm eff}} \frac{2k\,\Omega_{\rm prim}}{\lambda^2}.$$

Ω_{syn}

$$J_{\text{ant}}^{\text{syn}}$$

$$B_{\mathrm{eff}}^{\mathrm{int}} = 1$$

$$F_{\mathrm{eff}}^{\mathrm{int}} = 1$$

$$J_{\rm ant}^{\rm syn} = \frac{2k\,\Omega_{\rm syn}}{\lambda^2}.$$

$$\sigma_{\mathrm{K}} = \frac{\sigma_{\mathrm{Jy}}}{J_{\mathrm{ant}}^{\mathrm{syn}}} \quad \text{with} \quad J_{\mathrm{ant}}^{\mathrm{syn}} = \frac{2\pi\, k\, \theta_{\mathrm{maj}} \theta_{\mathrm{min}}}{4\, \ln 2\, \lambda^2},$$

$$\sigma_{\mathrm{K}} = \frac{\Omega_{\mathrm{prim}}}{\Omega_{\mathrm{syn}}} \left\langle \frac{F_{\mathrm{eff}}\, T_{\mathrm{sys}}}{B_{\mathrm{eff}}\, \eta_{\mathrm{atm}}} \right\rangle \frac{1}{\eta_{\mathrm{spec}} \sqrt{n_{\mathrm{ant}}\,(n_{\mathrm{ant}}-1)\, d\nu\, \Delta t}} = \frac{\theta_{\mathrm{prim}}^2}{\theta_{\mathrm{maj}}\, \theta_{\mathrm{min}}} \left\langle \frac{F_{\mathrm{eff}}\, T_{\mathrm{sys}}}{B_{\mathrm{eff}}\, \eta_{\mathrm{atm}}} \right\rangle \frac{1}{\eta_{\mathrm{spec}} \sqrt{n_{\mathrm{ant}}\,(n_{\mathrm{ant}}-1)\, d\nu\, \Delta t}},$$

