

Prospects for detecting pulsed gamma-ray emission from Pulsars with CTA

Cameron Rulten



Cameron Rulten - CTA UK Meeting -
Liverpool 10th Sep 2012



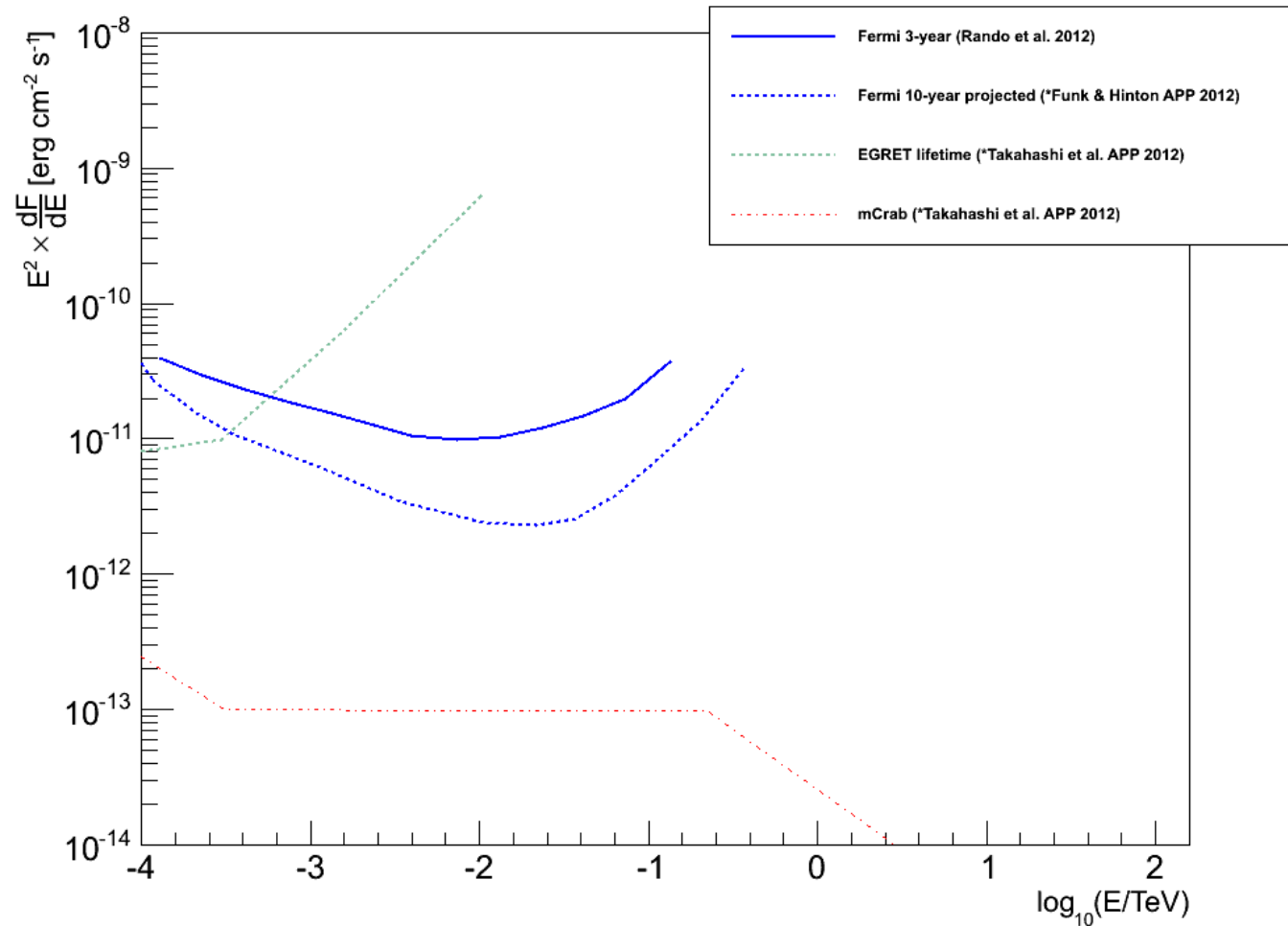
Outline



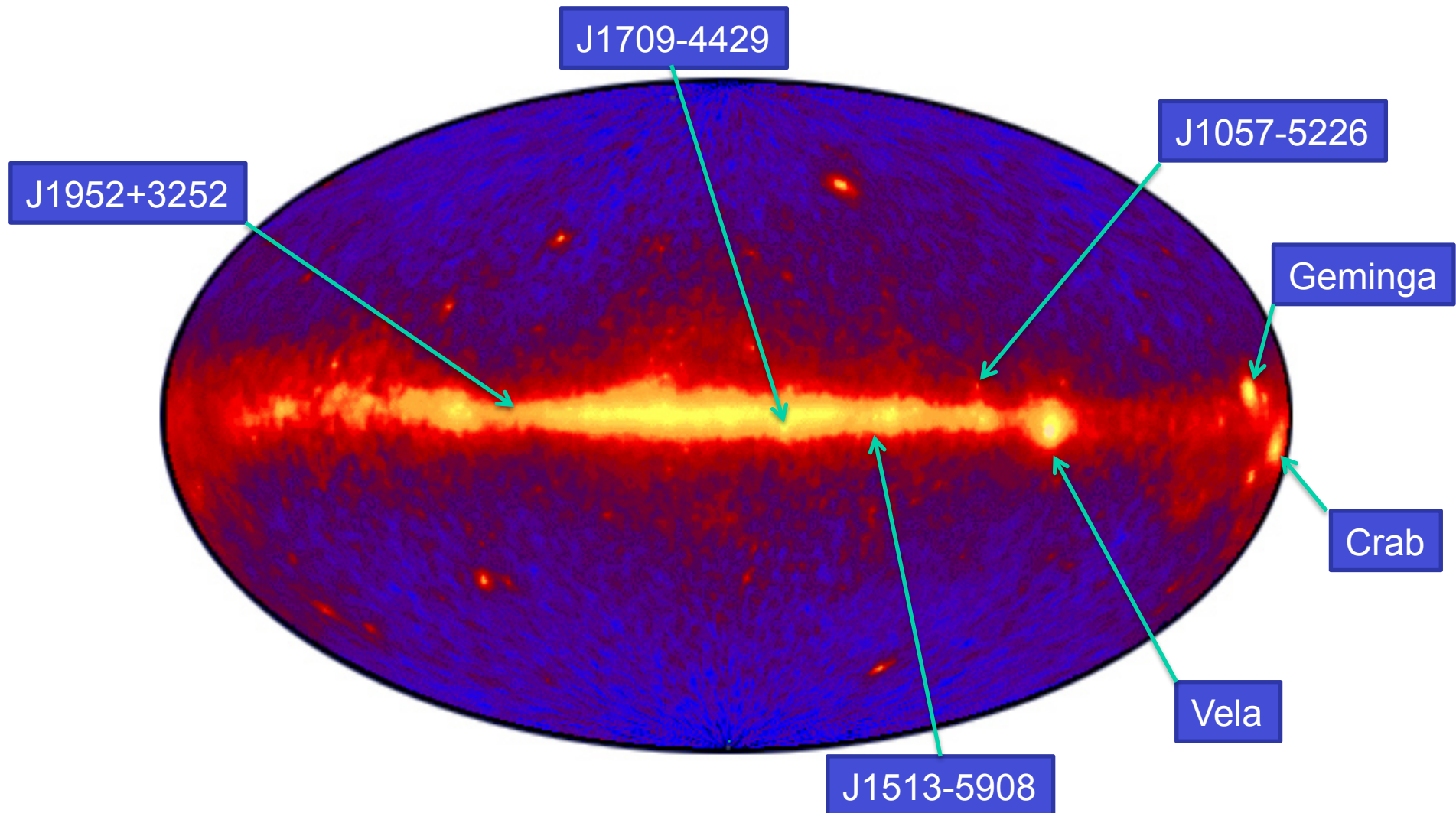
- **Space-based observations of γ -ray pulsars**
- **Fermi LAT observations of the Crab and Vela pulsars**
- **Energy spectra of γ -ray pulsars**
- **Ground-based observations of γ -ray pulsars**
- **CTA sensitivity performance and detection prospects**
- **Conclusions**
- **Future work**

