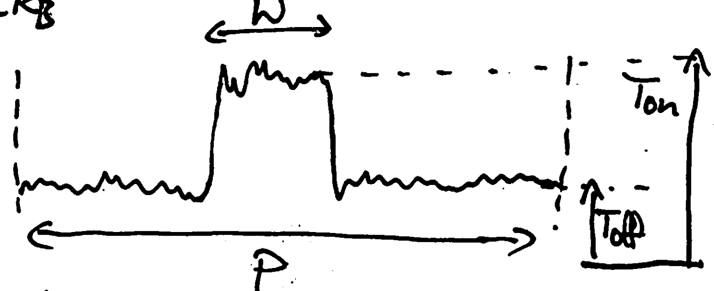
Crab telescope sensitivity

Crab pulsar mean flux density @ 408 MHz $\simeq$ 550 mJy
S_{mean}

Antenna temp $T_A = \dfrac{S_{peak} A_{eff}}{2 k_B}$ about $10\,m^2$

Take a 'top hat' pulse :



If $T_A \ll T_{sys}$, after τ of integration:

$$\sigma^2_{T_{on}} = \frac{T_{sys}^2}{\left(\Delta\nu \frac{W}{P} \tau\right)} \;;\quad \sigma^2_{T_{off}} = \frac{T_{sys}^2}{\left(\Delta\nu \frac{P-W}{P} \tau\right)}$$

$$SNR = \frac{\langle T_{on}\rangle - \langle T_{off}\rangle}{\sqrt{\sigma^2_{T_{on}} + \sigma^2_{T_{off}}}} = \frac{T_A}{T_{sys}} \sqrt{\Delta\nu\tau} \cdot \frac{W(P-W)}{P^2}$$

ie $$SNR = \frac{S_{peak} A_{eff}}{2 k_B T_{sys}} \sqrt{\Delta\nu\tau} \frac{\sqrt{W(P-W)}}{P}$$

$$S_{mean} = S_{peak}\left(\frac{W}{P}\right)$$

so $$SNR = \frac{S_{mean} A_{eff}}{2 k_B T_{sys}} \sqrt{\Delta\nu\tau} \frac{\sqrt{W(P-W)}}{\cancel{P}} \frac{\cancel{P}}{W}$$

$$= \frac{S_{mean} A_{eff}}{2 k_B T_{sys}} \sqrt{\Delta\nu\tau} \sqrt{\frac{(P-W)}{W}} = \sqrt{\frac{P}{W} - 1}$$

$$\frac{1}{2} SA = kT_A \Rightarrow T_A = \frac{SA}{2k}$$

$$\text{SNR} = \frac{SA}{2kT_{sys}} \sqrt{\Delta\nu \tau}$$

If $S = S_{mean} \cdot \frac{P}{W}$ ← period, ← width

$$\text{SNR} = S_{mean} \frac{P}{W} \frac{A}{2kT_{sys}} \sqrt{\Delta\nu \tau_0 \cdot W/P}$$

$$= S_{mean} \sqrt{\frac{P}{W}} \frac{A}{2kT} \sqrt{\Delta\nu \tau}$$

10

12h

4MHz

120

550mJy

2·7

$\Rightarrow$ SNR of 18

gas 19830·681

ele 34638