θ_{prim}

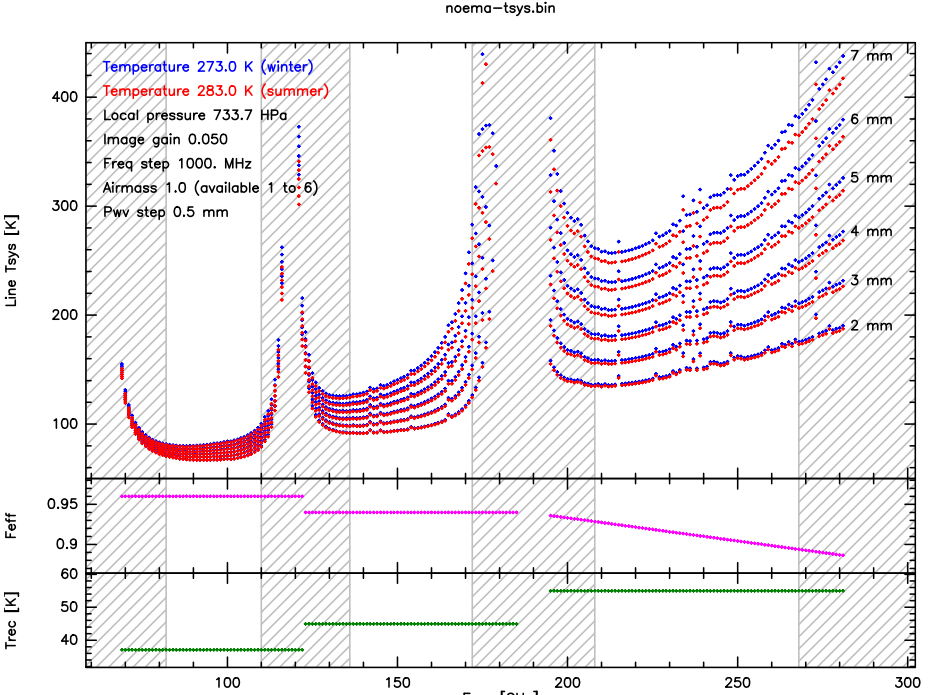
θ_{maj}

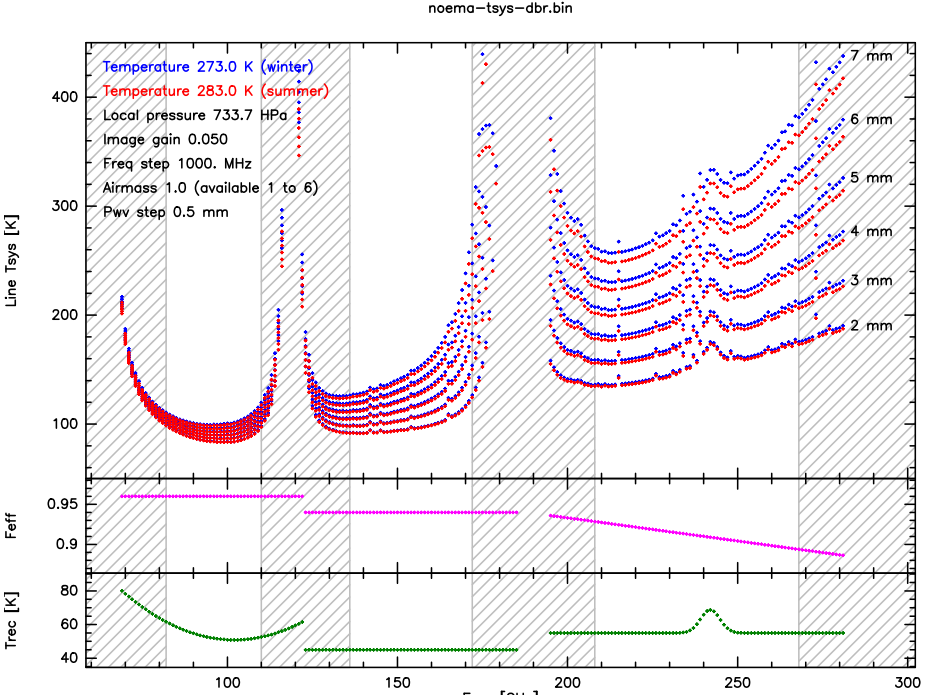
$\theta_{\min}$

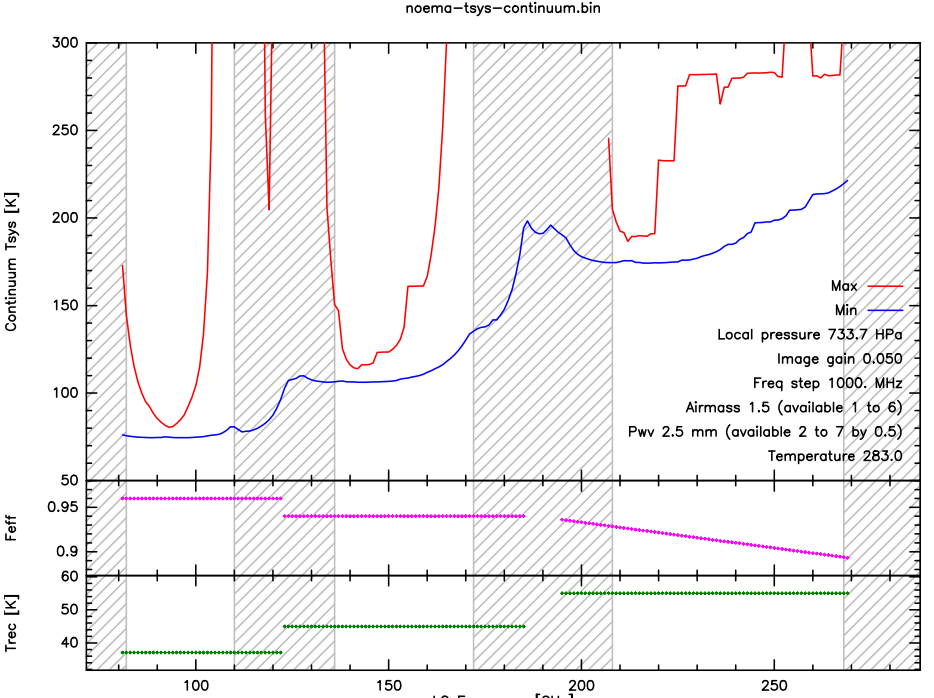
$4(= 2^2)$

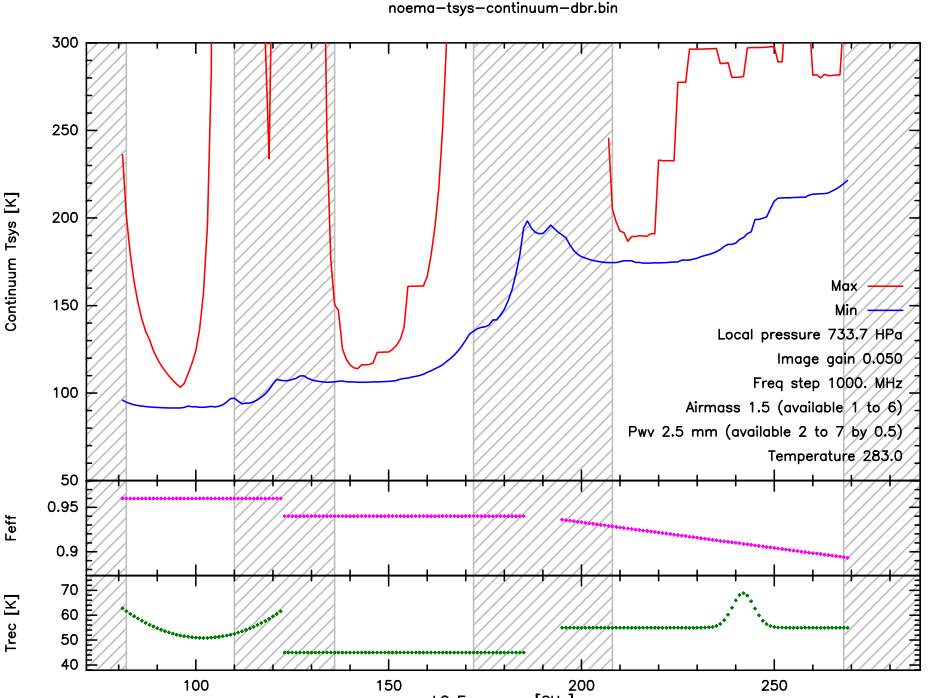
$16(= 2^4)$

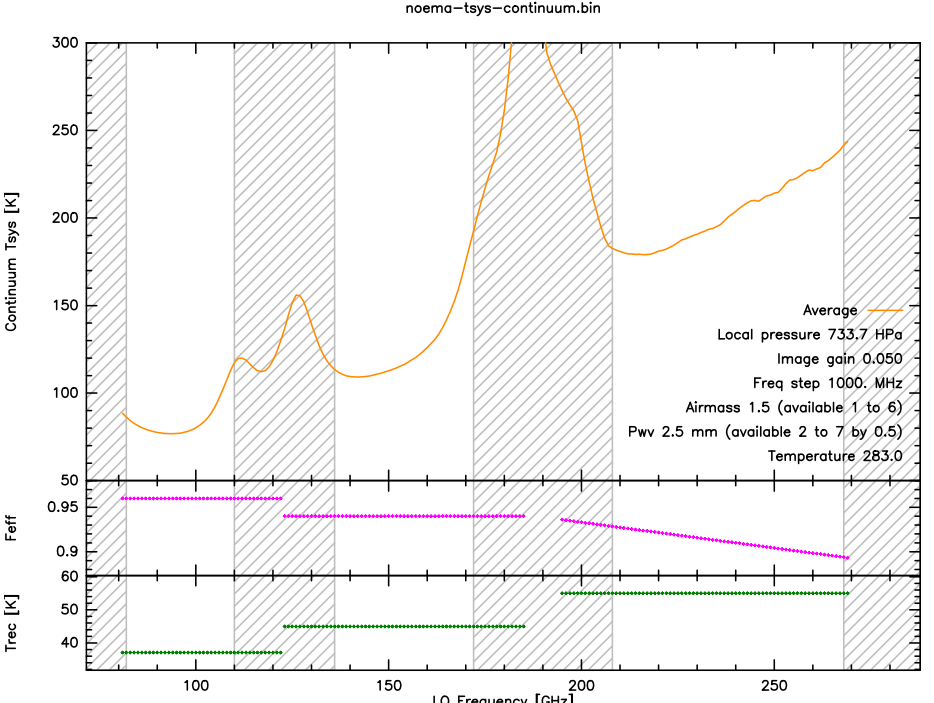
T_{sys}

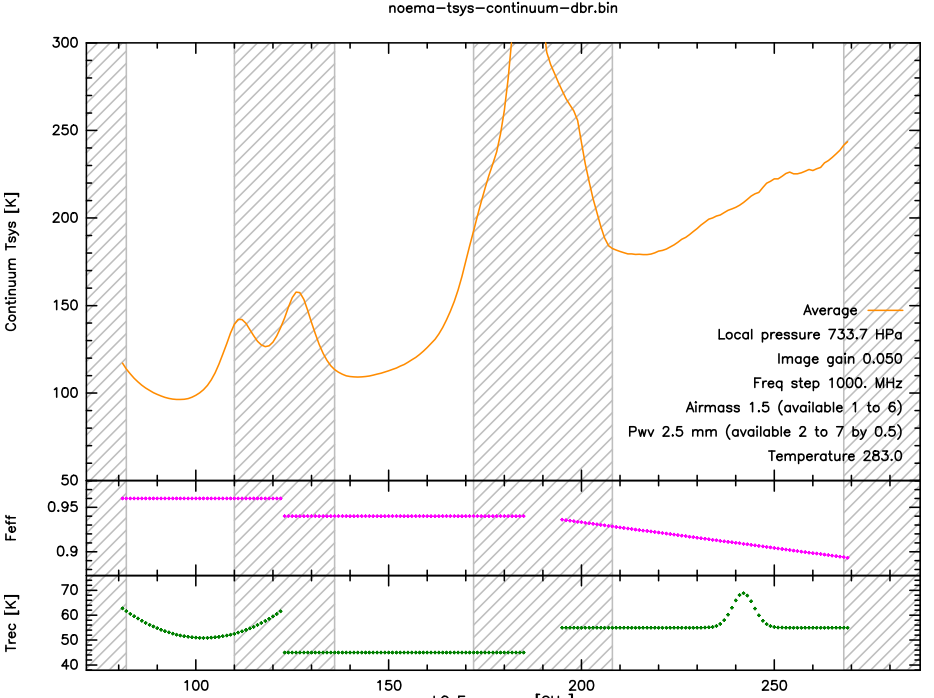

noema-tsys.bin
Temperature 273.0 K (winter)
Temperature 283.0 K (summer)
Local pressure 733.7 HPa
Image gain 0.050
Freq step 1000. MHz
Airmass 1.0 (available 1 to 6)
Pwv step 0.5 mm
7 mm
6 mm
5 mm
4 mm
3 mm
2 mm
Line Tsys [K]
Feff
Trec [K]
Freq [GHz]


noema-tsys-dbr.bin
Temperature 273.0 K (winter)
Temperature 283.0 K (summer)
Local pressure 733.7 HPa
Image gain 0.050
Freq step 1000. MHz
Airmass 1.0 (available 1 to 6)
Pwv step 0.5 mm
7 mm
6 mm
5 mm
4 mm
3 mm
2 mm
Line Tsys [K]
Feff
Trec [K]
Freq [GHz]


noema-tsys-continuum.bin
Continuum Tsys [K]
Feff
Trec [K]
LO Frequency [GHz]
Max
Min
Local pressure 733.7 HPa
Image gain 0.050
Freq step 1000. MHz
Airmass 1.5 (available 1 to 6)
Pwv 2.5 mm (available 2 to 7 by 0.5)
Temperature 283.0