Space-based sensitivities

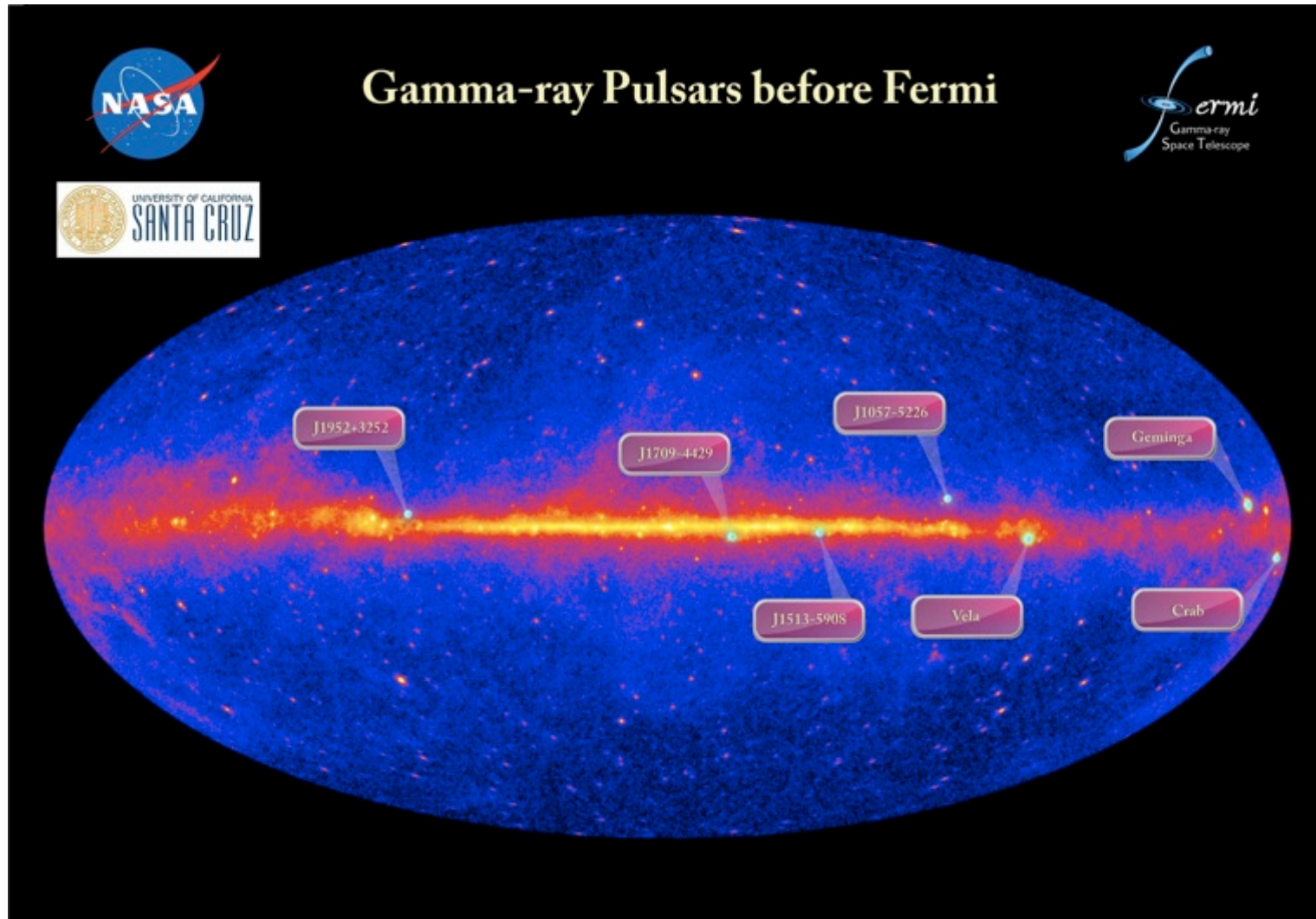
Space-based γ -ray telescopes: differential flux sensitivity



