

GRBs have preferred jet opening angles and bulk Lorentz factors

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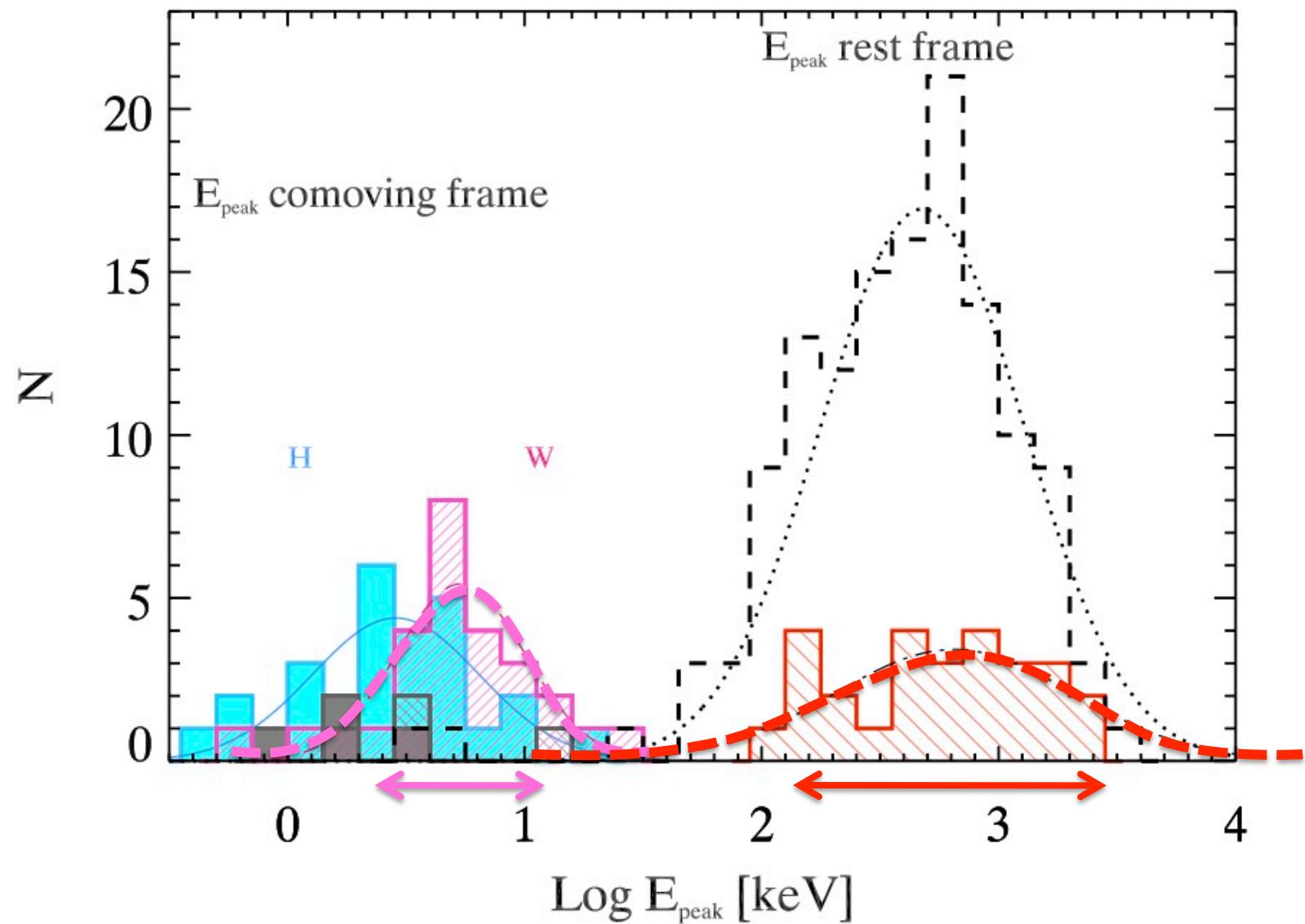
Ghirlanda+ 2012 (see poster II-14)

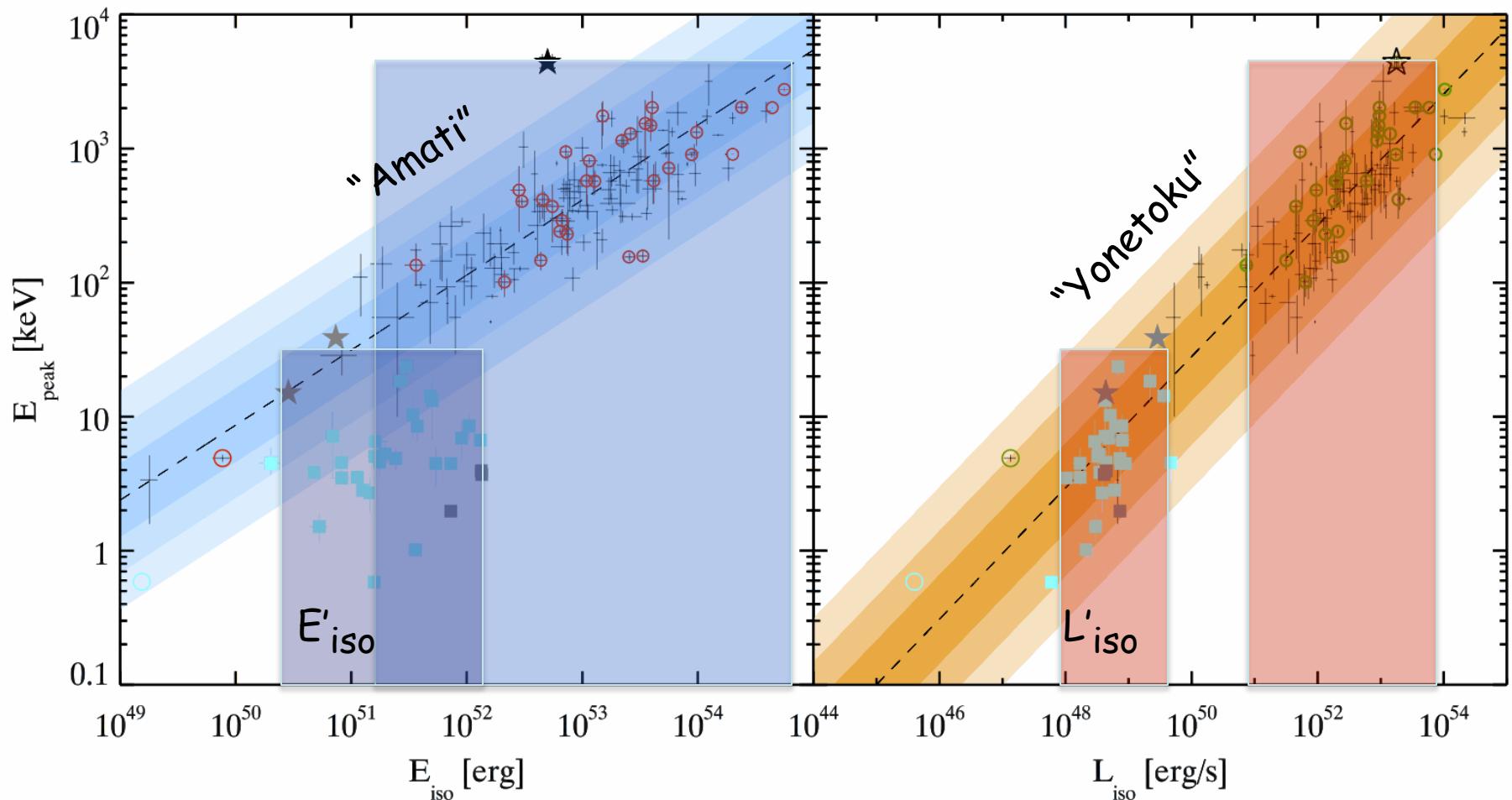
Γ from onset of afterglow

Find comoving quantities:

$E'_{\text{iso}} - E'_{\text{peak}} - L'_{\text{iso}}$

They cluster



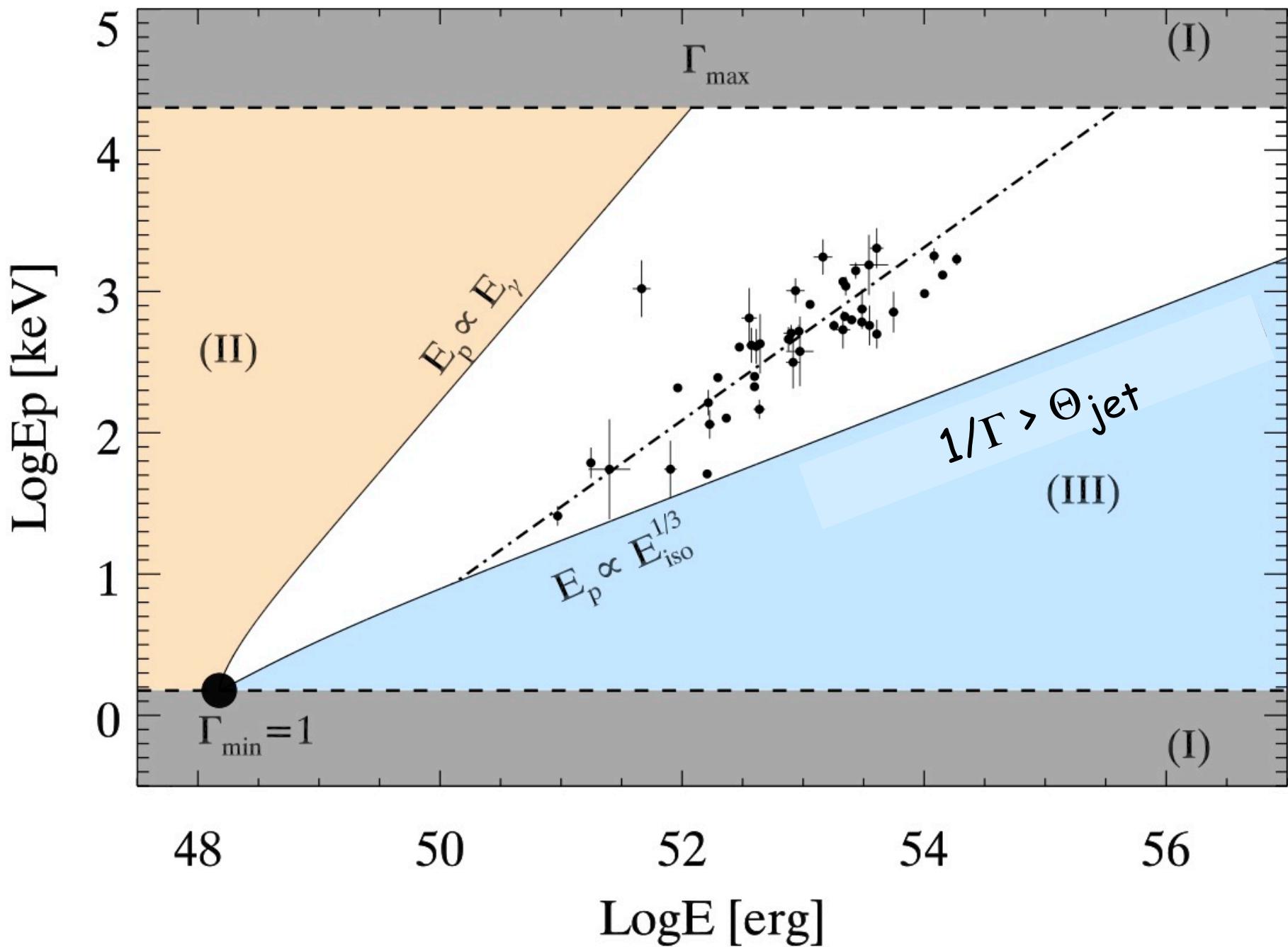


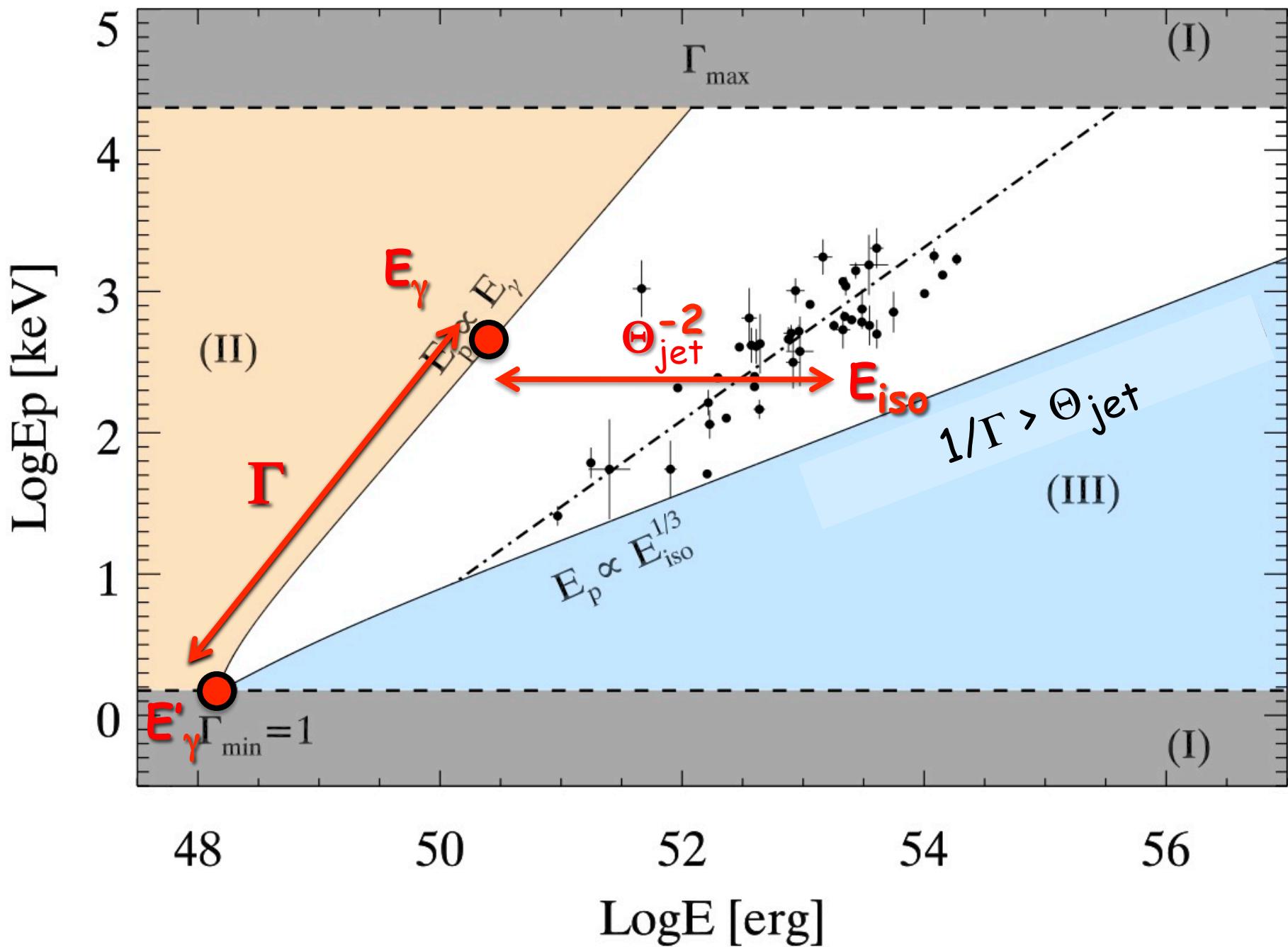
$$L'_{\text{iso}} \sim 5 \times 10^{48} \text{ erg/s}$$