noema-tsys-continuum-dbr.bin
Continuum Tsys [K]
Feff
Trec [K]
LO Frequency [GHz]
Max
Min
Local pressure 733.7 HPa
Image gain 0.050
Freq step 1000. MHz
Airmass 1.5 (available 1 to 6)
Pwv 2.5 mm (available 2 to 7 by 0.5)
Temperature 283.0


noema-tsys-continuum.bin
Continuum Tsys [K]
300
250
200
150
100
50
Average
Local pressure 733.7 HPa
Image gain 0.050
Freq step 1000. MHz
Airmass 1.5 (available 1 to 6)
Pwv 2.5 mm (available 2 to 7 by 0.5)
Temperature 283.0
Feff
0.95
0.9
Trec [K]
60
50
40
100
150
200
250
LO Frequency [GHz]


noema-tsys-continuum-dbr.bin
Continuum Tsys [K]
Feff
Trec [K]
LO Frequency [GHz]
Average
Local pressure 733.7 HPa
Image gain 0.050
Freq step 1000. MHz
Airmass 1.5 (available 1 to 6)
Pwv 2.5 mm (available 2 to 7 by 0.5)
Temperature 283.0

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

G_{im}

F_{eff}

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

τ_{S}

T_{atm}

T_{cab}

T_{rec}

$$\frac{1}{< T_{\rm sys} >^2} = \frac{1}{N} \sum \frac{1}{T_{\rm sys}^2}.$$

2×8

n_{pol}

$$\sigma_{\mathrm{Jy}} = \frac{J_{\mathrm{ant}}^{\mathrm{int}}\, T_{\mathrm{sys}}}{\eta_{\mathrm{spec}} \sqrt{n_{\mathrm{ant}} \left(n_{\mathrm{ant}} - 1\right) d\nu\, n_{\mathrm{pol}}\, \Delta t_{\mathrm{on}}}}.$$

$$\sigma_{\rm Jy} = \frac{J_{\rm ant}^{\rm int}\, T_{\rm sys}}{\eta_{\rm spec}\sqrt{n_{\rm ant}\,(n_{\rm ant}-1)\,d\nu\, n_{\rm pol}\,\Delta t_{\rm on}}} \quad \text{with} \quad J_{\rm ant}^{\rm int} = \frac{J_{\rm ant}^{\rm sd}}{\eta_{\rm atm}} \quad \text{and} \quad \eta_{\rm atm} = e^{-\frac{\phi_{\rm rms}^2}{2}} \leq 1.0,$$

$$\sigma_{\mathrm{K}} = \frac{\sigma_{\mathrm{Jy}}}{J_{\mathrm{ant}}^{\mathrm{syn}}} \quad \text{with} \quad J_{\mathrm{ant}}^{\mathrm{syn}} = \frac{2\pi\, k\, \theta_{\mathrm{maj}} \theta_{\mathrm{min}}}{4\, \ln 2\, \lambda^2}.$$

Δt_{tel}

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

$$\Delta t_{\mathrm{setup}} \sim 40$$

$$\Delta t_{\mathrm{setup}}$$

$$\boxed{\Delta t_{\mathrm{setup}} = \Delta t_{\mathrm{setupmin}} + \left(n_{\mathrm{freq}} - 1\right) \Delta t_{\mathrm{setup/freq}},}$$

$$\Delta t_{\mathrm{setupmin}}$$

$$\Delta t_{\mathrm{setup/freq}}$$

n_{track}

$$n_{\mathrm{track}} \times \Delta t_{\mathrm{setup}}$$

Δt_{obs}

$$\boxed{\Delta t_{\mathrm{obs}} = \Delta t_{\mathrm{tel}} - n_{\mathrm{track}} \times \Delta t_{\mathrm{setup}}.}$$

$$n_{\mathrm{track}} = \frac{\Delta t_{\mathrm{tel}}}{\Delta t_{\mathrm{visible}} + \Delta t_{\mathrm{setup}}},$$

$$\Delta t_{\text{visible}}$$

$0\,\mathrm{deg}$

$-10\,\mathrm{deg}$

$-20\,\mathrm{deg}$

$-30\,\mathrm{deg}$

$$\Delta t_{\mathrm{tel}} < \Delta t_{\mathrm{visible}} + \Delta t_{\mathrm{setup}}$$

$$\boxed{\Delta t_{\rm on} = \Delta t_{\rm obs} \times \eta_{\rm obs}}$$

$\eta_{\mathrm{obs}} < 1.0$

η_{obs}

$$n_{\mathrm{gaincal}} = 1$$

$$\eta_{\rm obs} = \frac{1}{\Omega_{\rm obs}} \quad \text{with} \quad \Omega_{\rm obs} = \Omega_{\rm min} + n_{\rm gaincal}\, n_{\rm freq}\, \Omega_{/\rm freq/gaincal}, \quad \Omega_{\rm min} = 1.3, \quad \text{and} \quad \Omega_{/\rm freq/gaincal} = 0.3.$$

$\Omega_{\min}$

$\Omega_{/\mathrm{freq}/\mathrm{gaincal}}$

$$\Omega_{\rm obs} = 1.6$$

$$\Omega_{\rm obs} = 1.9,$$

$$\lambda/(2d_{\mathrm{prim}})$$

$$d_{\mathrm{prim}}$$

η_{tot}

$$\boxed{\eta_{\mathrm{tot}} = \frac{\Sigma \Delta t_{\mathrm{on}}}{\Delta t_{\mathrm{tel}}}}$$

$$\eta_{\text{tot}} \leq 0.25$$

$$\sigma_{\mathrm{Jy}} = \frac{J_{\mathrm{ant}}^{\mathrm{int}}\, T_{\mathrm{sys}}}{\eta_{\mathrm{spec}} \sqrt{n_{\mathrm{ant}} \left(n_{\mathrm{ant}} - 1\right) d\nu\, n_{\mathrm{pol}}\, \Delta t_{\mathrm{on}}}},$$

$$\boxed{\Delta t_{\mathrm{on}} = \eta_{\mathrm{obs}}\, \eta_{\mathrm{freq}}\, \left(\Delta t_{\mathrm{tel}} \, - \, n_{\mathrm{track}} \times \Delta t_{\mathrm{setup}}\right),}$$

η_{freq}

$$\eta_{\text{freq}} = 1.0$$

$\eta_{\text{freq}} \sim 0.5$

η_{freq}

n_{sou}

$$\sigma_{\mathrm{Jy}} = \frac{J_{\mathrm{ant}}^{\mathrm{int}}\, T_{\mathrm{sys}}}{\eta_{\mathrm{spec}} \sqrt{n_{\mathrm{ant}} \left(n_{\mathrm{ant}} - 1\right) d\nu\, n_{\mathrm{pol}}\, \Delta t_{\mathrm{on}}}}$$

$$\boxed{\Delta t_{\mathrm{on}} = \eta_{\mathrm{obs}}\, \eta_{\mathrm{freq}} \left(\frac{\Delta t_{\mathrm{tel}} \; - \; n_{\mathrm{track}} \times \Delta t_{\mathrm{setup}}}{n_{\mathrm{sou}}} \right) .}$$

$$A_{\mathrm{map}}$$

n_{beam}

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

$$A_{\mathrm{beam}}$$

θ

$$A_{\rm beam} = \frac{0.8\,\pi\,\theta^2_{\rm prim}}{4\,\ln(2)},$$

$$\sigma_{\mathrm{Jy}} = \frac{J_{\mathrm{ant}}^{\mathrm{int}}\, T_{\mathrm{sys}}}{\eta_{\mathrm{spec}} \sqrt{n_{\mathrm{ant}} \left(n_{\mathrm{ant}} - 1\right) d\nu\, n_{\mathrm{pol}}\, \Delta t_{\mathrm{on}}}}$$

$$\Delta t_{\rm on} = \eta_{\rm obs}\eta_{\rm mos}\left(\frac{\Delta t_{\rm tel} - n_{\rm track} \times \Delta t_{\rm setup}}{n_{\rm beam}}\right), \quad \text{and} \quad \eta_{\rm mos} = \frac{\Delta t_{\rm point/cycle}}{\Delta t_{\rm point/cycle} + \Delta t_{\rm slew}},$$

$$\Delta t_{\text{point/cycle}}$$

$$\Delta t_{\mathrm{slew}}$$

n_{point}

$$n_{\text{point}} = n_{\text{beam}} \left(\frac{7}{4}\right)^2 ,$$

η_{mos}

$$\Delta t_{\mathrm{min}} \leq \Delta t_{\mathrm{int/scan}}$$

$$\Delta t_{\min} = 10$$

•

$$\frac{\Delta t_{\mathrm{int/scan}}}{1s} << \frac{6900}{\theta_{\mathrm{alias}}/\theta_{\mathrm{syn}}},$$

