

Survey Speed

$$SS = 0.211 \left(\frac{4}{\pi} \right)^2 \left(\frac{A_{eff}}{T_{sys}} \right)^2 BS_{min}^2 \Omega_{FOV} \left[\frac{\text{deg}^2}{s} \right]$$

$$SS = 161 \left(\frac{4}{\pi} \right)^2 \left(\frac{A_{eff}}{T_{sys}} \right)^2 BS_{min}^2 \Omega_{FOV} \left[\frac{\text{fractionalsky}}{\text{year}} \right]$$

- A_{eff} in m^2 ; T_{sys} in K; B in GHz; S_{min} in mJy; Ω_{FOV} in ster.
- This form has no explicit dependence on antenna size or λ .
- A , T_{sys} & Ω_{FOV}
 - expensive instrumental parameters.
 - B also an instrumental parameter for continuum observations.
- S_{min}
 - determined by “science”.
 - B determined by science for line observations.

SKA (Reference Design Specs)

- Specifications over 300-3000 MHz.
 - $A_{\text{eff}}/T_{\text{sys}} = 20000 \text{ m}^2/\text{K}$.
 - $\Omega_{\text{FOV}} = 50 \text{ deg}^2$ ($f < 1 \text{ GHz}$); $1\text{-}10 \text{ deg}^2$ ($f > 1 \text{ GHz}$).
- $T_{\text{sys}} = 25 \text{ K}$ (my guarded assumption, uncooled).
- Implications for astronomy e.g. HI-line galaxy survey:
 - To observe all M^* galaxies ($7 \times 10^9 M_{\text{solar}}$) at $z = 0.3$ requires $\sim 0.1 \text{ mJy}$ sensitivity (5σ).
 - $ss = 320 \text{ halvesky / yr}$.
 - At $z = 1$, $ss = 12.8 \text{ halvesky / yr}$.
 - At $z = 3$, $ss = 0.13 \text{ halvesky / yr}$.

Half-sky, 5-year HI Galaxy Survey Simulation

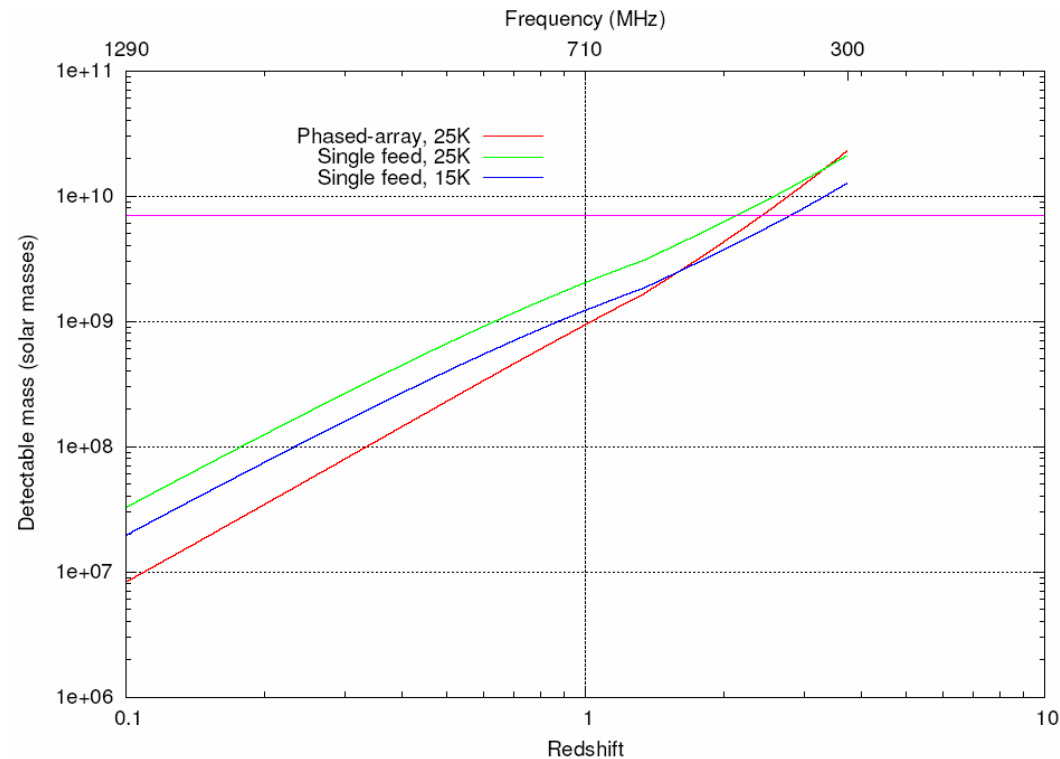
$$SS = 0.2111 \left(\frac{4}{\pi} \right)^2 \left(\frac{A_{sys}}{T_{sys}} \right)^2 BS(z)_{min}^2 \Omega_{sp} \left[\frac{\text{deg}^2}{s} \right]$$

$$SS = 0.2111 \left(\frac{4}{\pi} \right) \left(\frac{A_{sys}}{T_{sys}} \right)^2 BS(z)_{min}^2 \frac{\lambda^2}{D_{ant}^2} \left[\frac{\text{deg}^2}{s} \right]$$

PFPA feeds – fixed FoV.

