Estimating Observing Time

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The sensitivity of an observation is given by:

$$\sigma = \frac{K_1 T_{sys}}{\sqrt{K_2 t_{eff} N_{pol} BW / N_{chan}}}$$

K_1 is the backend sampling efficiency and is 1.032 for the Spectrometer with 9-level sampling or 1.235 with 3-level sampling. It is 1.3 for the Spectral Processor. K_2 is the autocorrelator weighting function and should be 1.21 for uniform weighting, which is the only appropriate value for the Spectrometer or Spectral Processor. Hanning weighting is not an available mode.

where,

$$t_{eff} = \frac{t_{on} t_{off}}{t_{on} + t_{off}}$$

Generally $t_{on}=t_{off}$ and $t_{obs} = t_{on}+t_{off}$

For single-beam position-switching or out-of-band frequency-switching,

$$t_{eff} = t_{on}/2 = t_{obs}/4$$

For nodding with a dual beam receiver or in-band frequency-switching,

$$t_{eff} = t_{on}/2 = t_{obs}/2$$

implying $t_{on}=t_{off}=t_{obs}$.

This does not include any estimate for overhead. Overhead should range from about 10% at low frequencies to 50% at high frequencies.

Get your T_{sys} values from Table 3 of the Proposer's Guide and/or from "Observation Planning Guide" (www.gb.nrao.edu/~rmaddale/GBT/ReceiverPerformance/PlaningObservations.htm) use either 25th percentile conditions or the appropriate percentile given dynamic scheduling considerations.

Useful Tools:

- Sensitivity Calculator: www.gb.nrao.edu/GBT/setups/senscalc.html
- Spectral Advisor: www.gb.nrao.edu/GBT/setups/configwiz.html
- Paul Ruffle's Open Office Spreadsheet (at www.gb.nrao.edu/gbt/support)