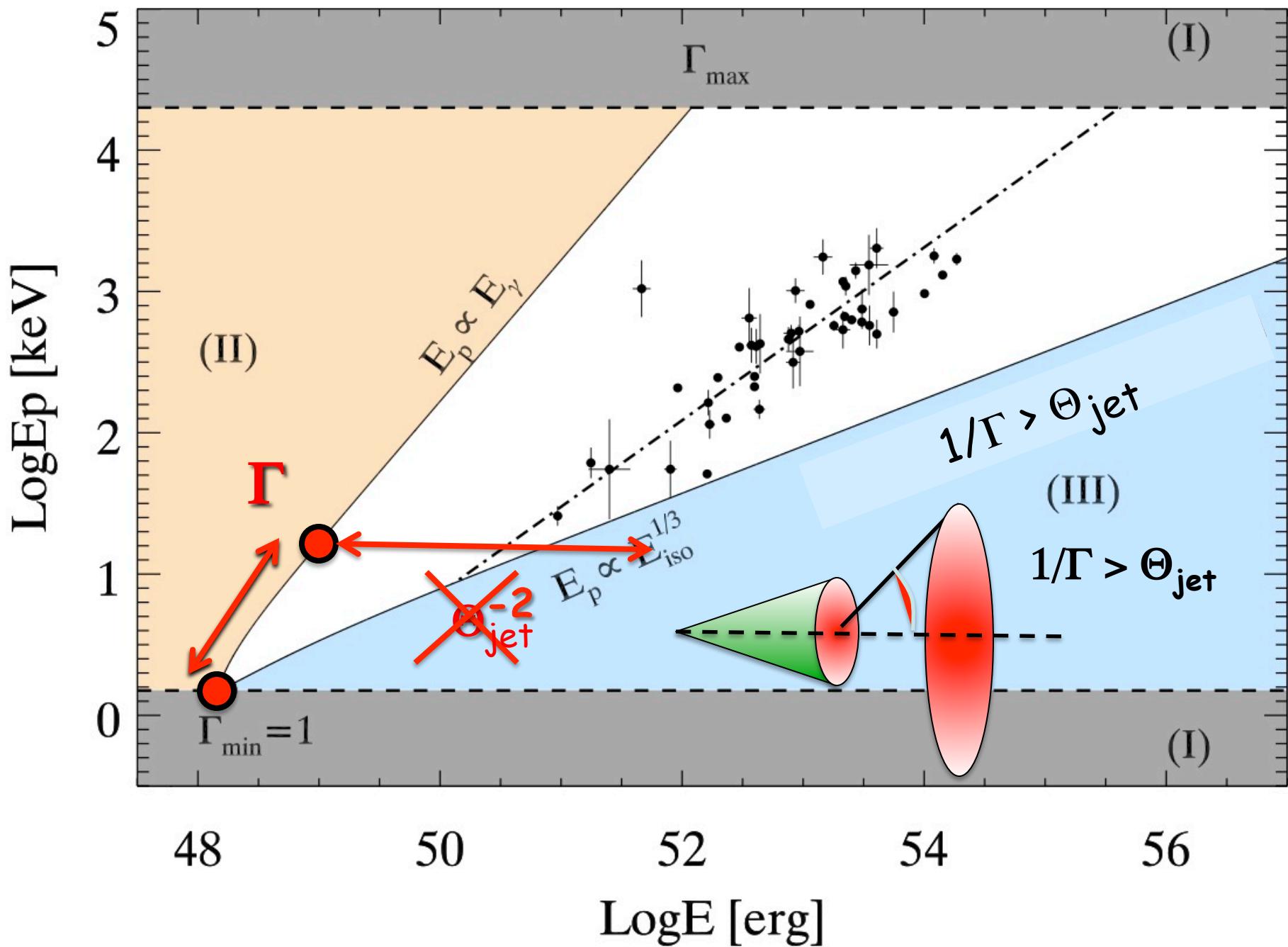
$$E'_{\text{iso}} \sim 2 \times 10^{51} \text{ erg}$$

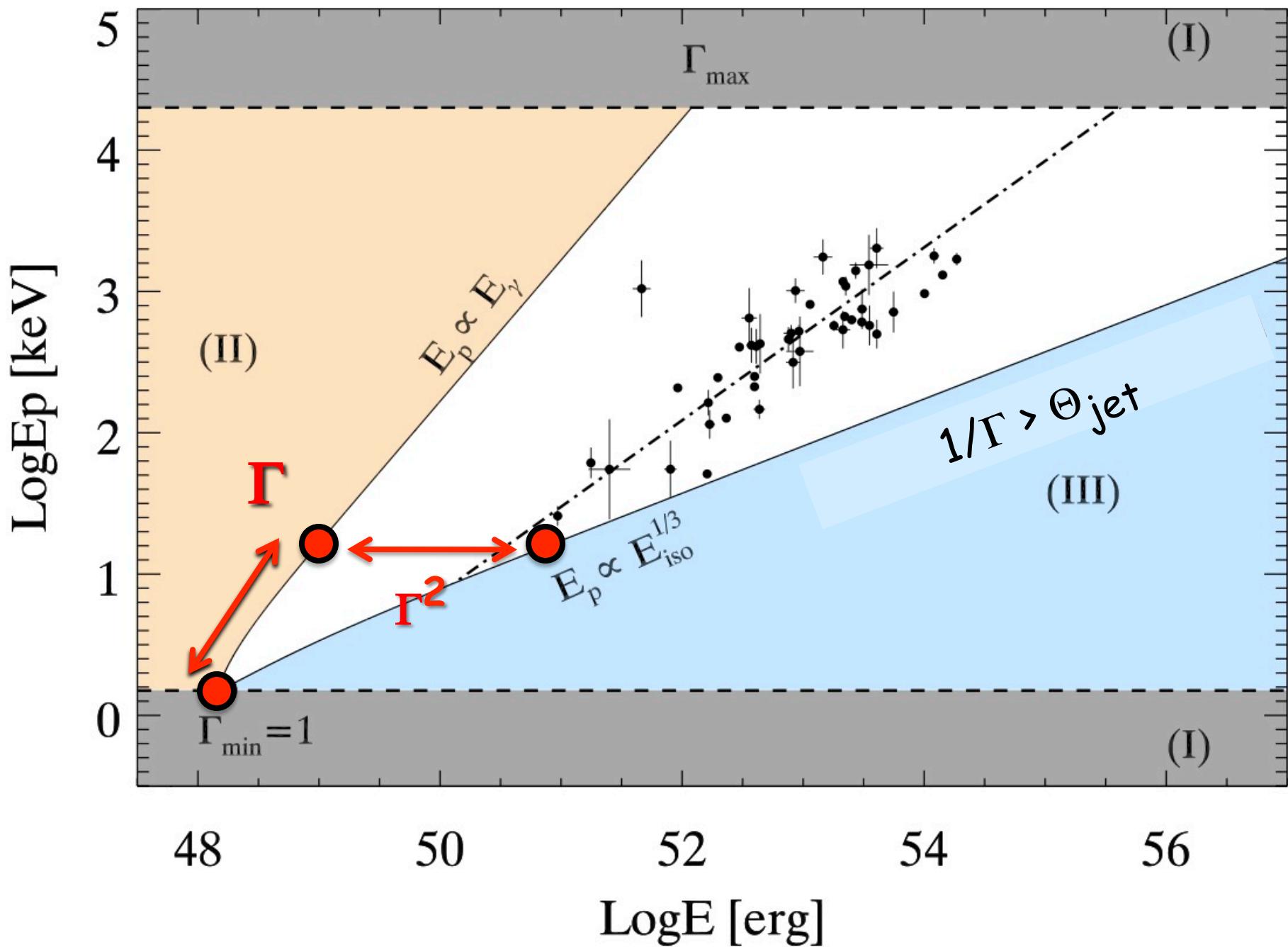
$$E'_{\text{peak}} \sim 1-5 \text{ keV}$$

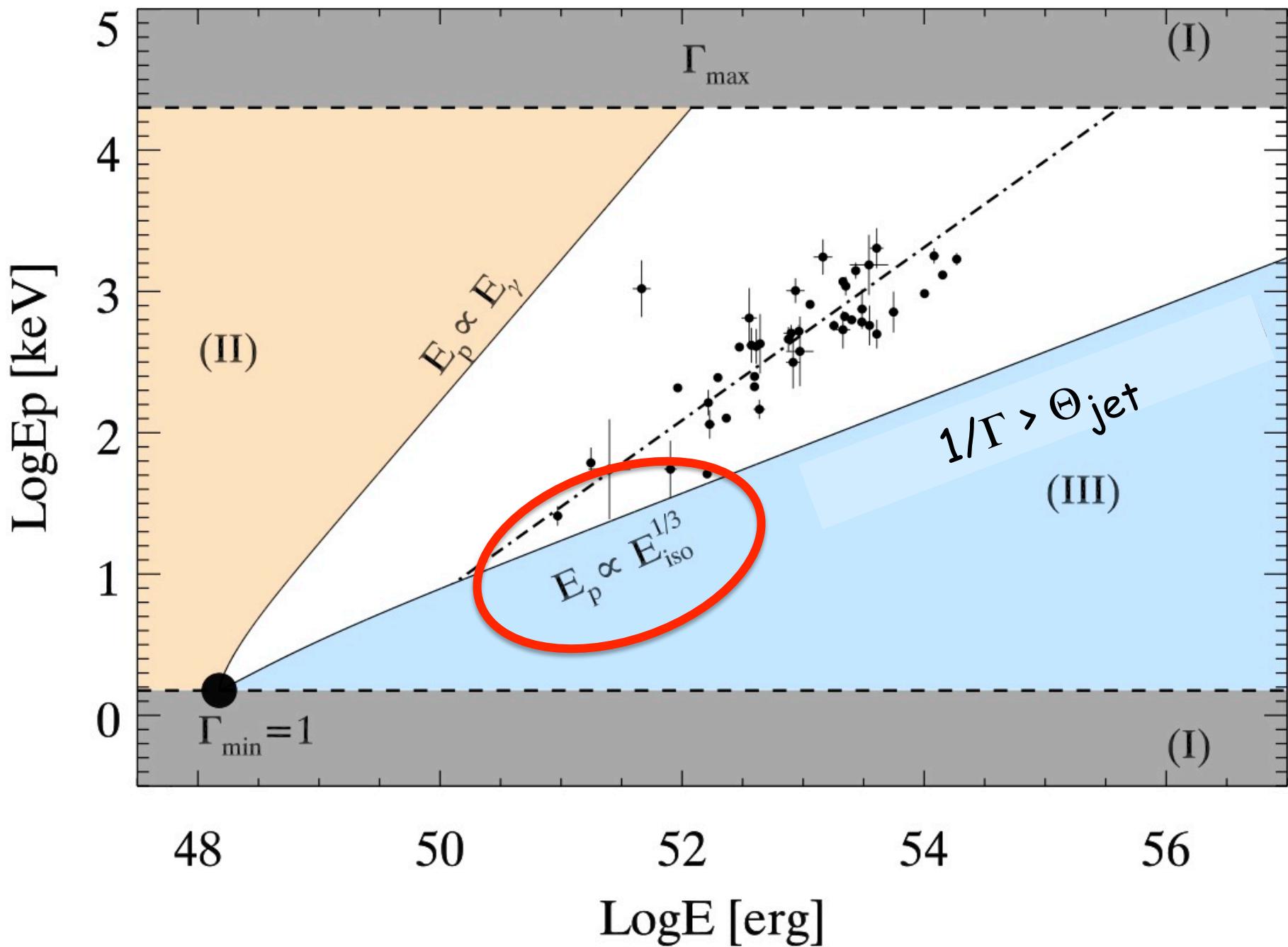
Also E'_{γ} clusters: $E'_{\gamma} \sim 10^{48} \text{ erg}$