θ_{alias}

θ_{syn}

$$\Delta t_{\mathrm{int/scan}} \leq \eta \, \frac{6\,900}{1\,\mathrm{sec}} \sqrt{\frac{\theta_{\mathrm{maj}}\theta_{\mathrm{min}}}{A_{\mathrm{map}}}},$$

η

sec

10

$$\leq \Delta t_{\mathrm{int/scan}} = \min\left(45\,\mathrm{sec}, \eta\,\frac{6\,900}{1\,\mathrm{sec}}\sqrt{\frac{\theta_{\mathrm{maj}}\theta_{\mathrm{min}}}{A_{\mathrm{map}}}}\right) \quad \text{with} \quad \eta = 0.5.$$

$$\Delta t_{\mathrm{slew}} = 11$$

$$0.47 \leq \eta_{\mathrm{mos}} \leq 1.0.$$

$$\eta_{\mathrm{mos}} = 0.67$$

$$\Delta t_{\min}$$

$n_{\text{repeat/point/cycle}}$

$$\eta_{\mathrm{mos}} = \frac{\Delta t_{\mathrm{point/cycle}}}{\Delta t_{\mathrm{point/cycle}} + \Delta t_{\mathrm{slew}}}$$

$$\Delta t_{\mathrm{cycle}} = n_{\mathrm{point/track}} \left(\Delta t_{\mathrm{point/cycle}} + \Delta t_{\mathrm{slew}} \right),$$

$$\Delta t_{\mathrm{point/cycle}} = n_{\mathrm{repeat/point/cycle}}\, \Delta t_{\mathrm{int/scan}}.$$

$$\Delta t_{\mathrm{calmax}} = 25$$

$$n^{\max}_{\mathrm{repeat/point/cycle}} = \frac{\Delta t_{\mathrm{calmax}}/n_{\mathrm{point/track}} - \Delta t_{\mathrm{slew}}}{\Delta t_{\mathrm{int/scan}}},$$

$$\eta_{\mathrm{mos}} = 1 - \frac{n_{\mathrm{point/track}}\,\Delta t_{\mathrm{slew}}}{\Delta t_{\mathrm{calmax}}}.$$

$$n^{\text{large}}_{\text{point/track}} = \text{floor}\left(\frac{\Delta t_{\text{calmax}}}{\Delta t_{\text{int/scan}} + \Delta t_{\text{slew}}}\right).$$

$$\Delta t_{\mathrm{cyclemax}}$$

$$n^{\max}_{\mathrm{point/track}} = \frac{\Delta t_{\mathrm{cyclemax}}}{\Delta t_{\mathrm{min}} + \Delta t_{\mathrm{slew}}} \sim 150.$$

$$\Delta t_{\mathrm{int/scan}} = \min\left\{\Delta t_{\mathrm{int/scan}}, \left(\frac{\Delta t_{\mathrm{cyclemax}}}{n_{\mathrm{point/track}}} - \Delta t_{\mathrm{slew}}\right)\right\}.$$

$$\eta_{\min} = \frac{\Delta t_{\min}}{\Delta t_{\min} + \Delta t_{\text{slew}}} = 0.47.$$

$$n_{\rm beam} = \frac{A_{\rm map}}{A_{\rm beam}}, \quad \text{where} \quad A_{\rm beam} = \frac{0.8\,\pi\,\theta^2_{\rm prim}}{4\,\ln(2)}.$$

$$\boxed{n_{\text{point}} = n_{\text{beam}} \left(\frac{7}{4}\right)^2, \quad \text{and} \quad n_{\text{point/track}} = \min\left(n_{\text{point}}, \frac{n_{\text{point}}}{n_{\text{track}}}\right).}$$

$$10\,\mathrm{sec} \leq \Delta t_{\mathrm{int/scan}} = \min\left(45\,\mathrm{sec}, \eta\,\frac{6\,900}{1\,\mathrm{sec}}\sqrt{\frac{\theta_{\mathrm{maj}}\theta_{\mathrm{min}}}{A_{\mathrm{map}}}}\right) \quad \text{with} \quad \eta = 0.5.$$

$$n^{\text{large}}_{\text{point/track}} = \text{floor}\left(\frac{\Delta t_{\text{calmax}}}{\Delta t_{\text{int/scan}} + \Delta t_{\text{slew}}}\right), \quad \text{where} \quad \Delta t_{\text{slew}} = 11\,\text{sec}, \quad \text{and} \quad \Delta t_{\text{calmax}} = 25\,\text{min}.$$

$$(n_{\text{point/track}} \leq n^{\text{large}}_{\text{point/track}})$$

$$n^{\max}_{\mathrm{repeat/point/cycle}} = \frac{\frac{\Delta t_{\mathrm{calmax}}}{n_{\mathrm{point/track}}} - \Delta t_{\mathrm{slew}}}{\Delta t_{\mathrm{int/scan}}}.$$

$$(n_{\text{point/track}} > n^{\text{large}}_{\text{point/track}})$$

$$n^{\max}_{\text{repeat/point/cycle}} = 1$$

$$n_{\text{point/track}} \leq n^{\max}_{\text{point/track}}, \quad \text{where} \quad n^{\max}_{\text{point/track}} = \frac{\Delta t_{\text{cyclemax}}}{\Delta t_{\min} + \Delta t_{\text{slew}}} \sim 150, \quad \text{and} \quad \Delta t_{\text{cyclemax}} = 60\,\text{min}.$$

$$\text{if} \quad n_{\text{point/track}} > n^{\text{large}}_{\text{point/track}}, \quad \text{then} \quad \Delta t_{\text{int/scan}} = \min\left\{\Delta t_{\text{int/scan}}, \left(\frac{\Delta t_{\text{cyclemax}}}{n_{\text{point/track}}} - \Delta t_{\text{slew}}\right)\right\}.$$

$$\eta_{\mathrm{mos}} = \frac{\Delta t_{\mathrm{point/cycle}}}{\Delta t_{\mathrm{point/cycle}} + \Delta t_{\mathrm{slew}}}, \quad \text{and} \quad \Delta t_{\mathrm{point/cycle}} = n^{\mathrm{max}}_{\mathrm{repeat/point/cycle}}\, \Delta t_{\mathrm{int/scan}},$$

$$\boxed{\Delta t_{\mathrm{cycle}} = n_{\mathrm{point/track}} \left(\Delta t_{\mathrm{point/cycle}} + \Delta t_{\mathrm{slew}} \right) .}$$

$$\sigma_{\mathrm{Jy}} = \frac{J_{\mathrm{ant}}^{\mathrm{int}}\, T_{\mathrm{sys}}}{\eta_{\mathrm{spec}} \sqrt{n_{\mathrm{ant}}\,(n_{\mathrm{ant}}-1)\, d\nu\, n_{\mathrm{pol}}\, \Delta t_{\mathrm{on}}}}, \quad \text{and} \quad \Delta t_{\mathrm{on}} = \eta_{\mathrm{obs}}\eta_{\mathrm{mos}} \left(\frac{\Delta t_{\mathrm{tel}} - n_{\mathrm{track}} \times \Delta t_{\mathrm{setup}}}{n_{\mathrm{beam}}} \right).$$