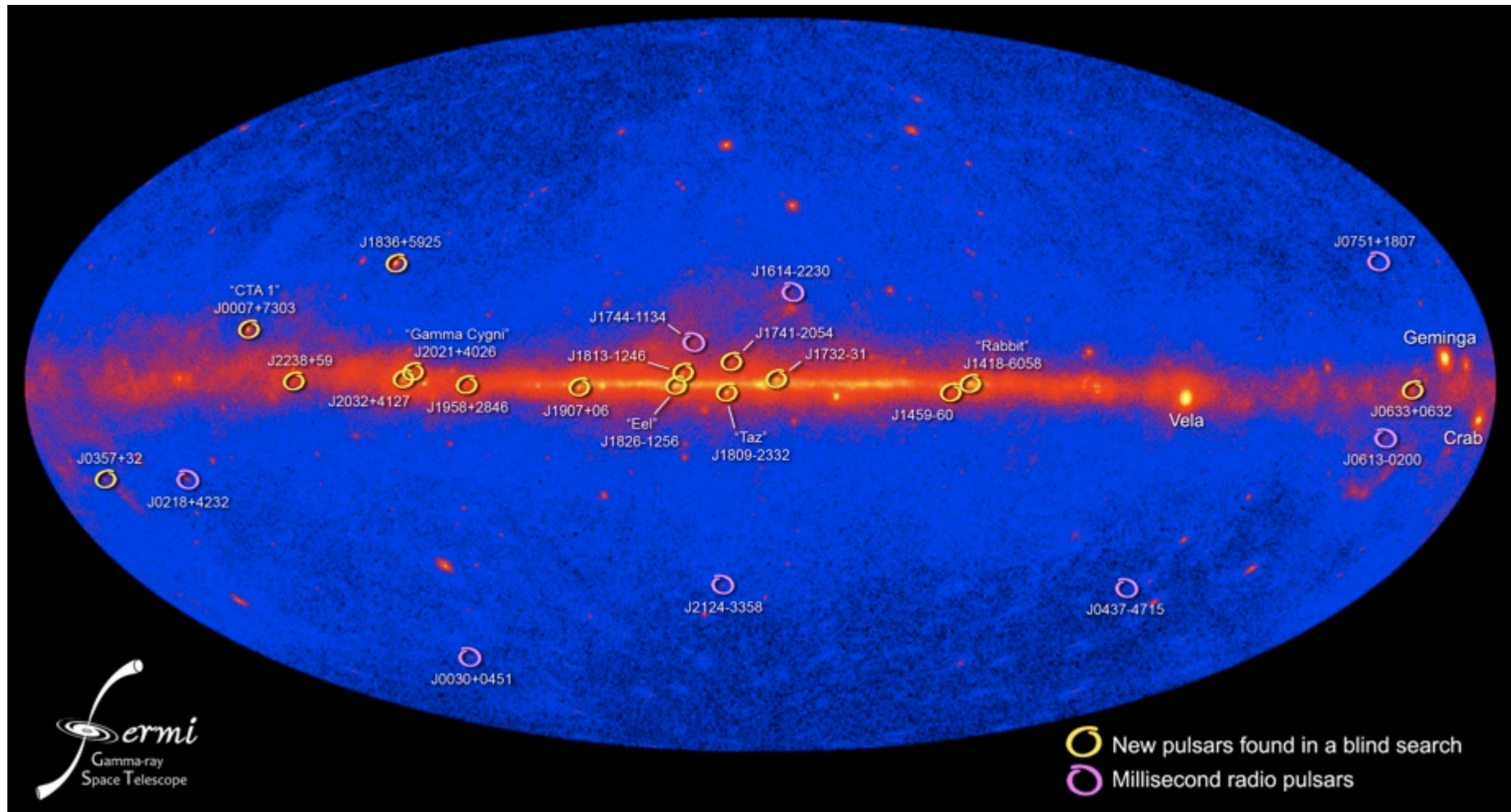
EGRET detected pulsars



Fermi LAT – 7 Samurai



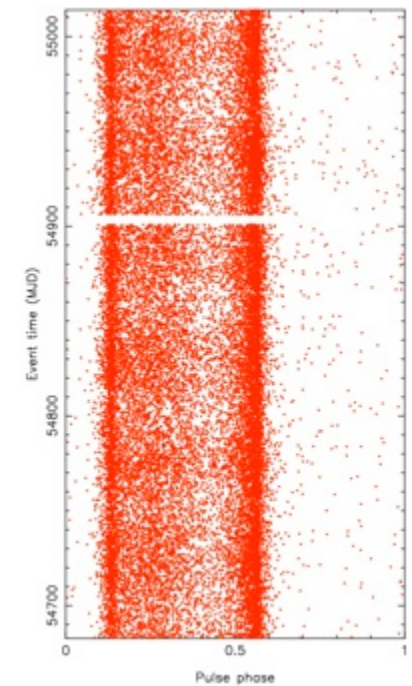