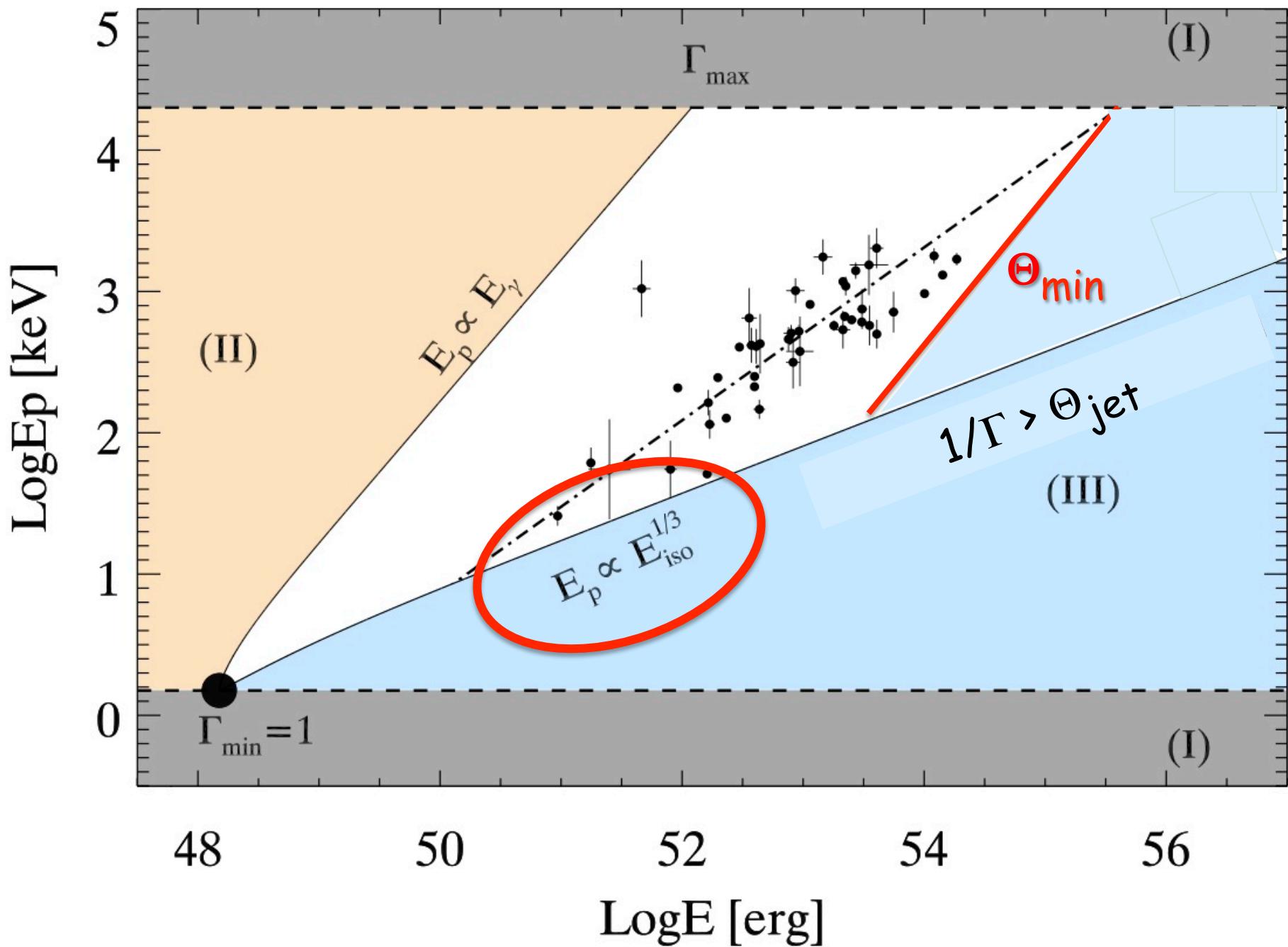


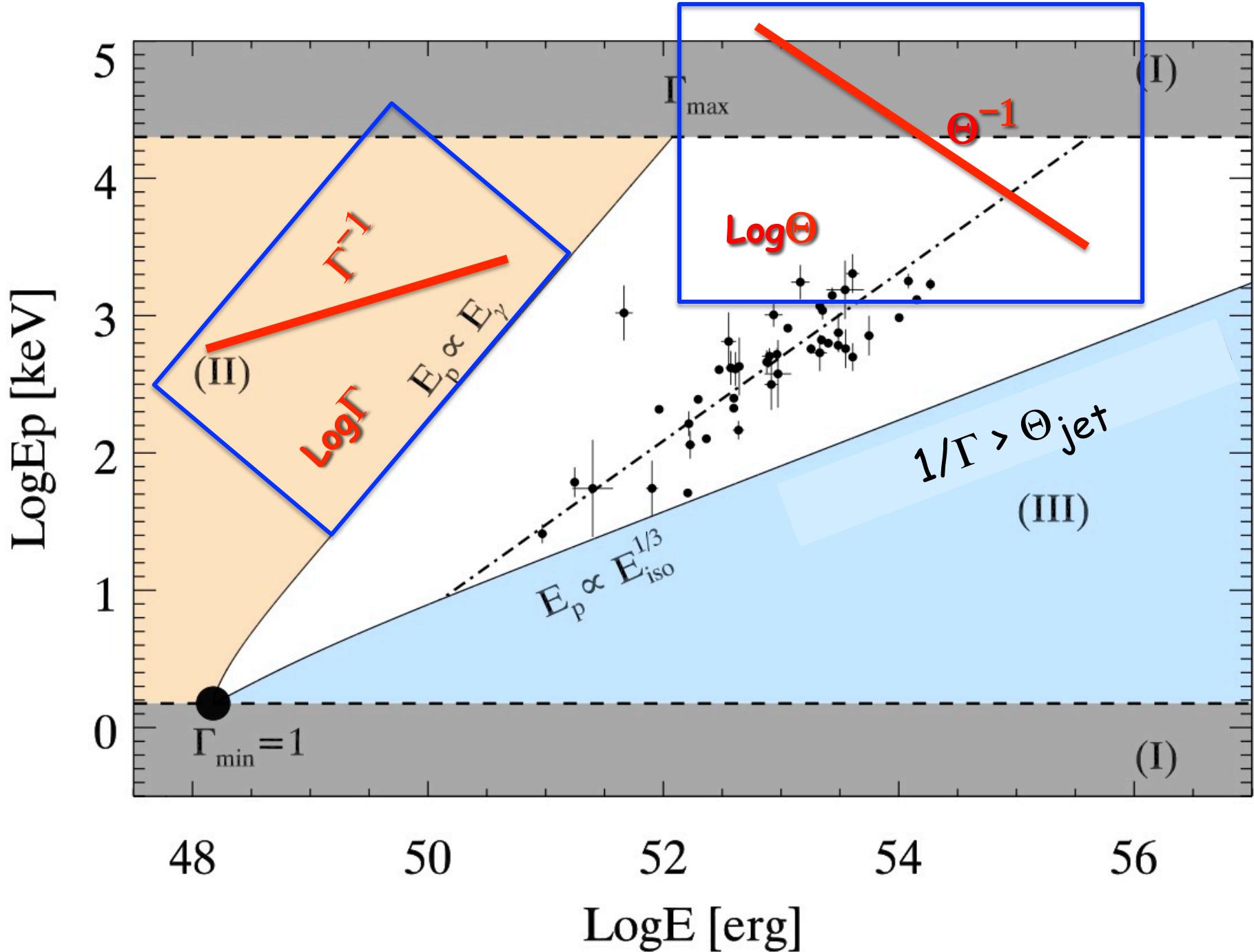


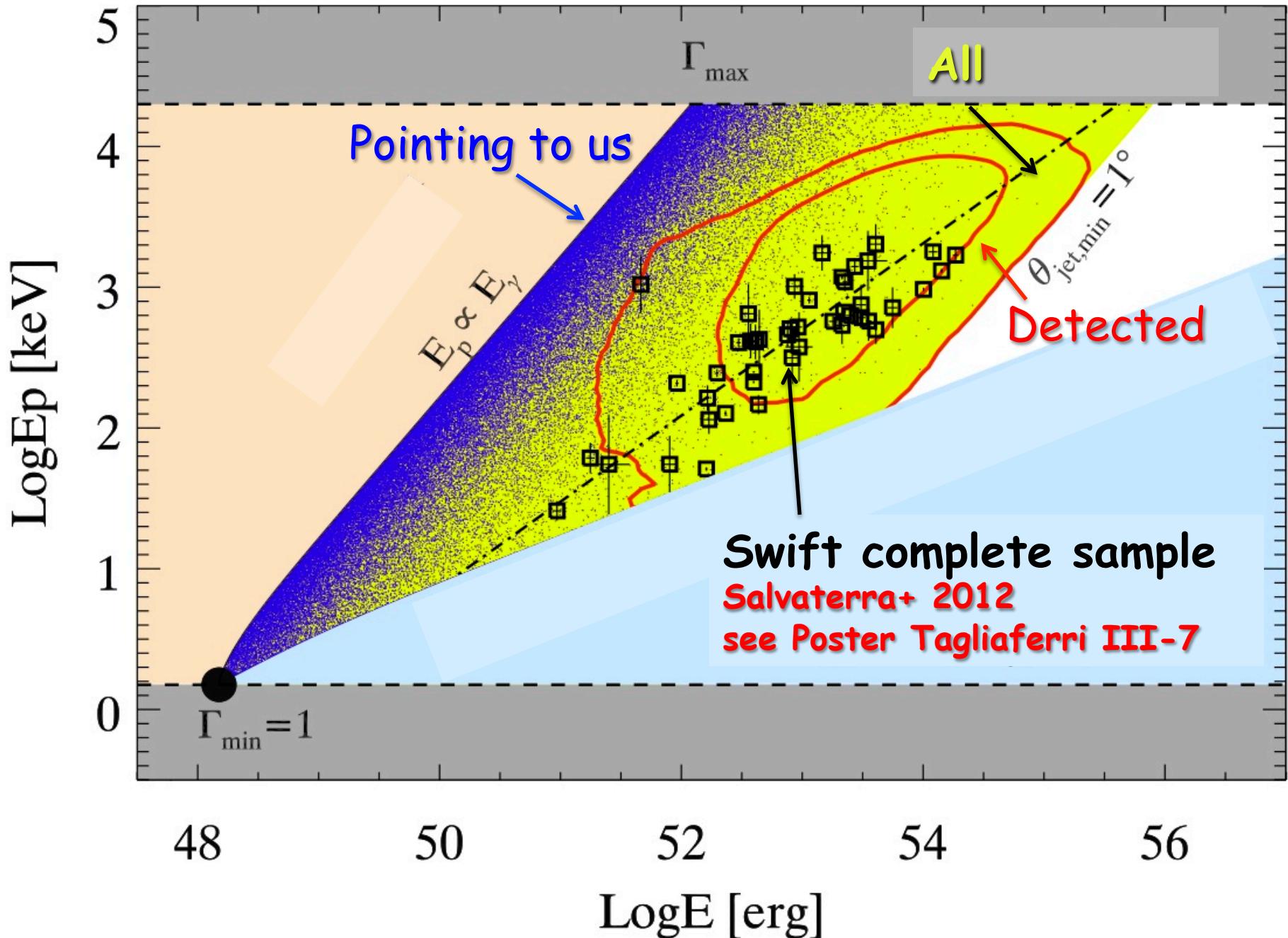




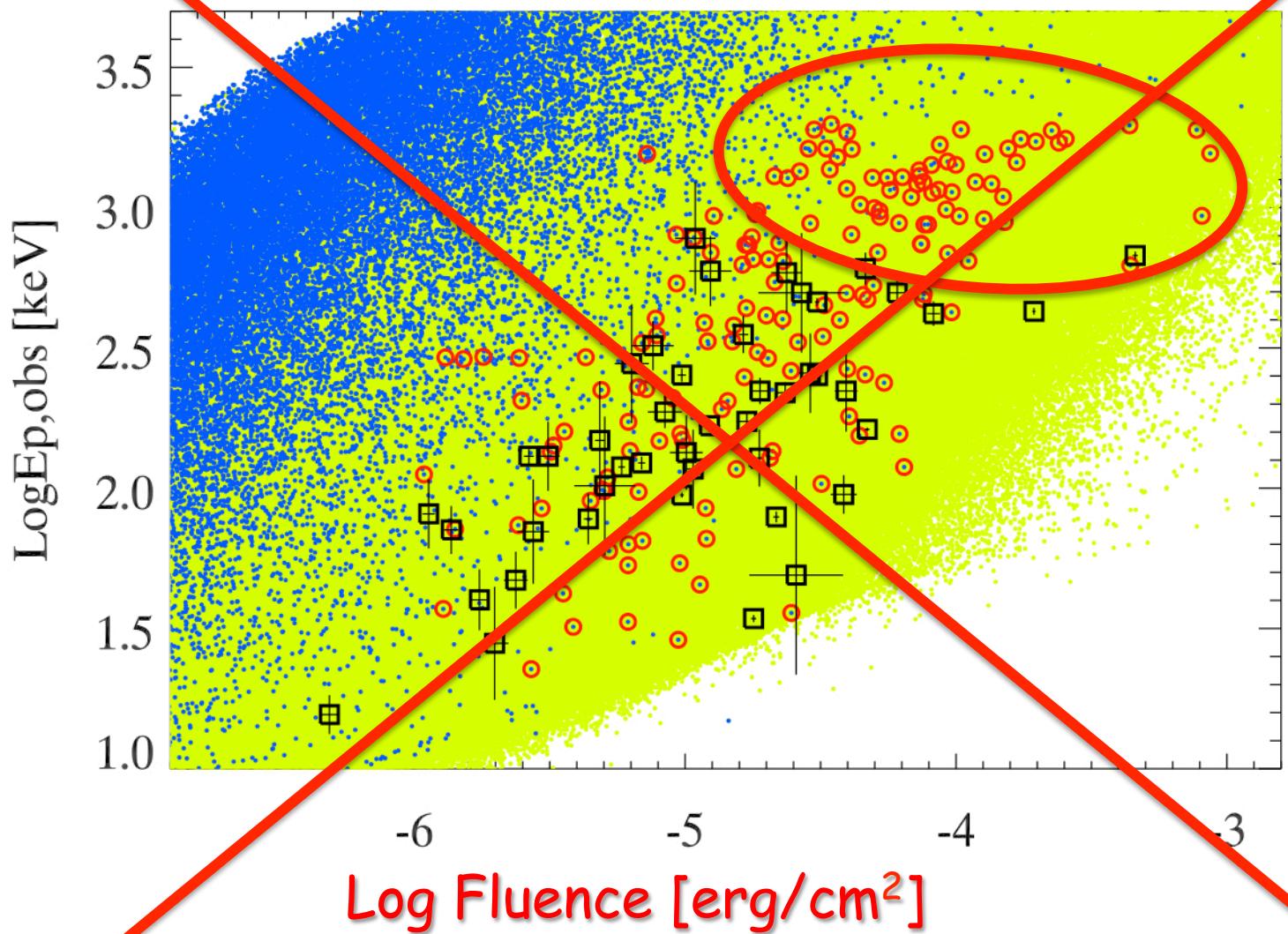


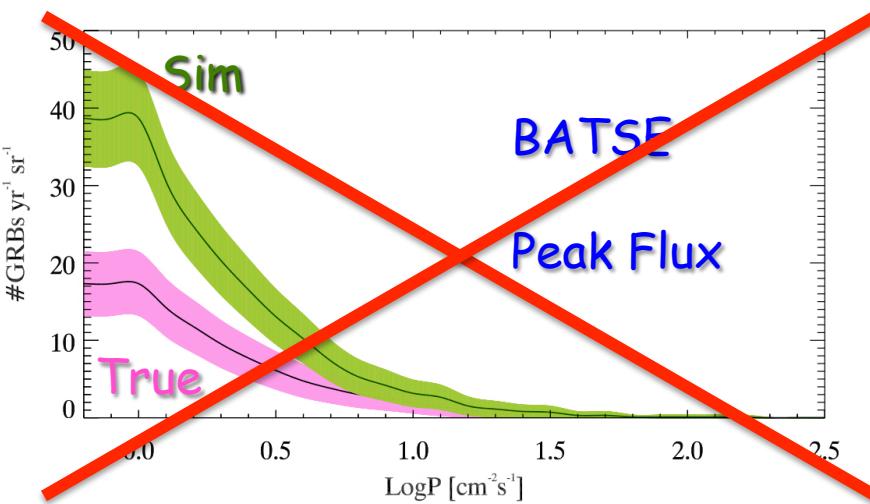
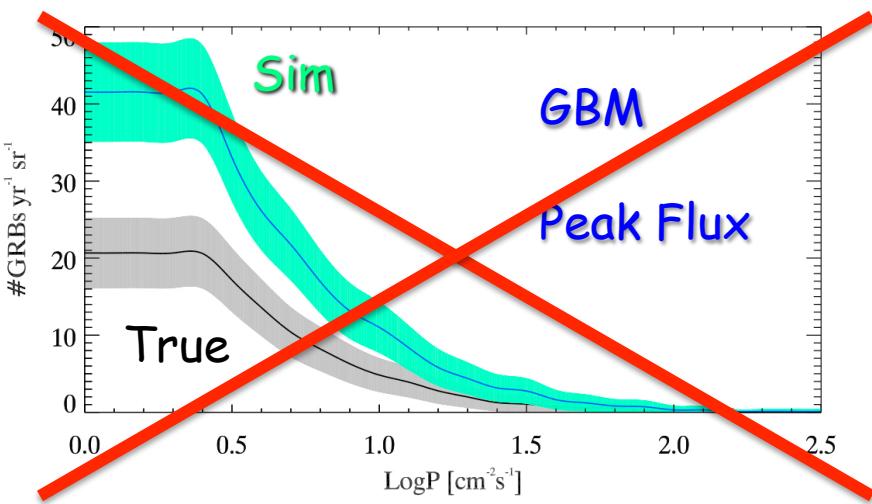
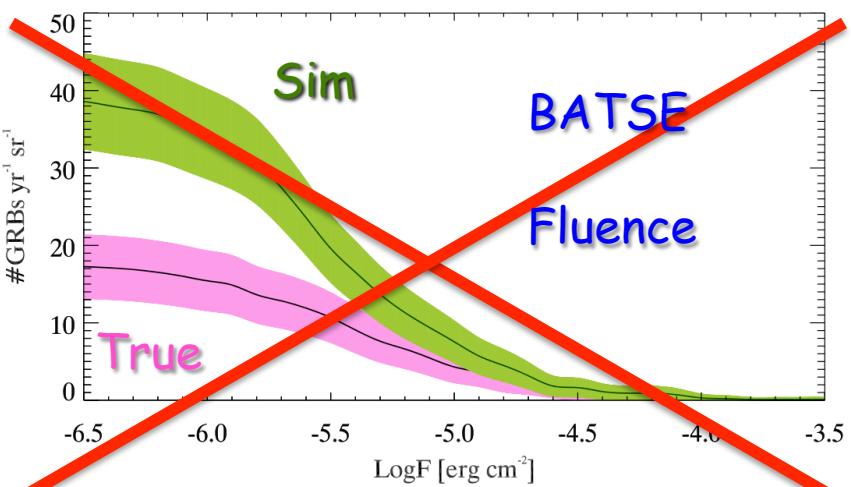
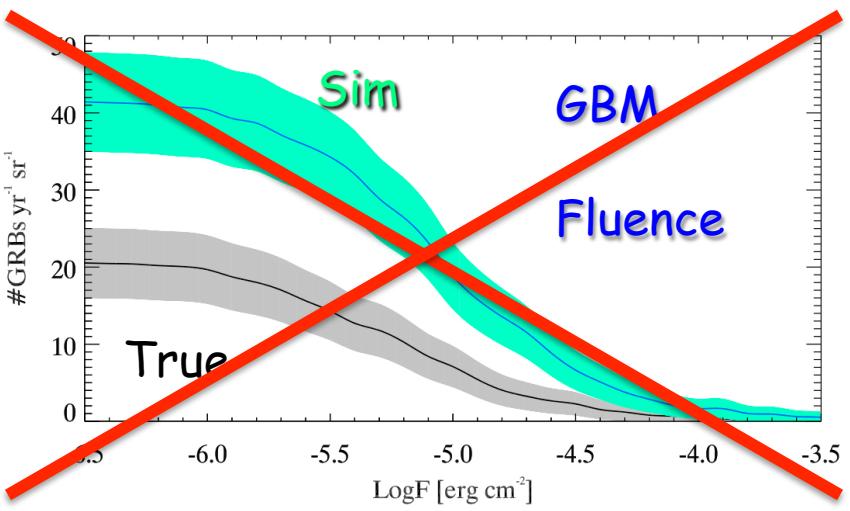