ν

$$\sigma_{\mathrm{Jy,point}}(\nu) = \frac{J_{\mathrm{ant}}^{\mathrm{int}}(\nu)\, T_{\mathrm{sys}}(\nu)}{\eta_{\mathrm{spec}} \sqrt{n_{\mathrm{ant}}\,(n_{\mathrm{ant}} - 1)\, d\nu\, n_{\mathrm{pol}}\, \Delta t_{\mathrm{on,point}}}},$$

$$\Delta t_{\mathrm{on,point}} = \eta_{\mathrm{obs}}\, \eta_{\mathrm{mos}} \left(\frac{\Delta t_{\mathrm{tel}} \; - \; n_{\mathrm{track}} \times \Delta t_{\mathrm{setup}}}{n_{\mathrm{point}}} \right) .$$

$$B_i(p, \nu)$$

p

$$f_\nu(p) = \left[\sum_{i=1}^{n_{\mathrm{point}}} B_i^2(p,\nu) \right]^{-1/2} .$$

$$\sigma_{\mathrm{Jy,mos}}(p,\nu) = \sigma_{\mathrm{Jy,point}}(\nu)\, f_\nu(p),$$

$$\sigma_{\mathrm{Jy,mos}}(p,\nu) = \frac{J_{\mathrm{ant}}^{\mathrm{int}}(\nu)\, T_{\mathrm{sys}}(\nu)}{\eta_{\mathrm{spec}}\, \sqrt{n_{\mathrm{ant}}\,(n_{\mathrm{ant}}-1)\, d\nu\, n_{\mathrm{pol}}\, \Delta t_{\mathrm{on,point}}}} \left[\sum_{i=1}^{n_{\mathrm{point}}} B_i^2(p,\nu) \right]^{-1/2} .$$

$$\mathcal{A}_\nu = \{p \,|\, f_\nu(p) \text{ is not blanked}\}\,.$$

$$\sigma_{\mathrm{Jy,typ}}(\nu) = \mathrm{median}_{p \in \mathcal{A}_\nu} \left\{ \sigma_{\mathrm{Jy,mos}}(p, \nu) \right\}.$$

$$\sigma_{\mathrm{Jy,typ}}(\nu) = \sigma_{\mathrm{Jy,point}}(\nu)\,\tilde{f}_{\nu},$$

$$\widetilde{f}_\nu = \mathrm{median}_{p \in \mathcal{A}_\nu} \left\{ f_\nu(p) \right\}.$$

$\mathcal{A}_\nu$

$$\sigma_{\mathrm{Jy,min}}(\nu), \quad \sigma_{\mathrm{Jy,typ}}(\nu), \quad \sigma_{\mathrm{Jy,max}}(\nu).$$

$$A_{\mathrm{img}}(\nu) = N_{\mathrm{valid}}(\nu)\,\Omega_{\mathrm{pix}}.$$

$$A_{\mathrm{img}}(\nu_1)$$

$$A_{\mathrm{img}}(\nu_2)$$

$$\nu_1 < \nu_2$$

ν_1

ν_2

$$A_{\text{overlap}} = A_{\text{img}}(\nu_2).$$

$$P_{1\cap 2|1} = 100\,\frac{A_{\mathrm{img}}(\nu_2)}{A_{\mathrm{img}}(\nu_1)}, \quad P_{1\cap 2|2} = 100\%.$$

$$n_{\mathrm{beam,geom}}(\nu) = \frac{A_{\mathrm{img}}(\nu)}{A_{\mathrm{beam}}(\nu)}.$$

$$\boxed{n_{\mathrm{beam,eq}}(\nu) = n_{\mathrm{point}}\, \tilde{f}_{\nu}^{2}.}$$

$n_{\mathrm{beam,eq}}$

$$n_{\mathrm{beam,geom}}(\nu)$$

$$\boxed{f_\nu(p) = \frac{1}{\sqrt{\sum_{i=1}^{n_{\text{point}}} B_{i,\nu}^2(p)}}.}$$

$$B_{i,\nu}(p)$$

$$\boxed{A_{\mathrm{img}}(\nu) = N_{\mathrm{valid}}(\nu)\,\Omega_{\mathrm{pix}},}$$

$$\boxed{\widetilde{f}_\nu = \mathrm{median}_{p \in \mathcal{A}_\nu} \left[f_\nu(p) \right],}$$

ν

$$f_\nu(p)$$

$$\boxed{A_{\mathrm{map}} \longrightarrow A_{\mathrm{img}}(\nu).}$$

$$n_{\text{point}} = \text{number of pointings in the PMS pointing list}, \quad \text{and} \quad n_{\text{point/track}} = \min\left(n_{\text{point}}, \frac{n_{\text{point}}}{n_{\text{track}}}\right).$$

$$n_{\text{point}} = n_{\text{beam}} \left(\frac{7}{4} \right)^2$$

$$\Delta t_{\mathrm{on,point}} = \eta_{\mathrm{obs}}\, \eta_{\mathrm{mos}} \left(\frac{\Delta t_{\mathrm{tel}} \; - \; n_{\mathrm{track}} \times \Delta t_{\mathrm{setup}}}{n_{\mathrm{point}}} \right),$$

$$\sigma_{\mathrm{Jy,point}}(\nu) = \frac{J_{\mathrm{ant}}^{\mathrm{int}}(\nu)\, T_{\mathrm{sys}}(\nu)}{\eta_{\mathrm{spec}} \sqrt{n_{\mathrm{ant}}\,(n_{\mathrm{ant}} - 1)\, d\nu\, n_{\mathrm{pol}}\, \Delta t_{\mathrm{on,point}}}}.$$

$$\boxed{\sigma_{\mathrm{Jy,typ}}(\nu) = \sigma_{\mathrm{Jy,point}}(\nu)\,\tilde{f}_{\nu}.}$$

$$\boxed{n_{\mathrm{beam,eq}}(\nu) = n_{\mathrm{point}}\, \tilde{f}_{\nu}^{2}.}$$

P_{ant}

θ, ϕ

θ

ϕ

$$\boxed{\Omega_{\mathrm{ant}}(\nu) = \iint_{4\pi} P_{\mathrm{ant}}(\theta, \phi, \nu)\, d\Omega,}$$

sr

dimensionless

$d\Omega$

$$(= \sin\theta \, d\theta \, d\phi)$$

2π

$$\Omega_{\mathrm{fb}}(\nu) = \iint_{2\pi} P_{\mathrm{ant}}(\theta, \phi, \nu)\, d\Omega, \quad \text{and} \quad \Omega_{\mathrm{mb}}(\nu) = \iint_{\text{main lobe}} P_{\mathrm{ant}}(\theta, \phi, \nu)\, d\Omega.$$

$$\boxed{F_{\text{eff}} = \frac{\Omega_{\text{fb}}}{\Omega_{\text{ant}}}, \quad \text{and} \quad B_{\text{eff}} = \frac{\Omega_{\text{mb}}}{\Omega_{\text{ant}}}.}$$

$$\boxed{F_{\mathrm{sou}}(\nu) = \iint_{\mathrm{source}} B(\theta, \phi, \nu)\, d\Omega,}$$

F_{sou}

$\mathrm{W\,m^{-2}\,Hz^{-1}}$

B

$\mathrm{W\,m^{-2}\,Hz^{-1}\,sr^{-1}}$

θ_0, ϕ_0

$$F_{\rm obs}(\theta_0, \phi_0, \nu) = \iint_{\rm source} B(\theta, \phi, \nu)\, P_{\rm ant}(\theta - \theta_0, \phi - \phi_0, \nu)\, d\Omega,$$