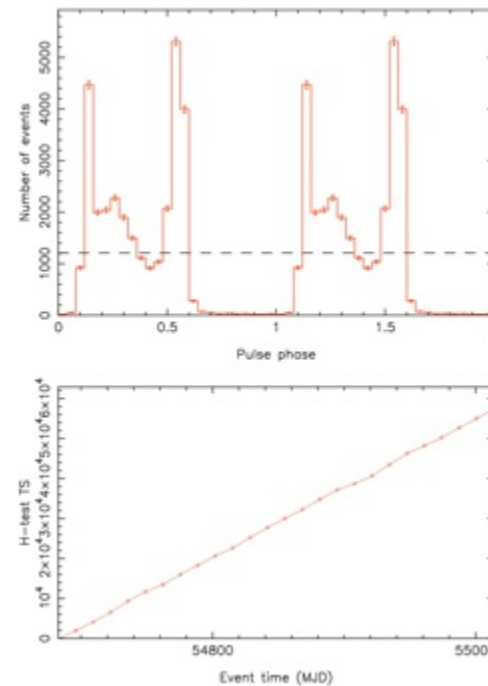
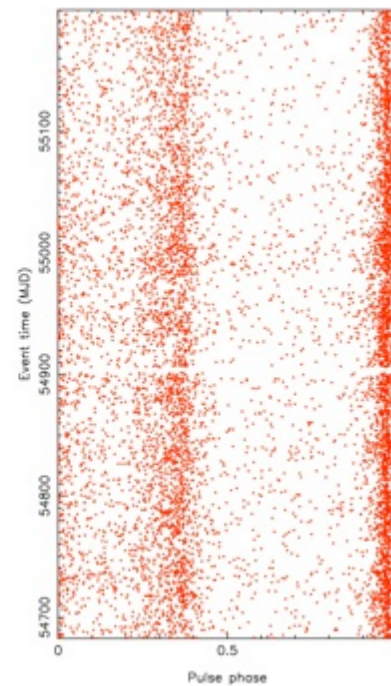
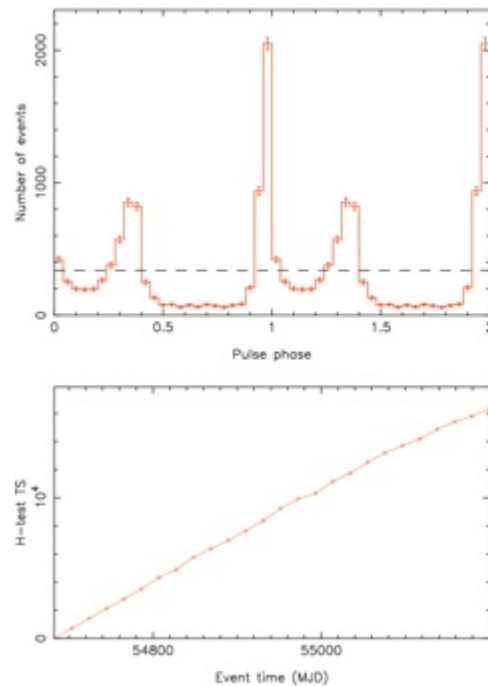
Fermi LAT – New pulsars