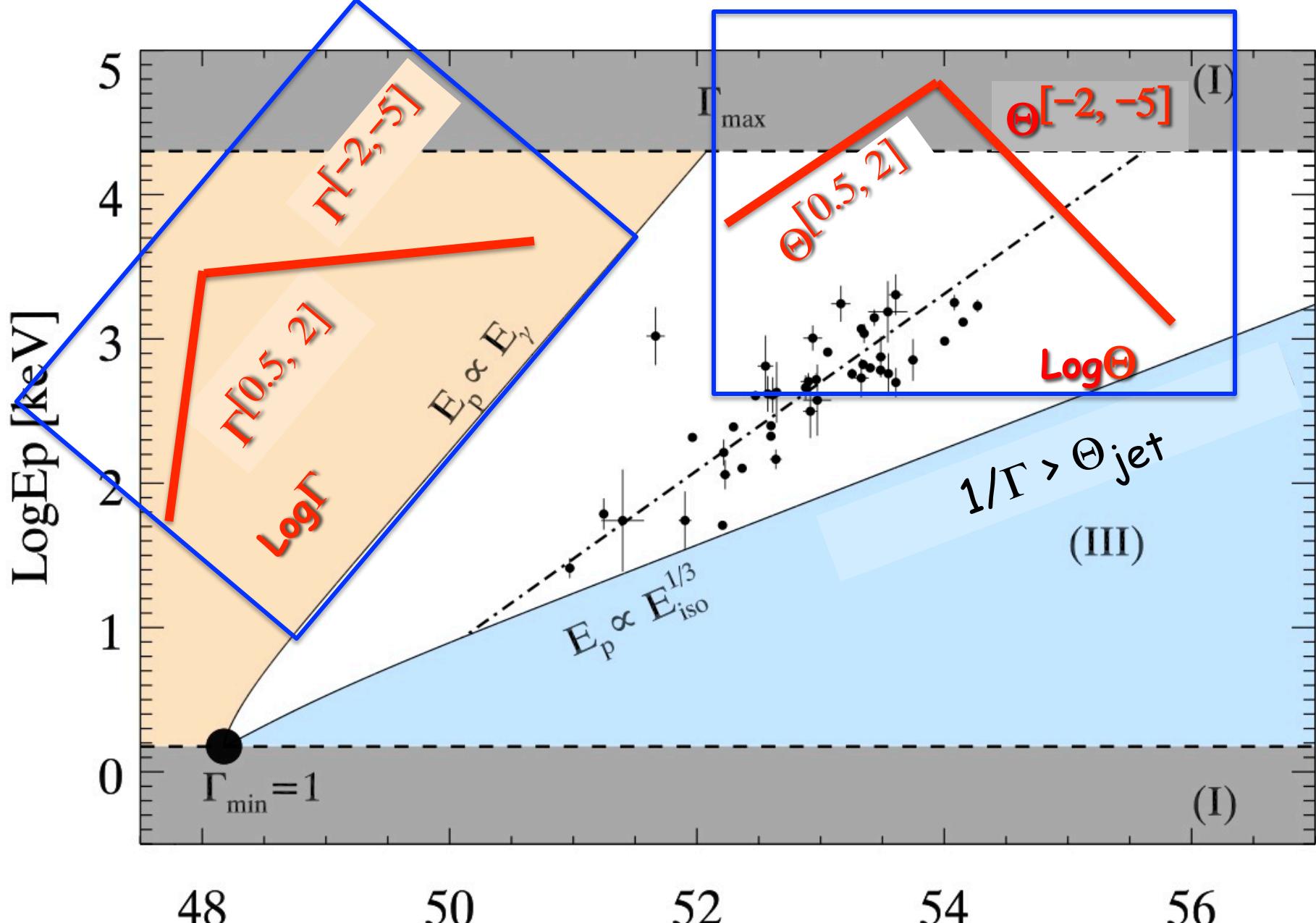




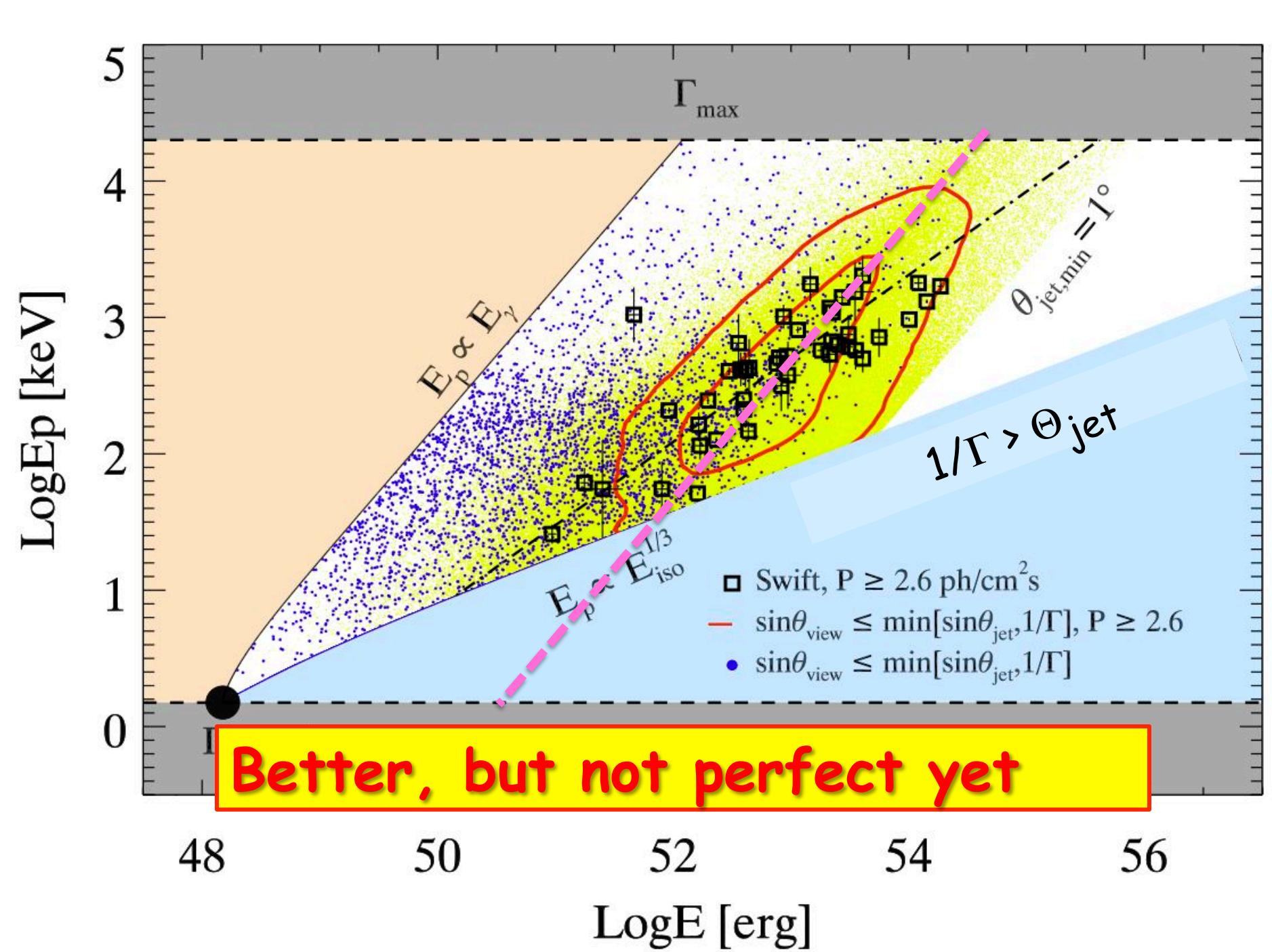
Observational plane

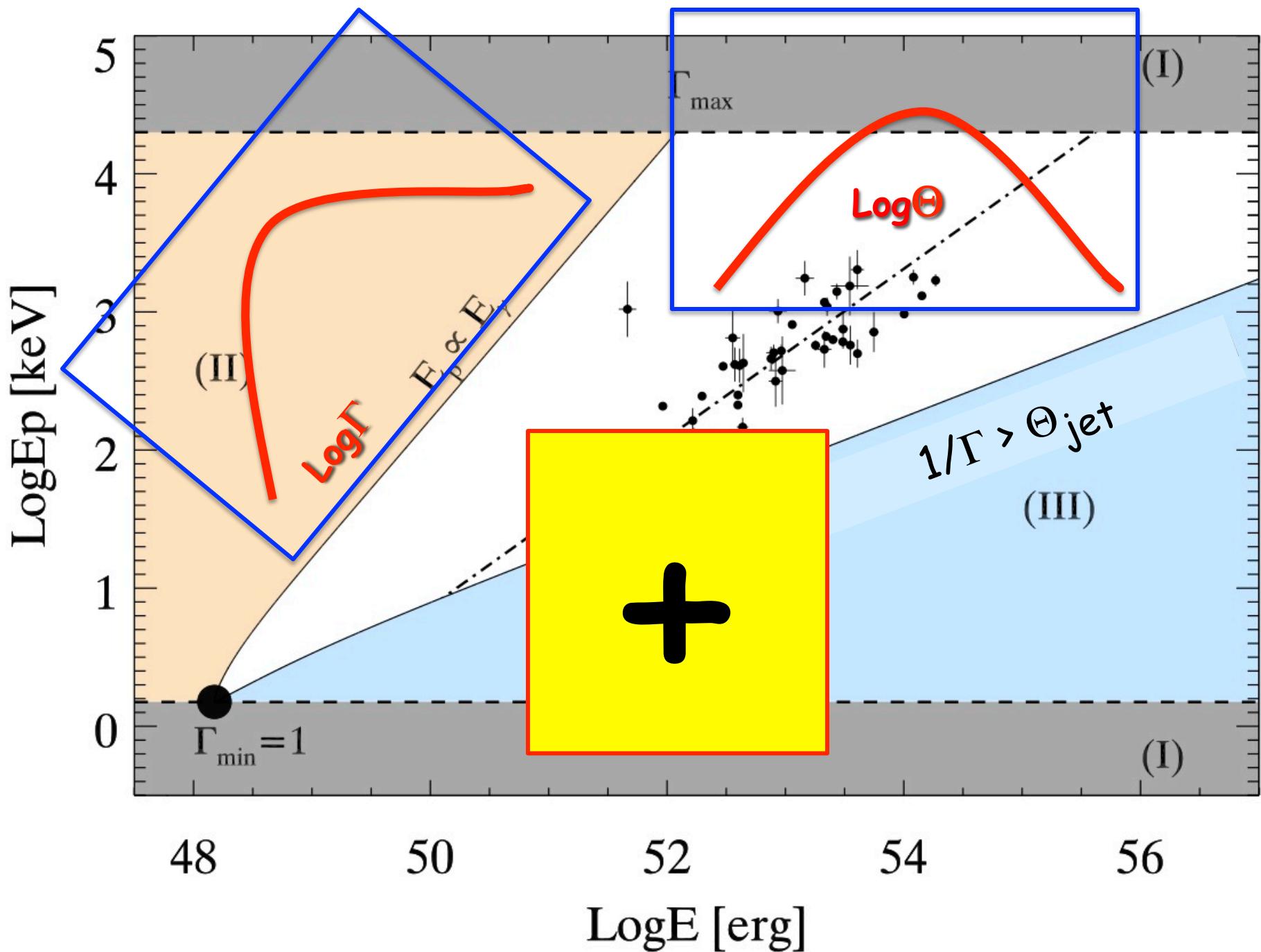


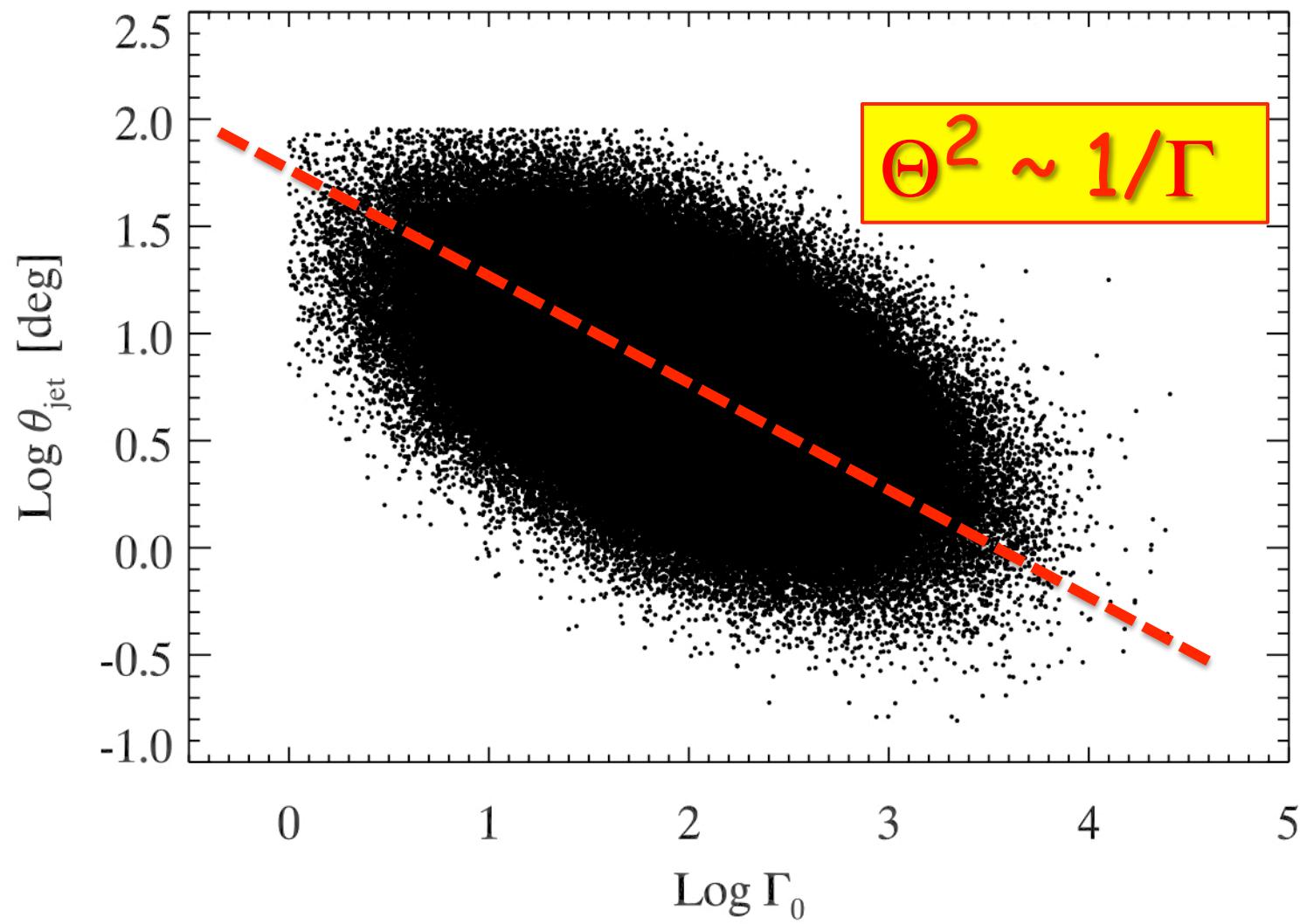


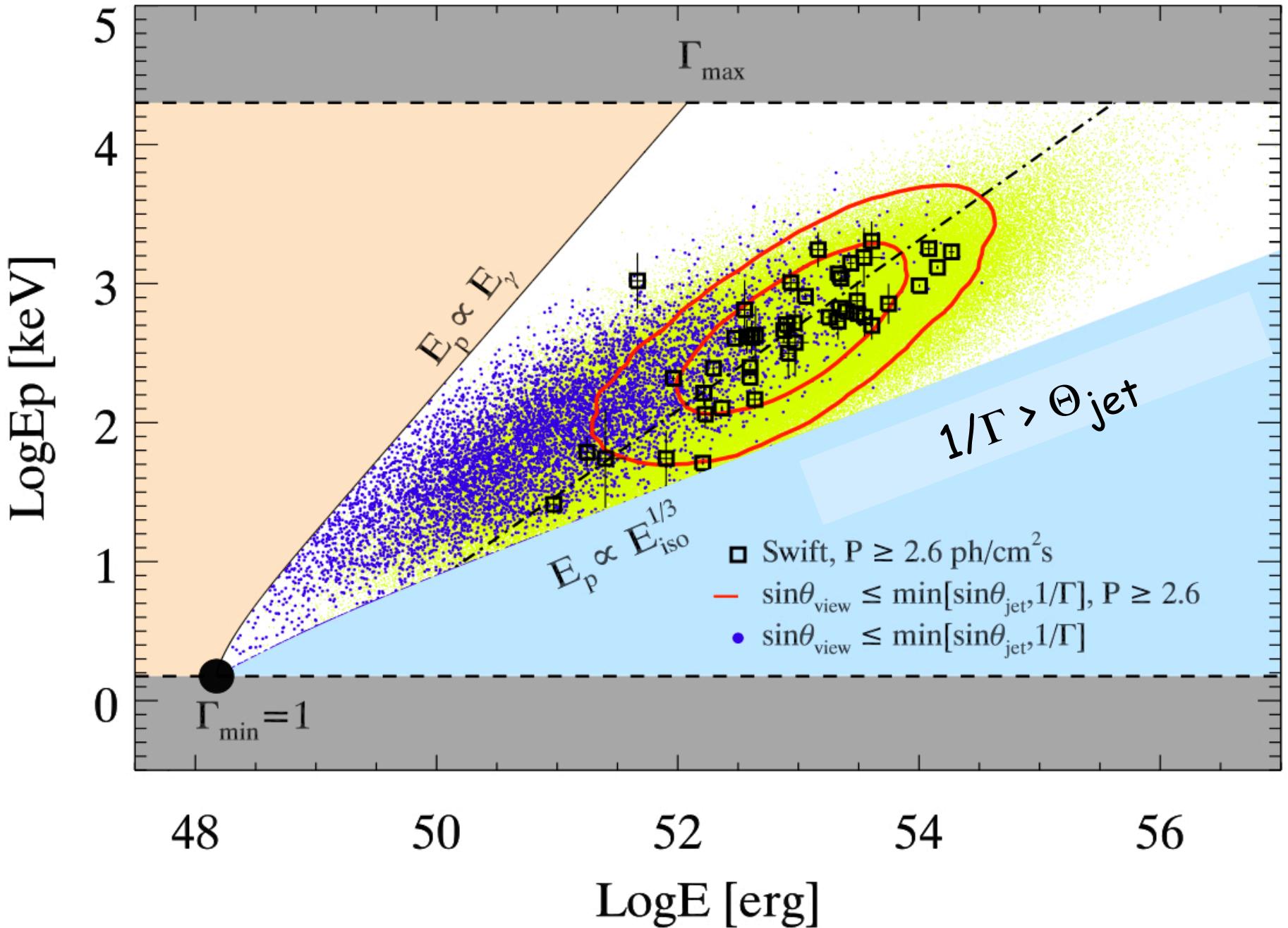


