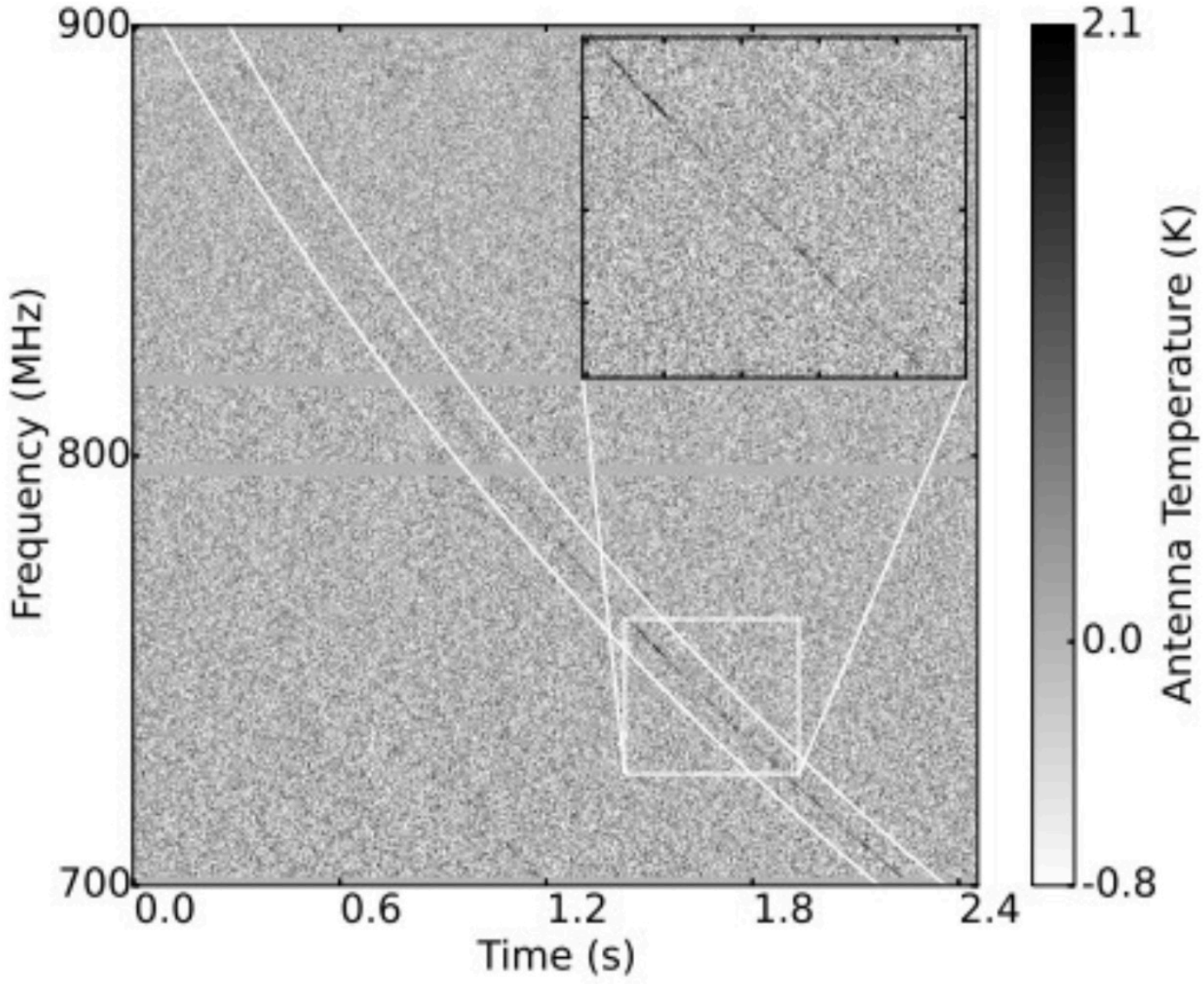
TianLai FRB Rate Estimate

- FRB110523 was discovered from GBT off line data.
- It was found near 800MHz,and remains the only FRB not found in 1.4GHz.



According to this FRB event, Liam Connor etc. estimated the FRB rate of GBT and extrapolate a universal formula for other telescope survey estimate. [MNRAS 460, 1054–1058 (2016)]

$$N_\Sigma = \frac{1}{27.5}\left(\frac{G_\Sigma}{G_{\mathrm{GBT}}}\frac{\langle T^{\mathrm{sys}}_{\mathrm{GBT}}\rangle}{\langle T^{\mathrm{sys}}_{\Sigma}\rangle}\sqrt{\frac{B_\Sigma}{B_{\mathrm{GBT}}}}\right)^{\gamma}\left(\frac{\Omega_\Sigma}{\Omega_{\mathrm{GBT}}}\right)\mathrm{d}^{-1}$$

Where as N_Σ stand for the number of FRB That survey $\sum$ could observed.
G is the gain depends on the effective aperture and the receive area. T_{sys} is system temperature. B is the observed bandwidth. Ω is the beam size and γ is depend what universe is. Here We assume γ = 1.5 which stand for a Euclidean Universe. More details in Connor's paper above.

TianLai parameter calculate

G_{TL}:

The radius of GBT is 50m. With a 75% aperture effective, The equal receive area is 5890 m^2.

We use actual $12 \times 11.4 = 136.8\ m^2$, and 2/3 aperture effective for one TianLai cylinder. So that the equal receive area is 91.2 m^2.

As $G_{GBT} = 2\ K / Jy$,

So the $G_{TL} = 2\ K/Jy * 91.2 / 5890 \backsimeq 0.031\ K /Jy$

TianLai parameter calculate

Ω_{TL}:

TianLai telescope is cylinder, of which The N-S beam φ could reach120 degree. And according to λ*1.22 / D,
W-E beam θ is 1.86 degree.

The actual beam shape is a ellipse, We could regard it as a rectangular to make a rough estimate.

So the Total beam $\Omega_{TL} = \theta * \varphi = 1.86 * 120 = 223.2\ deg^2$

Compare

	GBT	TianLai
G (k/Jy)	2	0.031
T^{sys} (K)	26.5	80
B (MHz)	200	100
Ω (deg^2)	0.055	223.2

With the formula developed by Liam Connor, The TianLai survey might observe 0.032 day^{-1} FRB event or 1 burst a month .