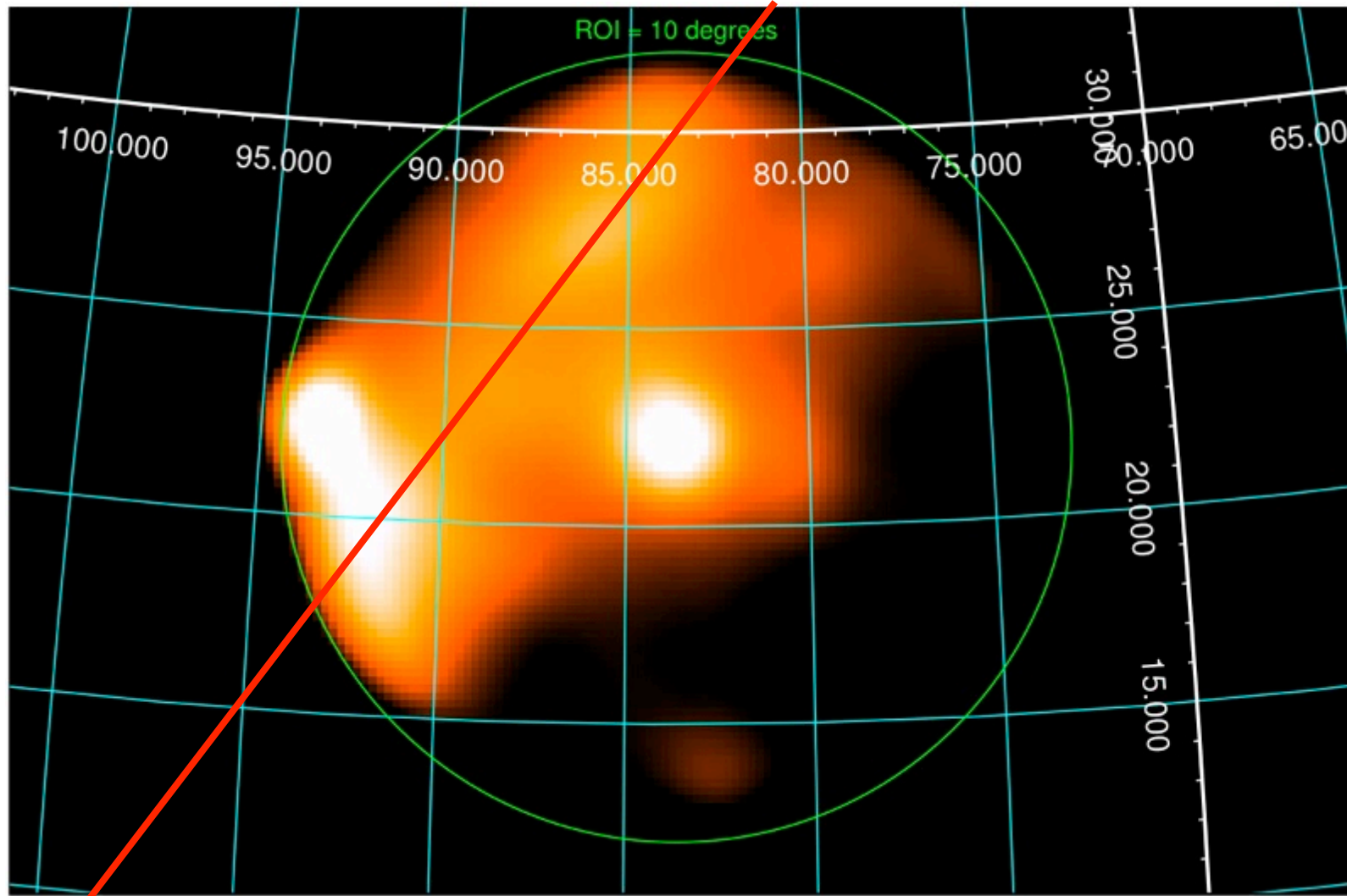
Crab & Vela pulsars

Crab

Vela