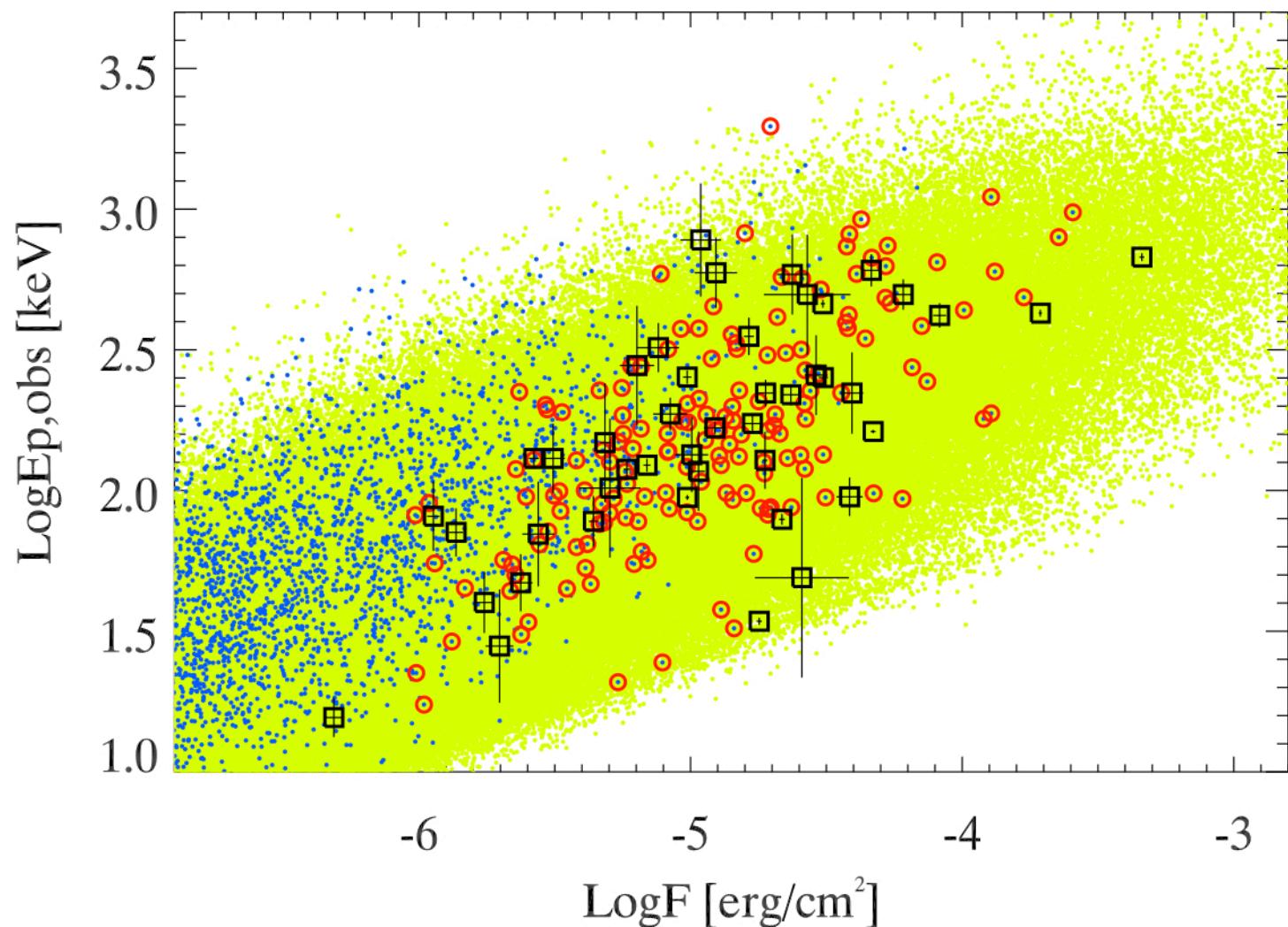
$\text{Log}E [\text{erg}]$

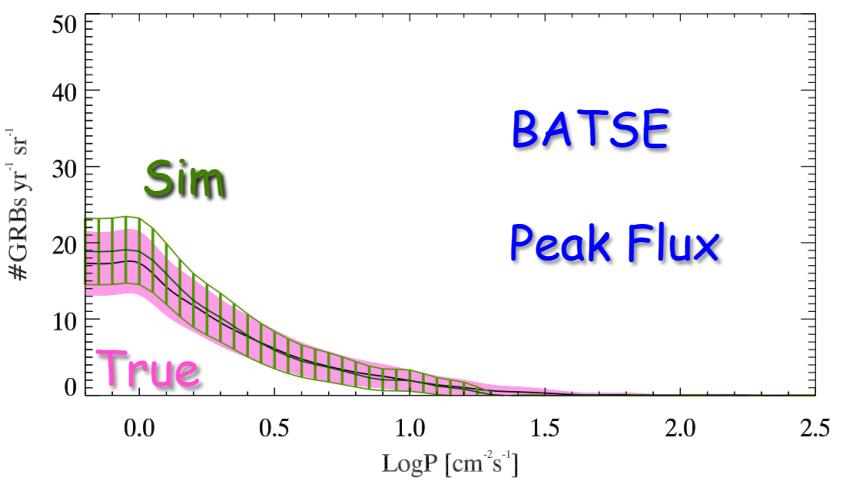
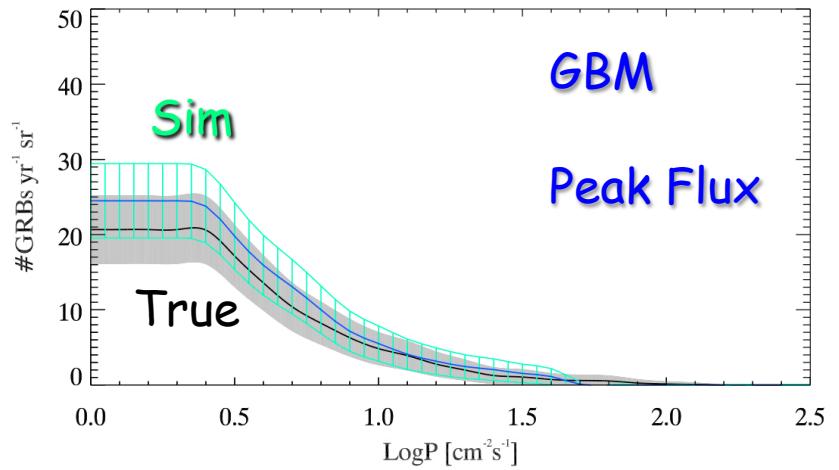
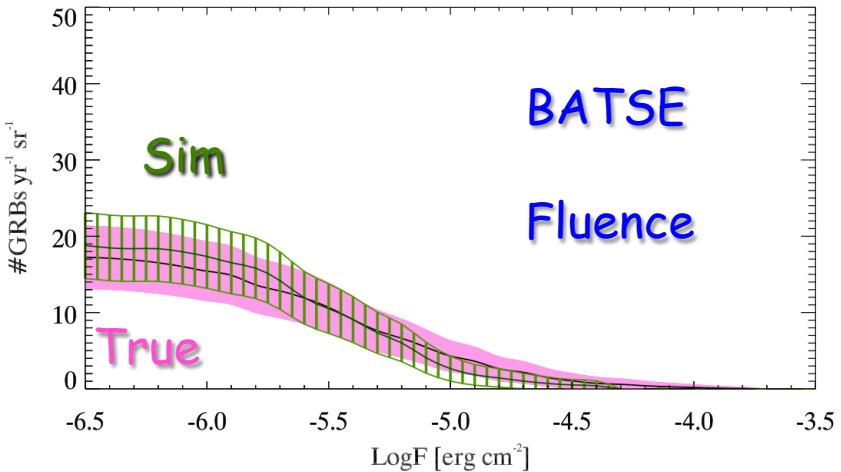
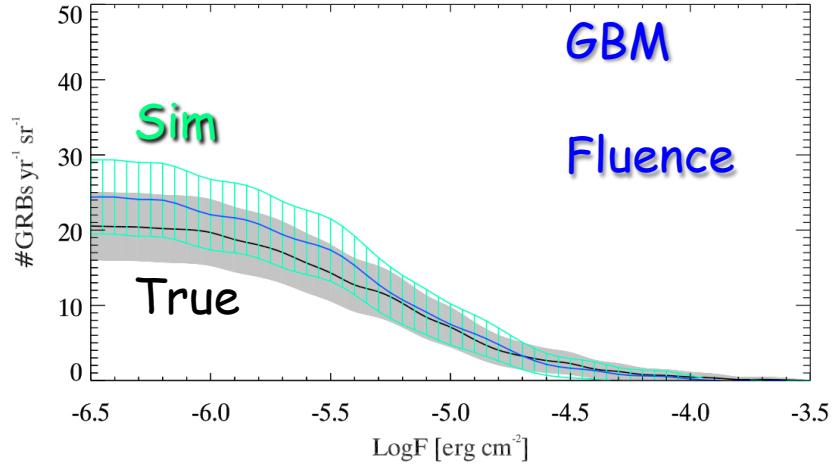