F_{obs}

$$F_{\rm obs}(\theta_0, \phi_0, \nu) = \iint_{\rm source} B(\theta, \phi, \nu)\, \tilde{P}_{\rm ant}(\theta_0 - \theta, \phi_0 - \phi, \nu)\, d\Omega,$$

$$\tilde{P}_{\mathrm{ant}}(\theta_0 - \theta, \phi_0 - \phi, \nu) = P_{\mathrm{ant}}(\theta - \theta_0, \phi - \phi_0, \nu).$$

$$B_{\rm obs}(\theta_0, \phi_0, \nu) = \frac{1}{\Omega} \iint_{\rm source} B(\theta, \phi, \nu)\, \tilde{P}_{\rm ant}(\theta_0 - \theta, \phi_0 - \phi, \nu)\, d\Omega,$$

B_{obs}

Ω

Ω_{fb}

Ω_{mb}

$$B_{\mathrm{ant}}(\theta_0, \phi_0, \nu)$$

$$= \frac{1}{\Omega_{\mathrm{ant}}} \iint_{\mathrm{source}} B(\theta, \phi, \nu)\, \tilde{P}_{\mathrm{ant}}(\theta_0 - \theta, \phi_0 - \phi, \nu)\, d\Omega,$$

$$B_{\mathrm{fb}}(\theta_0, \phi_0, \nu)$$

$$= \frac{1}{\Omega_{\mathrm{fb}}} \iint_{\mathrm{source}} B(\theta, \phi, \nu)\, \tilde{P}_{\mathrm{ant}}(\theta_0 - \theta, \phi_0 - \phi, \nu)\, d\Omega,$$

$$B_{\mathrm{mb}}(\theta_0, \phi_0, \nu)$$

$$= \frac{1}{\Omega_{\mathrm{mb}}} \iint_{\mathrm{source}} B(\theta, \phi, \nu)\, \tilde{P}_{\mathrm{ant}}(\theta_0 - \theta, \phi_0 - \phi, \nu)\, d\Omega.$$

$$\boxed{B_{\mathrm{fb}} = \frac{1}{F_{\mathrm{eff}}}\, B_{\mathrm{ant}} \quad \text{and} \quad B_{\mathrm{mb}} = \frac{F_{\mathrm{eff}}}{B_{\mathrm{eff}}}\, B_{\mathrm{fb}}.}$$

$$dw(\theta, \phi, \nu) = B(\theta, \phi, \nu)\, \cos\theta\, d\Omega\, dA,$$

dw

$\mathrm{W\,Hz^{-1}}$

$$dA$$

m^2

R

T

$$dw = k\,T.$$

$$T_{\mathrm{mb}}(\theta_0, \phi_0, \nu) = \frac{1}{\Omega_{\mathrm{mb}}} \iint_{\mathrm{source}} B(\theta, \phi, \nu)\, \tilde{P}_{\mathrm{ant}}(\theta_0 - \theta, \phi_0 - \phi, \nu)\, d\Omega.$$

$$(h\nu \ll kT)$$

$$h\nu \sim kT$$

$$k = 1.380658 \times 10^{23}\,\mathrm{J\,K^{-1}}$$

$$dw(\theta_0, \phi_0, \nu) = \frac{1}{2} A_{\rm eff} \iint_{\rm source} B(\theta, \phi, \nu)\, \tilde{P}_{\rm ant}(\theta_0 - \theta, \phi_0 - \phi, \nu)\, d\Omega.$$

m^{-2}

η_{ant}

$$\eta_{\mathrm{ant}} = \frac{A_{\mathrm{eff}}}{A_{\mathrm{geo}}} < 1,$$

$$A_{\mathrm{geo}} = \pi \left(\frac{D_{\mathrm{ant}}}{2} \right)^2 .$$

$$\boxed{A_{\mathrm{eff}}(\nu)\,\Omega_{\mathrm{ant}}(\nu) = \lambda^2,}$$

$$B(\theta, \phi, \nu) = \frac{2\,kT}{\lambda^2},$$

$$dw(\theta_0, \phi_0, \nu) = \frac{1}{2}\, A_{\rm eff} \iint_{\rm source} B(\theta, \phi, \nu)\, \tilde{P}_{\rm ant}(\theta_0 - \theta, \phi_0 - \phi, \nu)\, d\Omega = \frac{1}{2}\, A_{\rm eff}\, \Omega_{\rm ant}(\nu)\, \frac{2\, kT}{\lambda^2}.$$

$$dw(\theta_0, \phi_0, \nu) = k\,T,$$

4π sr

$$\boxed{A_{\rm eff}(\nu)\,\Omega_{\rm fb}(\nu) = \lambda^2\,F_{\rm eff}(\nu) \quad \text{and} \quad A_{\rm eff}(\nu)\,\Omega_{\rm mb}(\nu) = \lambda^2\,B_{\rm eff}(\nu).}$$

$$B_{\mathrm{eff}}(\nu) = \eta_{\mathrm{ant}}\, A_{\mathrm{geo}}\, \frac{\Omega_{\mathrm{mb}}(\nu)}{\lambda^2}.$$

$$A_{\mathrm{geo}} = \frac{\pi}{4} D^2, \quad \frac{\Omega_{\mathrm{mb}}(\nu)}{\lambda^2} = \frac{\pi}{4 \ln 2} \left(\frac{\theta_{\mathrm{mb}}}{\lambda} \right)^2,$$

$$\theta_{\mathrm{mb}} = \alpha \frac{\lambda}{D},$$

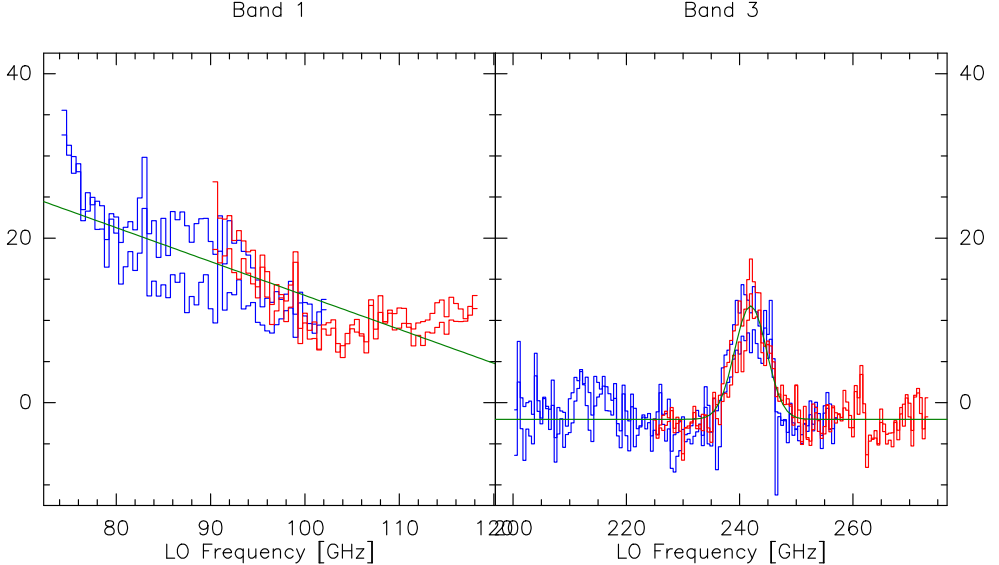
$$\boxed{B_{\rm eff}(\nu) = \frac{\pi^2}{16\ln 2}\alpha^2\ \eta_{\rm ant}(\nu) \simeq 0.8899\,\alpha^2\,\eta_{\rm ant}(\nu).}$$