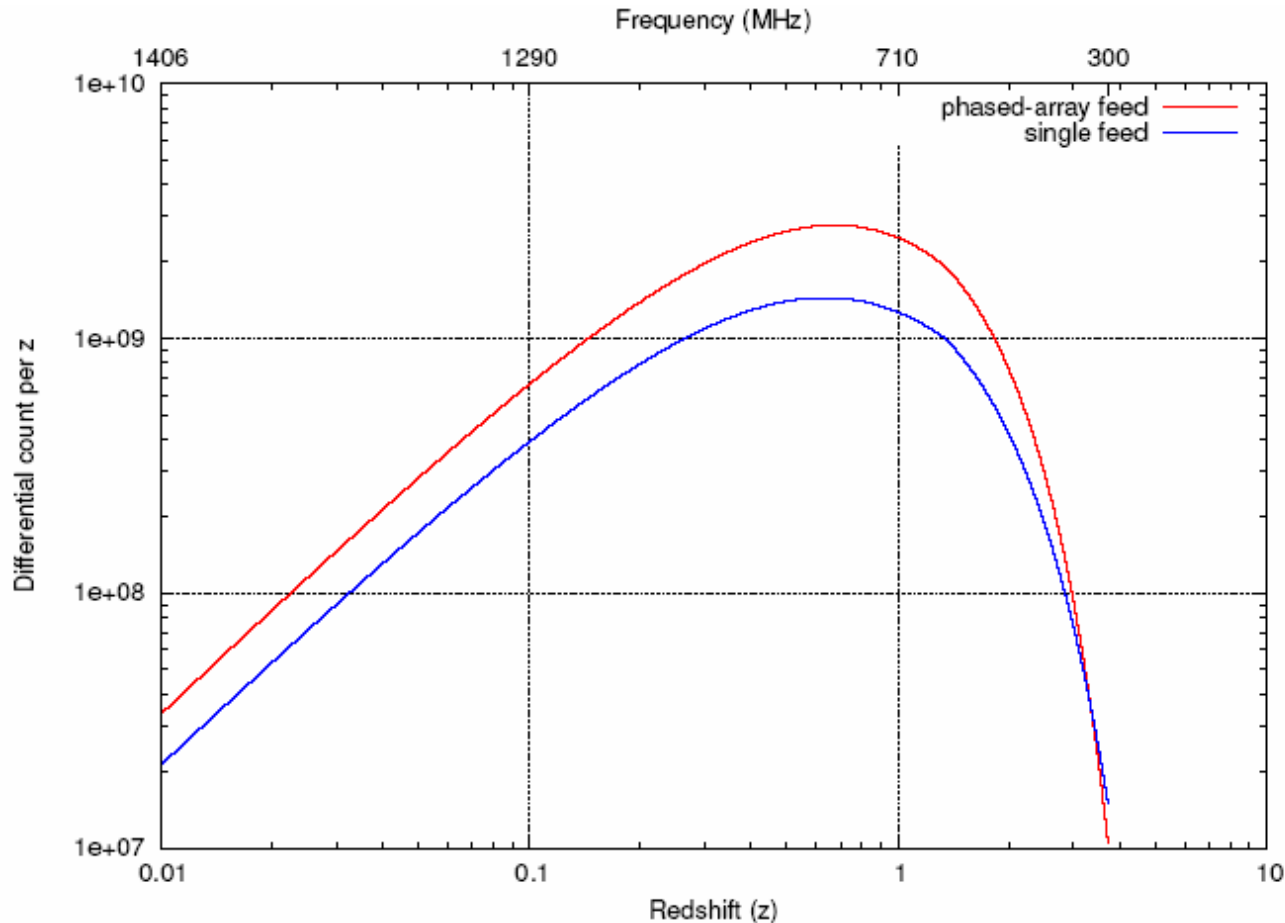
“Single-pixel” feeds for 10-m dia. Antennas.

- All galaxies more massive than the curve will be detected.
- Survey coverage at $z = 0$ determines the time scale.
- Purple horizontal line is the mass of an M^* Galaxy.
- For single-pixel feeds, more observing time is provided to high- z objects (FoV overlap).
- “Cosmology” introduces slight curvature at high z .
- Single-pixel feed
 - green line: uncooled.
 - blue line: cooled.



Note: Sky-noise included at low freq.

Differential Galaxy Counts



Counts for unity redshift bin (ie for counts in a redshift bin of 0.01, then multiply the counts by 0.01.).

Integral Galaxy Counts