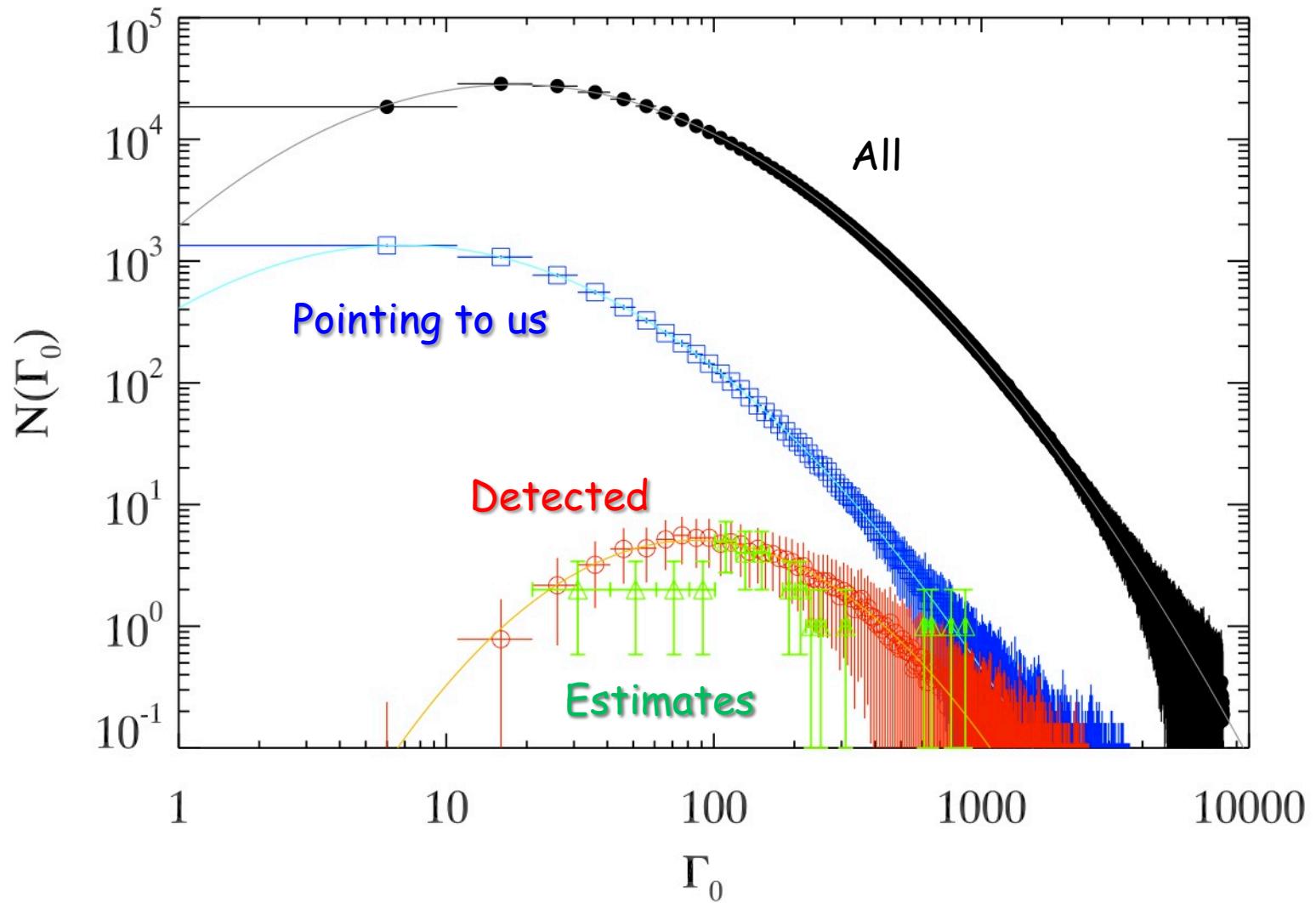


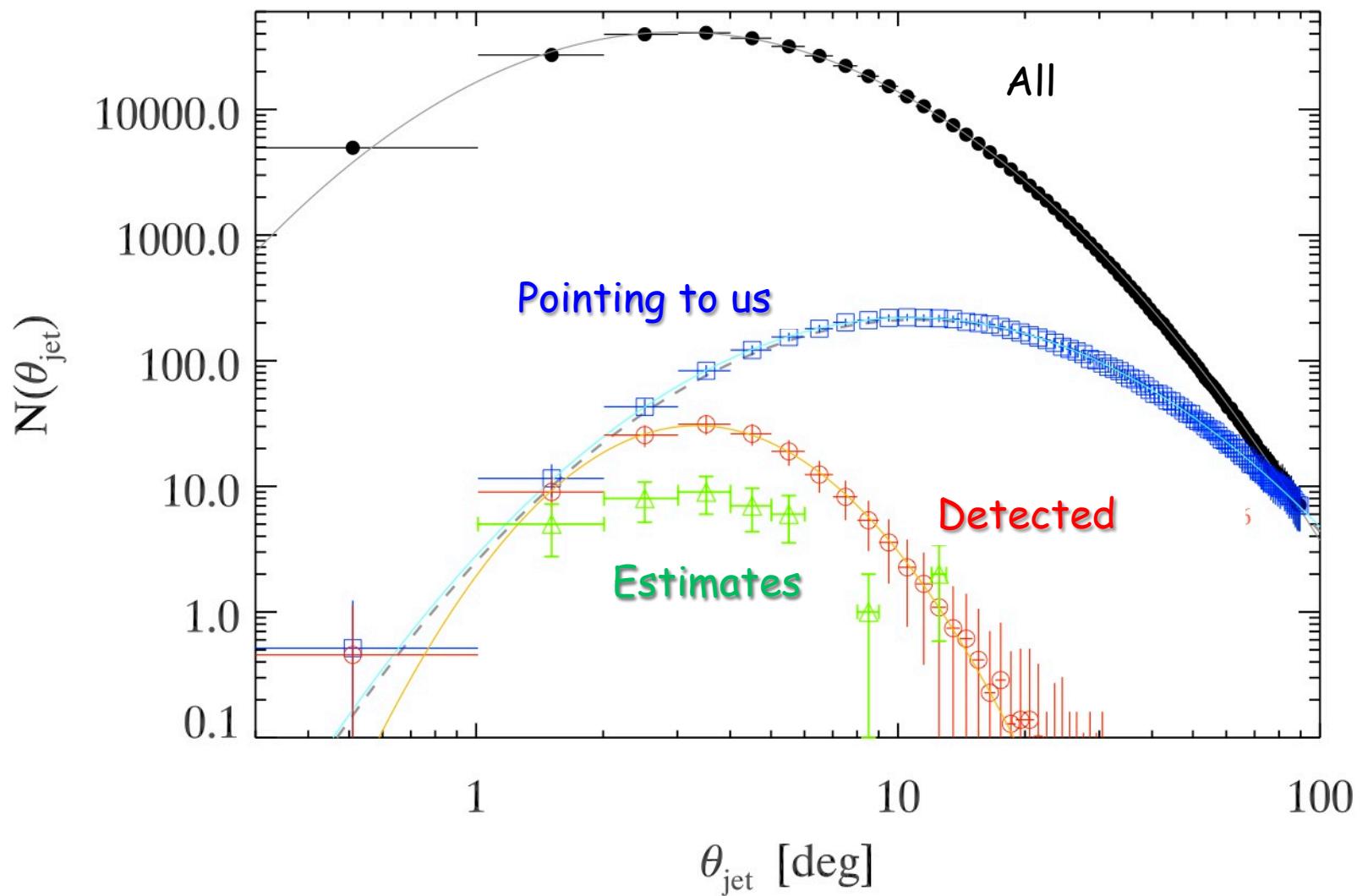


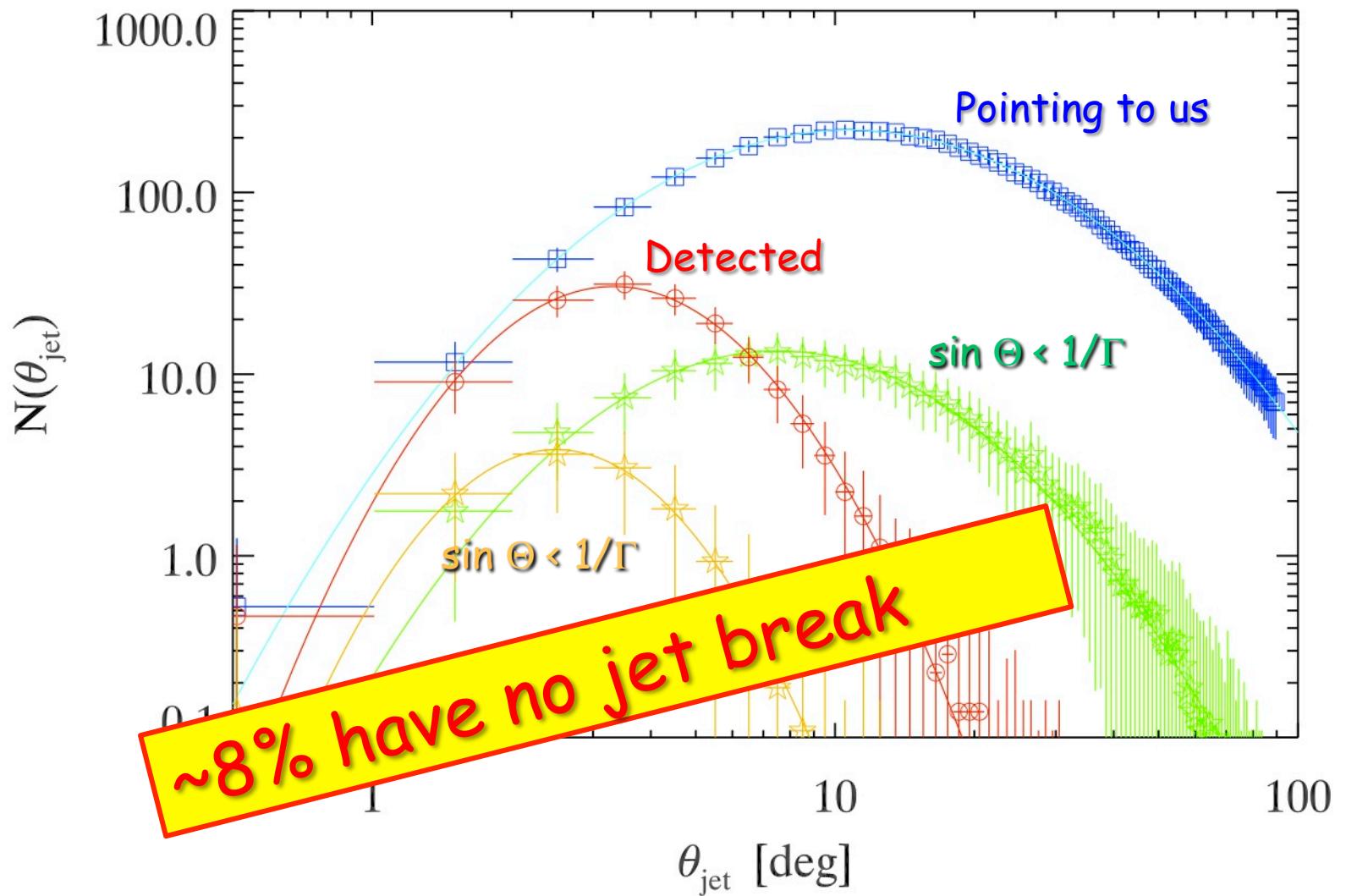


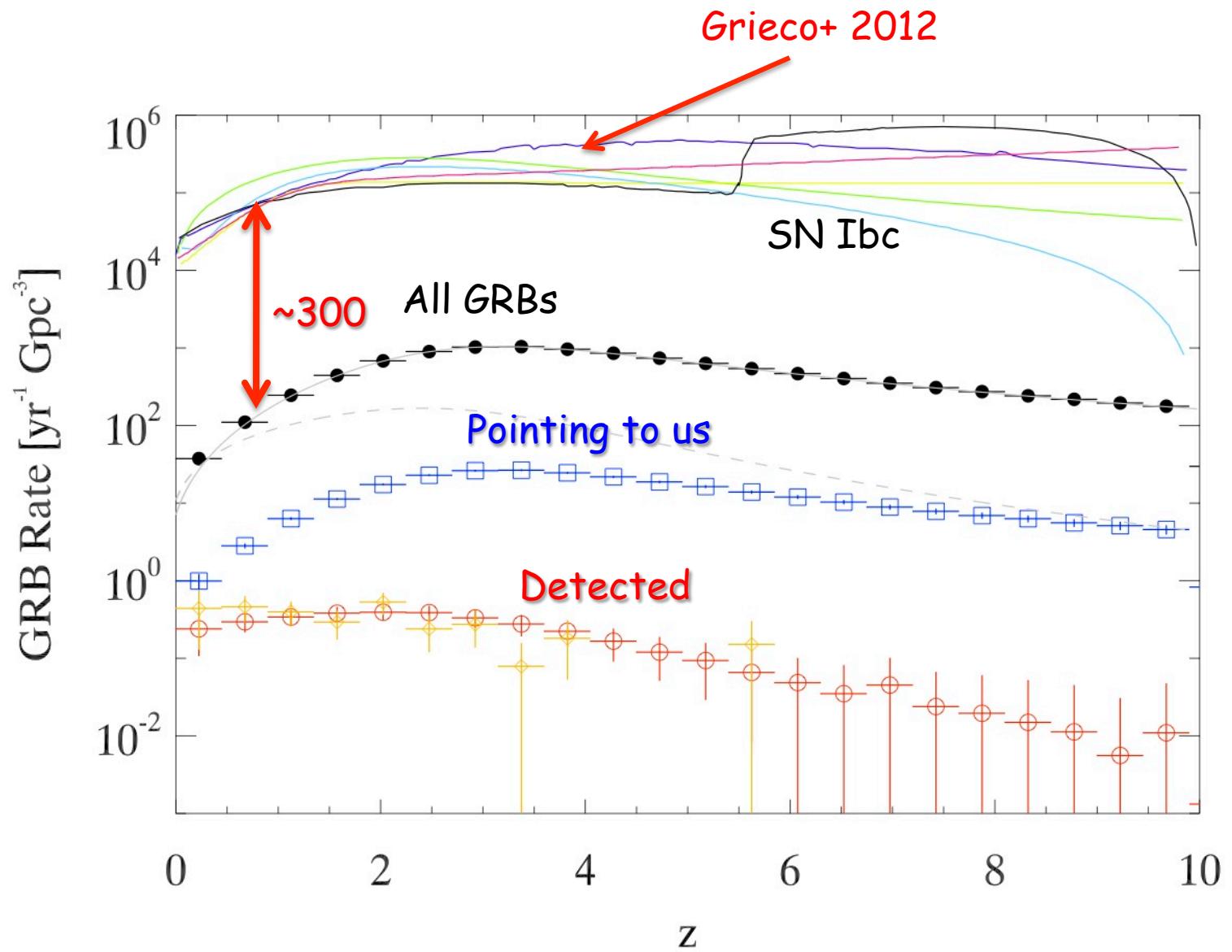






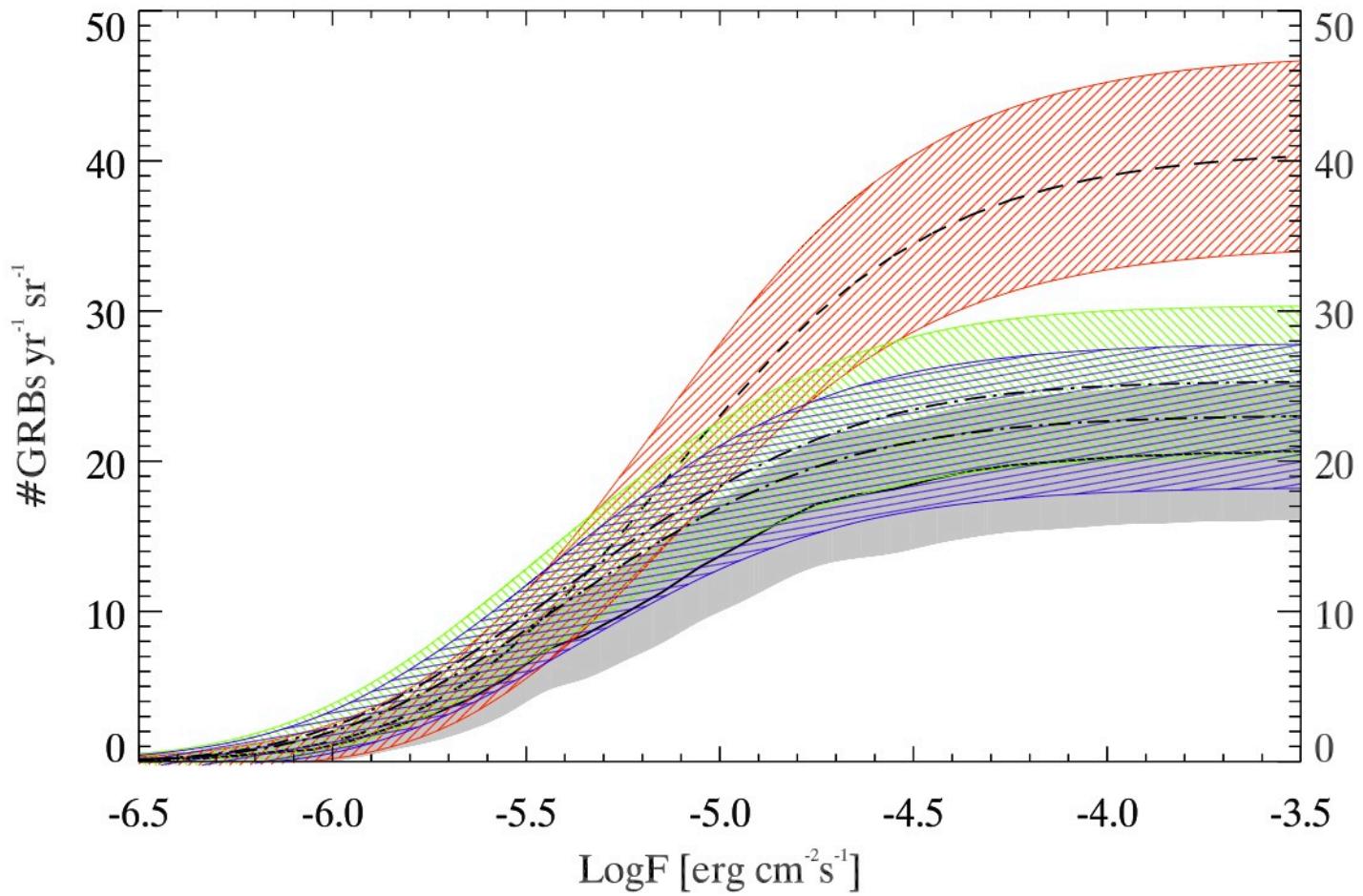


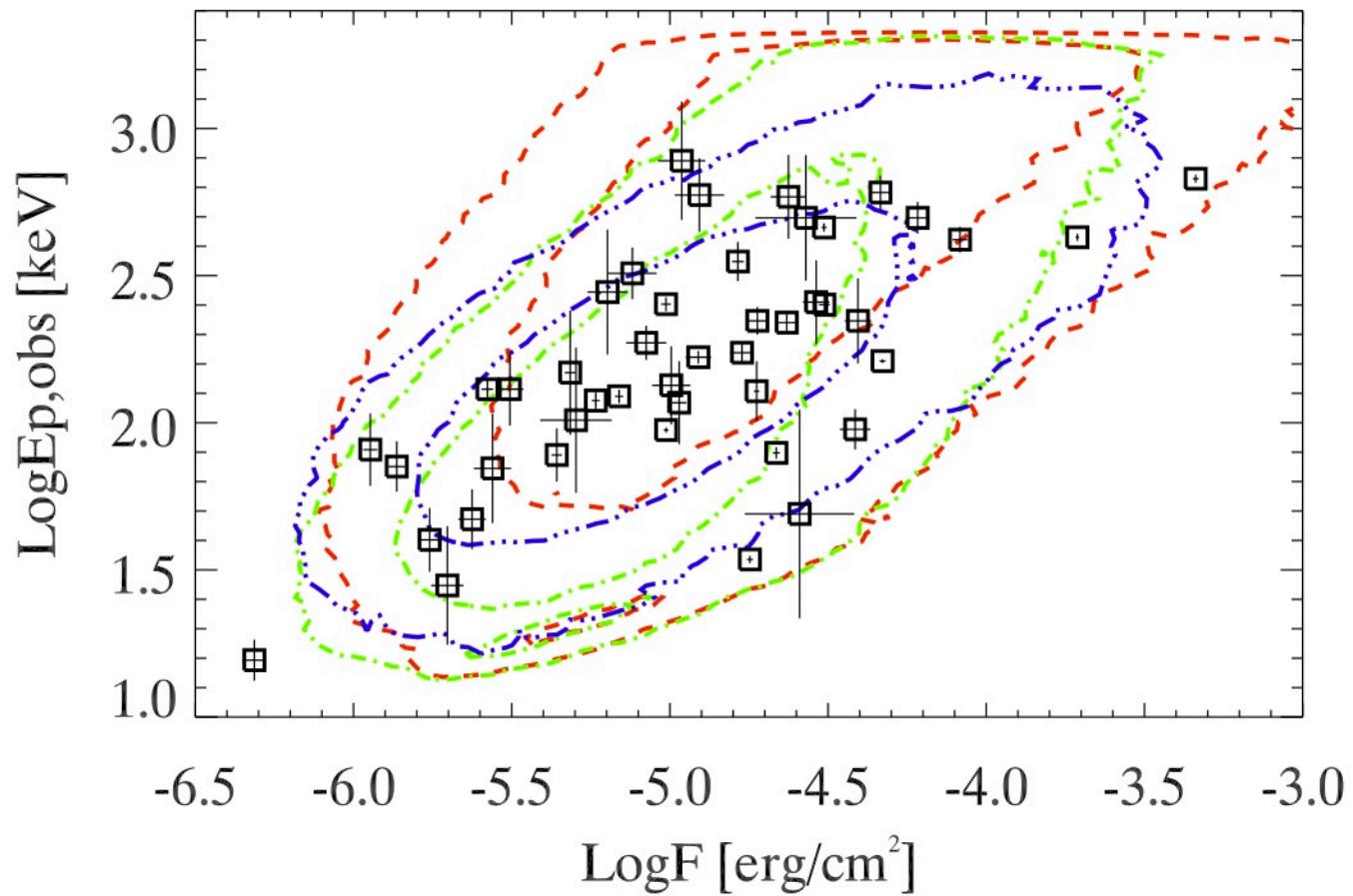


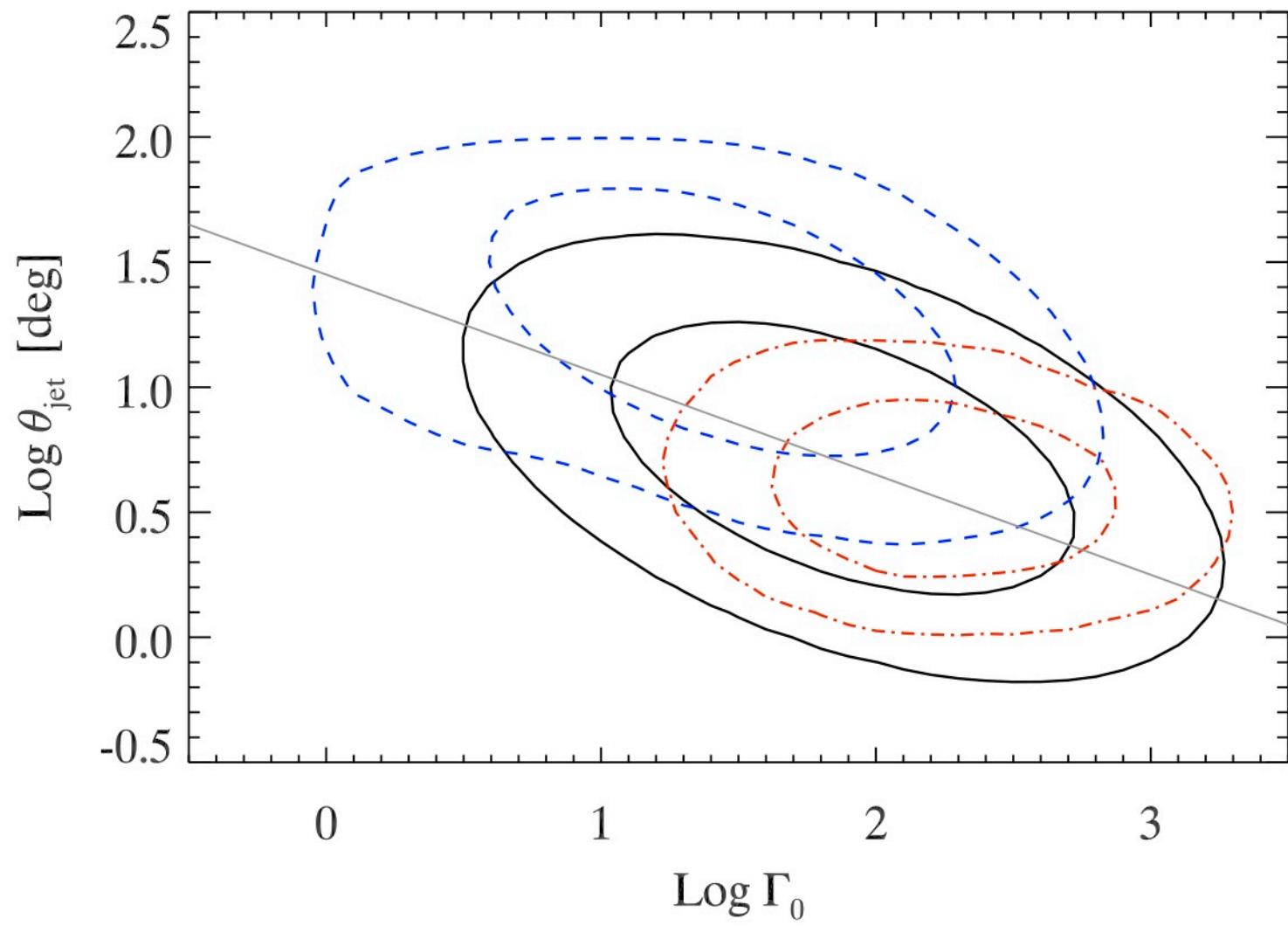


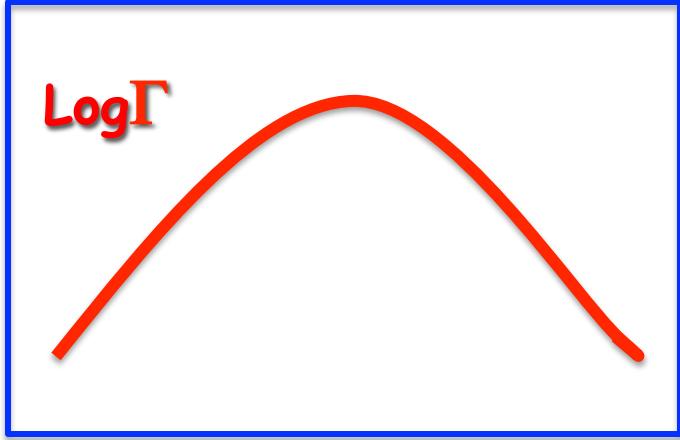
Conclusions

- Consistent picture
- There must be preferred jet angles and Γ
- The typical jet angle is small (3-5 degrees)
- The typical Γ is relatively small (30-100)