α

$\alpha \sim 1.2$

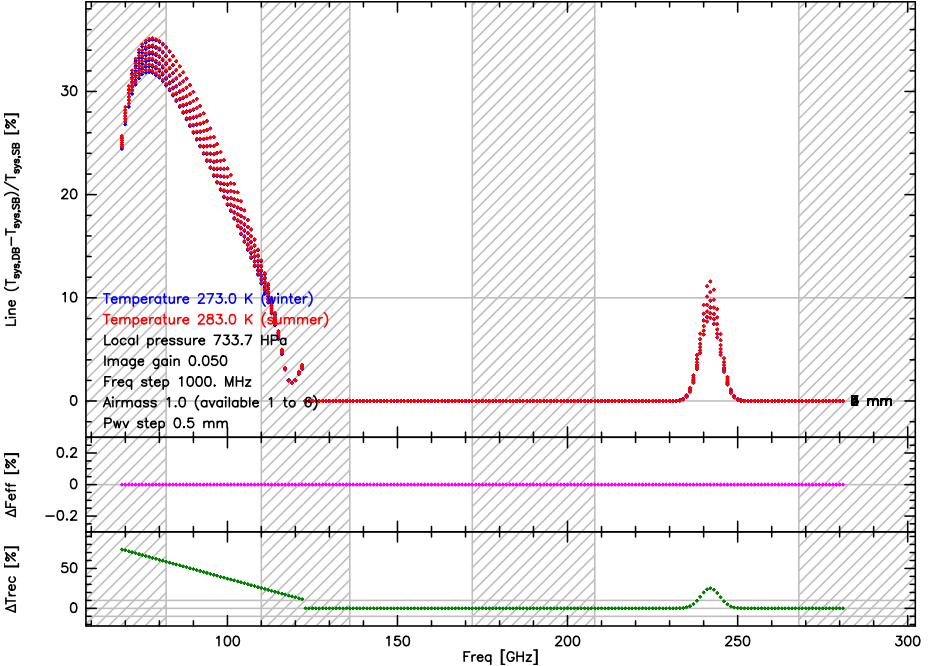
$$\left(\sigma\right)$$

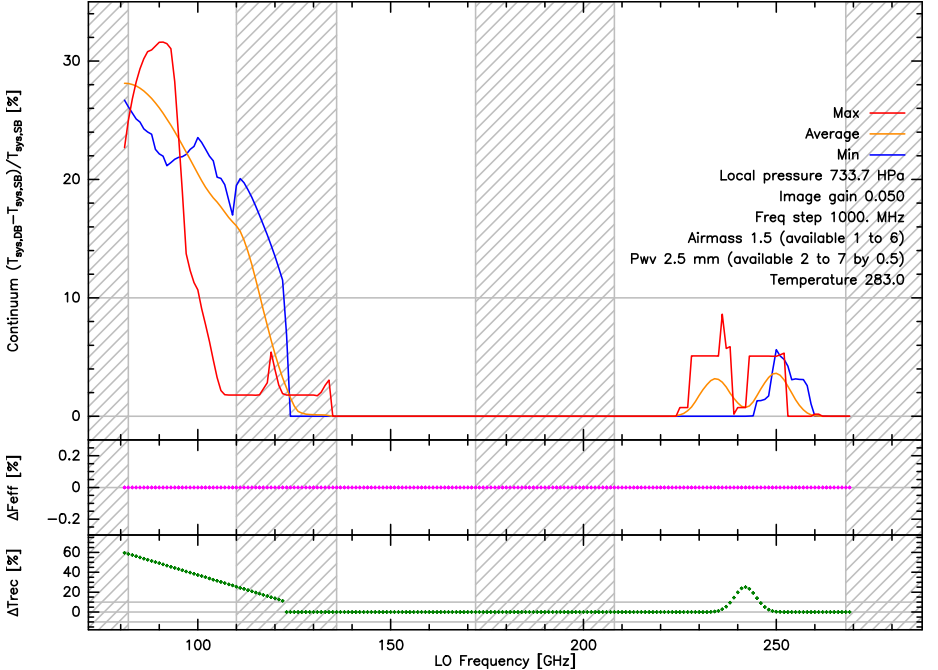
$$\boxed{\eta_{\mathrm{ant}}(\nu) = \eta_{\mathrm{ant}}^{0}\ \exp\left\{-\left(\frac{4\pi\sigma}{\lambda}\right)^{2}\right\}.}$$

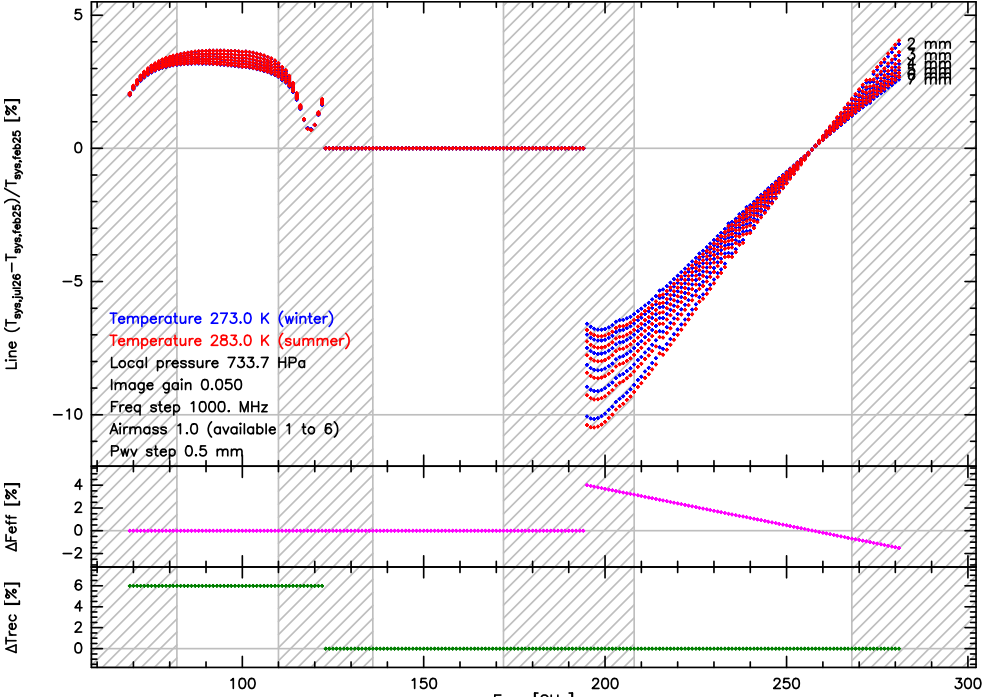

Band 1
Band 3
40
20
0
80
90
100
110
120
LO Frequency [GHz]
200
220
240
260
LO Frequency [GHz]