- There must be a relation between Θ_{jet} and Γ
- ~8% of GRBs have no jet breaks ($\Theta_{\text{jet}} < 1/\Gamma$)
- GRBs are ~ 0.3% of SN Ibc

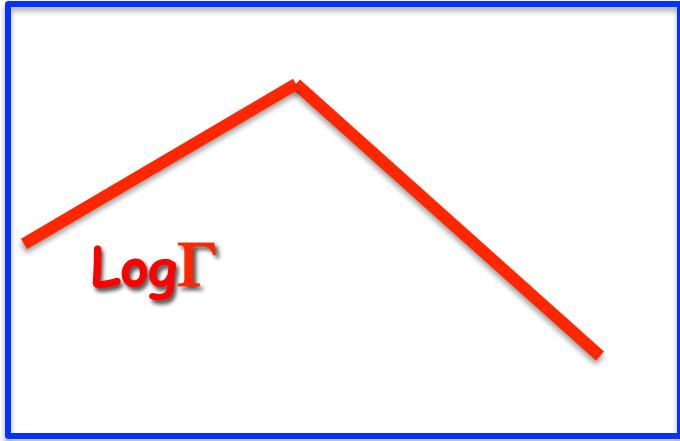




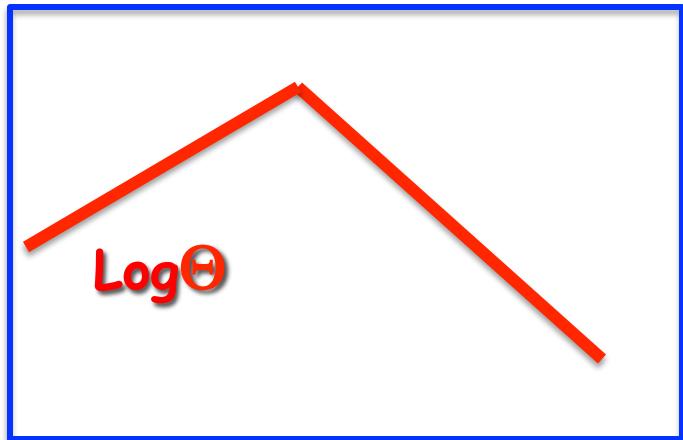
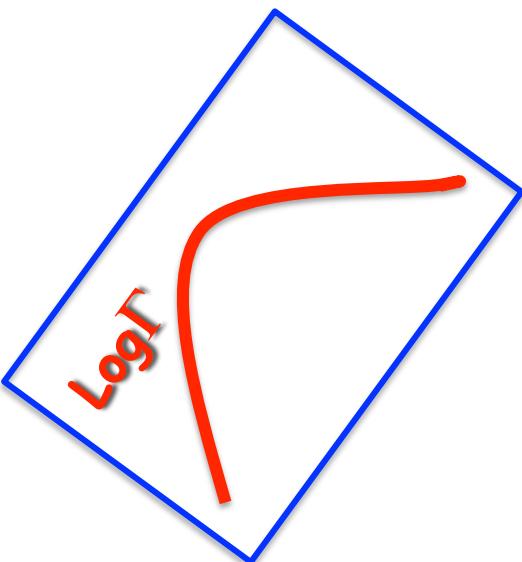




$\text{Log}\Gamma$

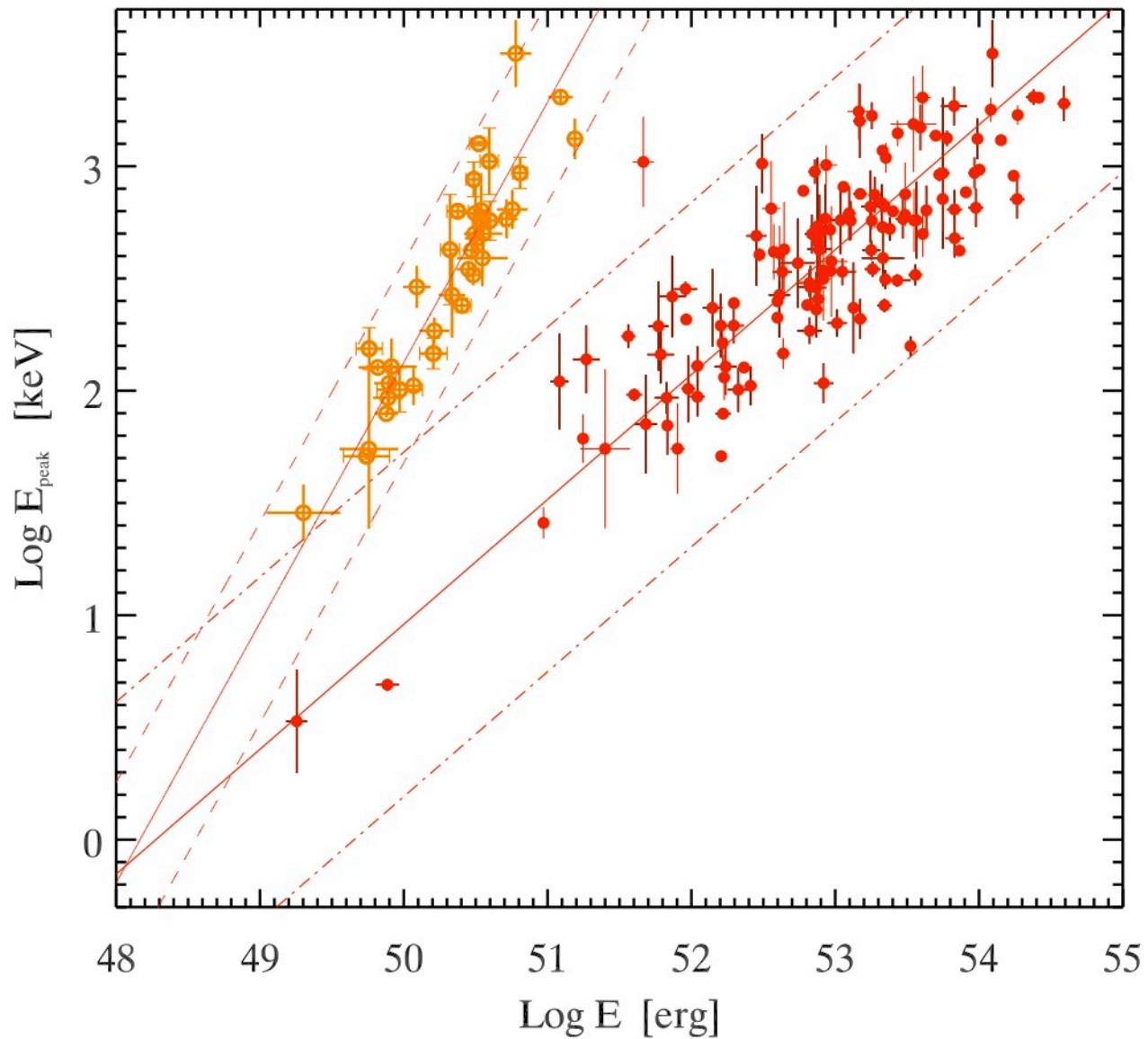
A graph showing a red curve that starts at a low value on the left, rises to a peak, and then falls back down to a lower value on the right. The curve is smooth and continuous.

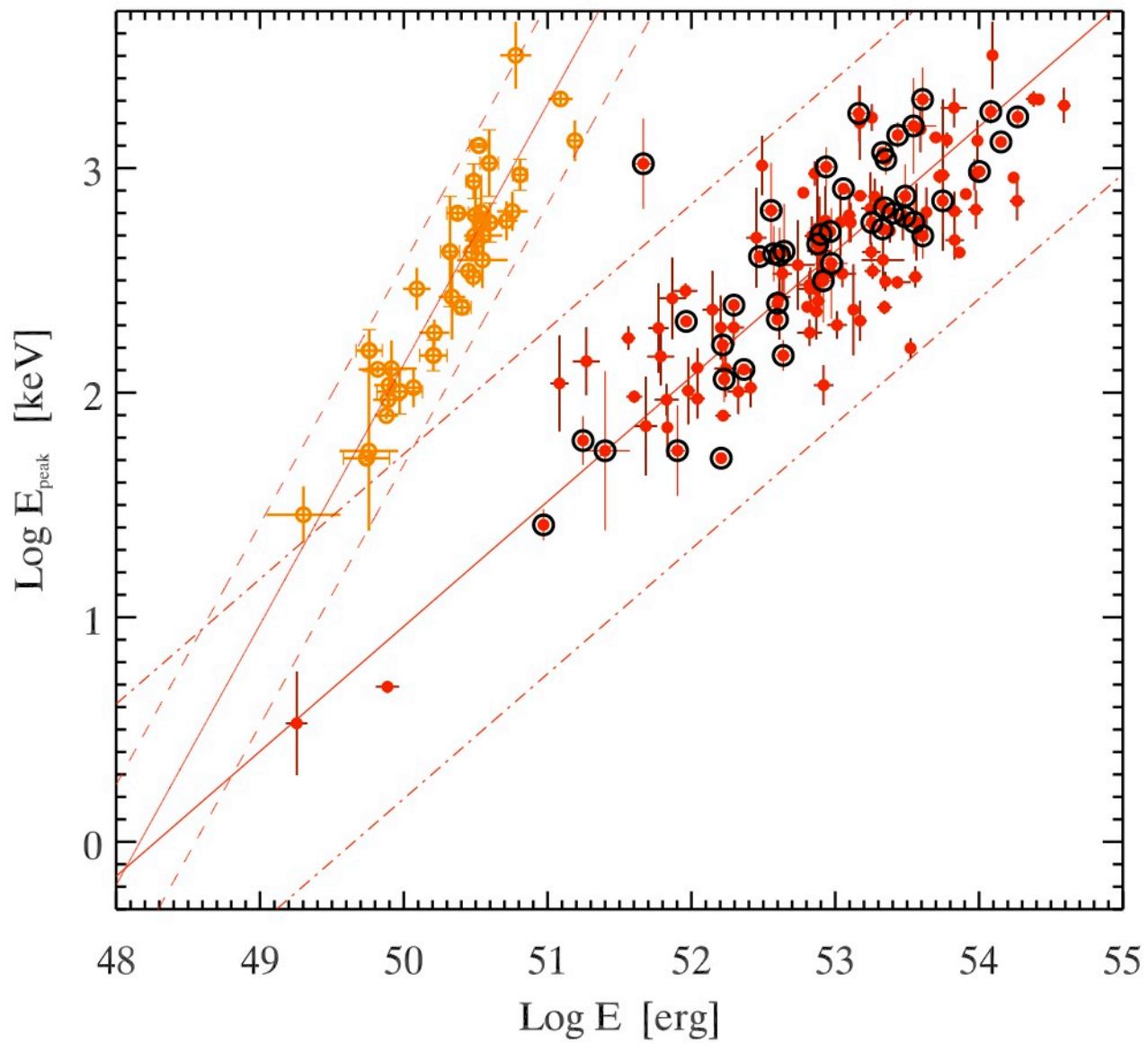
$\text{Log}\Gamma$

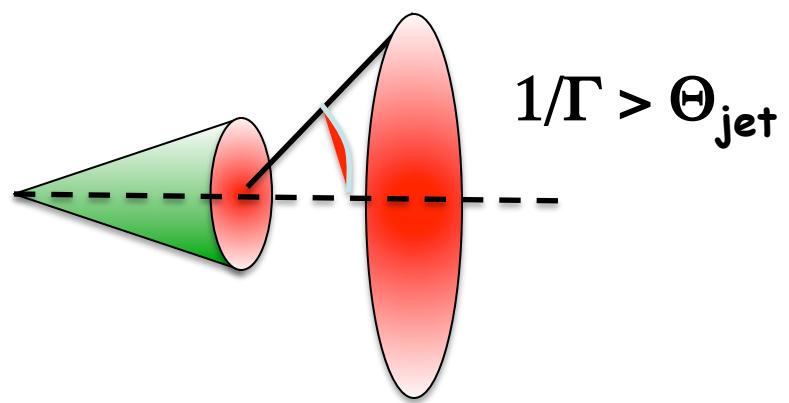
A graph showing a red curve that starts at a low value on the left, rises sharply to a peak, and then falls back down to a lower value on the right. The curve is smooth and continuous.

$\text{Log}\Theta$

A graph showing a red curve that starts at a low value on the left, rises sharply to a peak, and then falls back down to a lower value on the right. The curve is smooth and continuous.







$$1/\Gamma > \Theta_{\text{jet}}$$