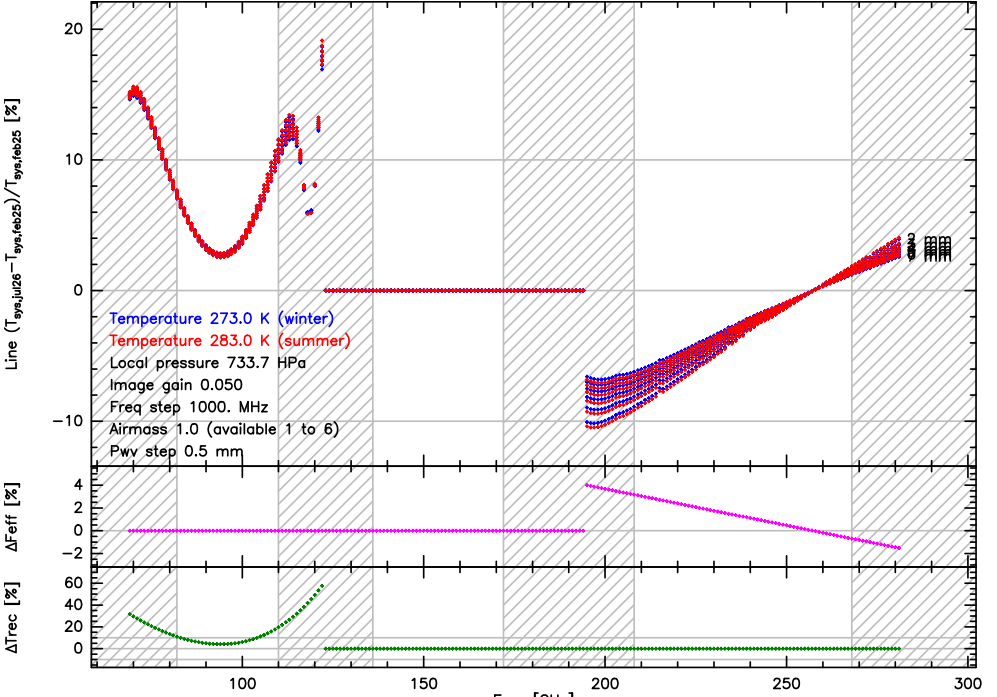
T_{rec}

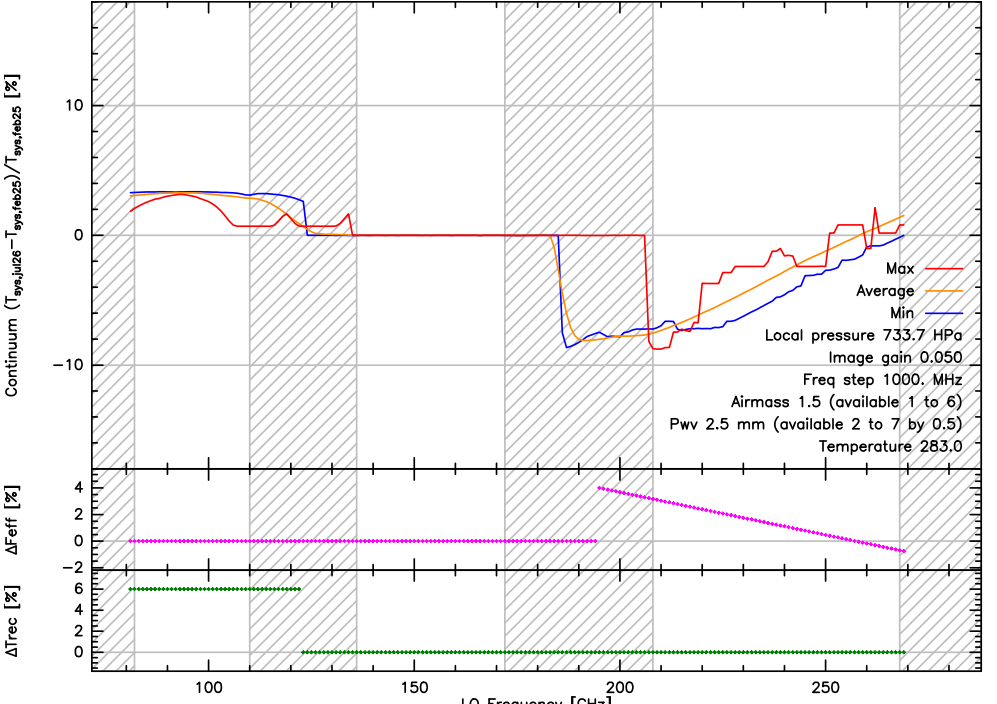
F_{eff}

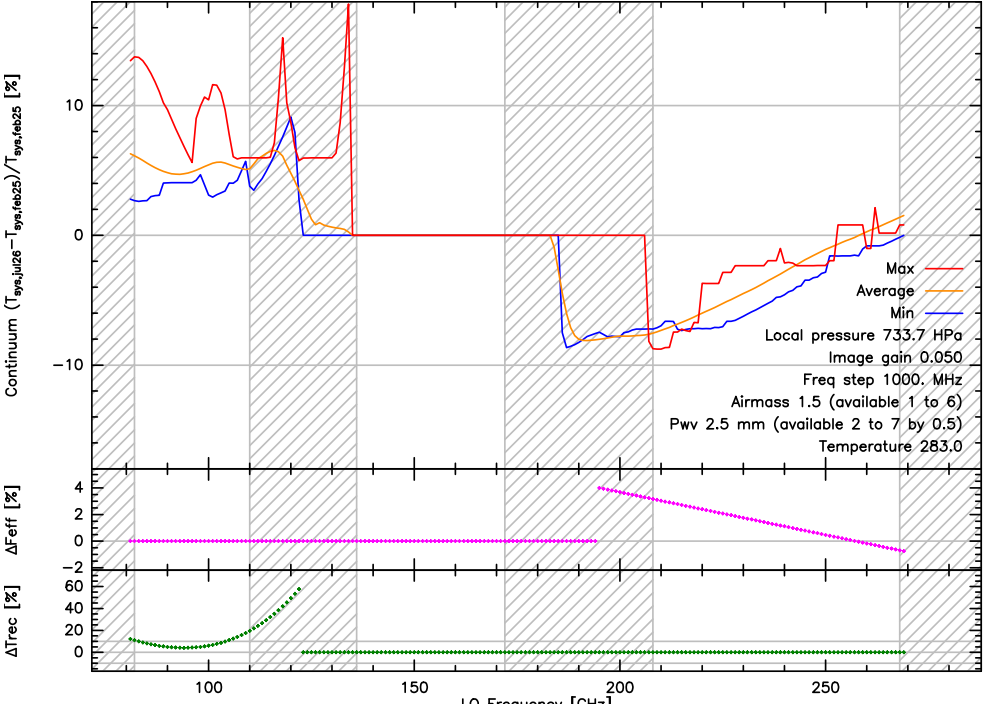

Line (T_sys,DB−T_sys,SB)/T_sys,SB [%]
Temperature 273.0 K (winter)
Temperature 283.0 K (summer)
Local pressure 733.7 HPa
Image gain 0.050
Freq step 1000. MHz
Airmass 1.0 (available 1 to 6)
Pwv step 0.5 mm
ΔFeff [%]
ΔTrec [%]
Freq [GHz]


Max
Average
Min
Local pressure 733.7 HPa
Image gain 0.050
Freq step 1000. MHz
Airmass 1.5 (available 1 to 6)
Pwv 2.5 mm (available 2 to 7 by 0.5)
Temperature 283.0
Continuum ($T_{sys,DB}-T_{sys,SB}$)/$T_{sys,SB}$ [%]
ΔFeff [%]
ΔTrec [%]
LO Frequency [GHz]
0
10
20
30
0.2
0
−0.2
60
40
20
0
100
150
200
250


2 mm
3 mm
4 mm
5 mm
6 mm
7 mm
Temperature 273.0 K (winter)
Temperature 283.0 K (summer)
Local pressure 733.7 HPa
Image gain 0.050
Freq step 1000. MHz
Airmass 1.0 (available 1 to 6)
Pwv step 0.5 mm
Line (T_sys,jul26−T_sys,feb25)/T_sys,feb25 [%]
ΔFeff [%]
ΔTrec [%]
Freq [GHz]


Line (T_sys,jul26−T_sys,feb25)/T_sys,feb25 [%]
20
10
0
−10
Temperature 273.0 K (winter)
Temperature 283.0 K (summer)
Local pressure 733.7 HPa
Image gain 0.050
Freq step 1000. MHz
Airmass 1.0 (available 1 to 6)
Pwv step 0.5 mm
ΔFeff [%]
4
2
0
−2
ΔTrec [%]
60
40
20
0
100
150
200
250
300
Freq [GHz]


Continuum (T_sys,jul26 − T_sys,feb25)/T_sys,feb25 [%]
10
0
−10
Max
Average
Min
Local pressure 733.7 HPa
Image gain 0.050
Freq step 1000. MHz
Airmass 1.5 (available 1 to 6)
Pwv 2.5 mm (available 2 to 7 by 0.5)
Temperature 283.0
ΔFeff [%]
4
2
0
−2
ΔTrec [%]
6
4
2
0
100
150
200
250
LO Frequency [GHz]


Continuum (T_sys,jul26 − T_sys,feb25)/T_sys,feb25 [%]
10
0
−10
Max
Average
Min
Local pressure 733.7 HPa
Image gain 0.050
Freq step 1000. MHz
Airmass 1.5 (available 1 to 6)
Pwv 2.5 mm (available 2 to 7 by 0.5)
Temperature 283.0
ΔFeff [%]
4
2
0
−2
ΔTrec [%]
60
40
20
0
100
150
200
250
LO Frequency [GHz]