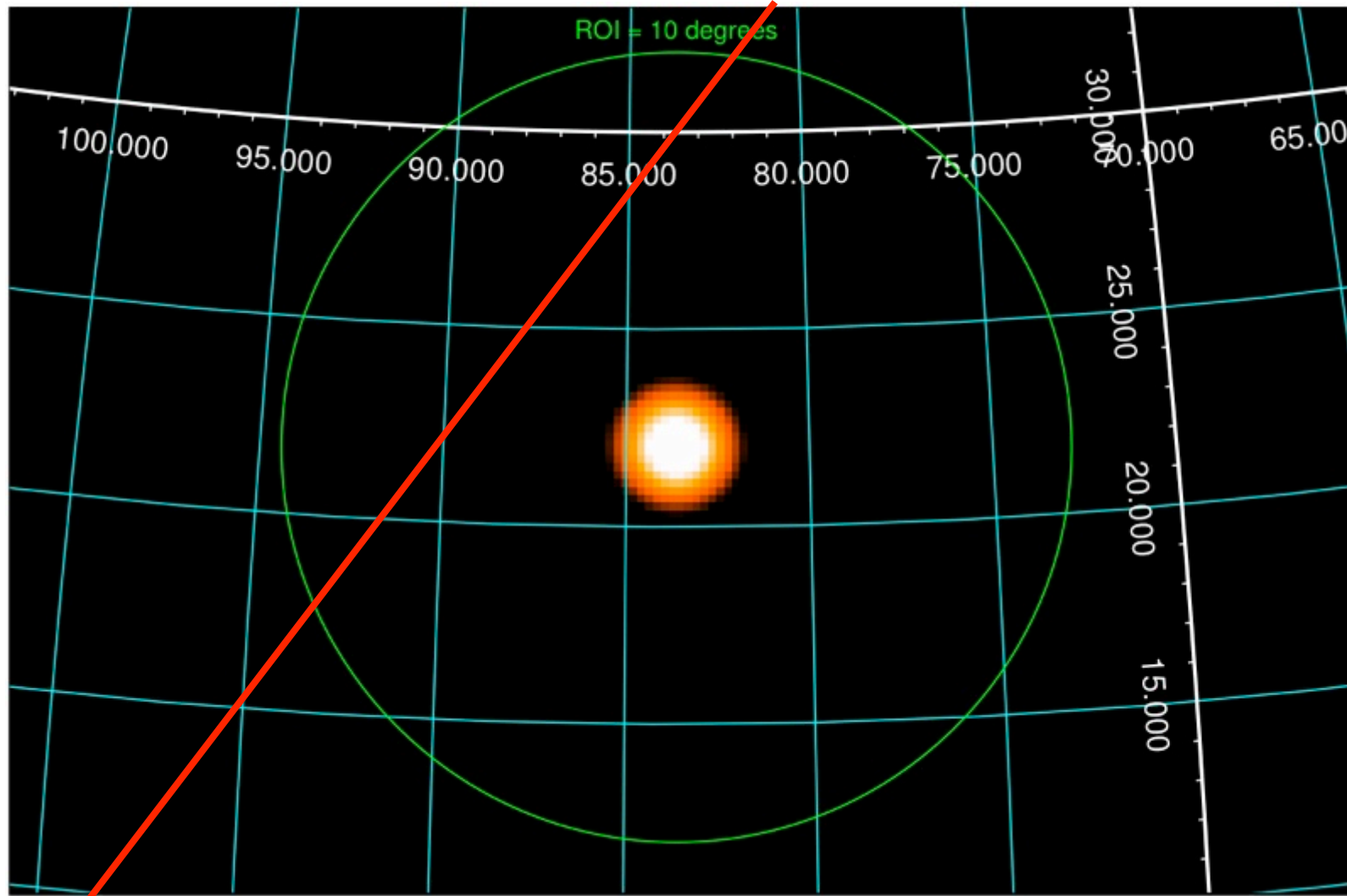


Crab pulsar – off pulse



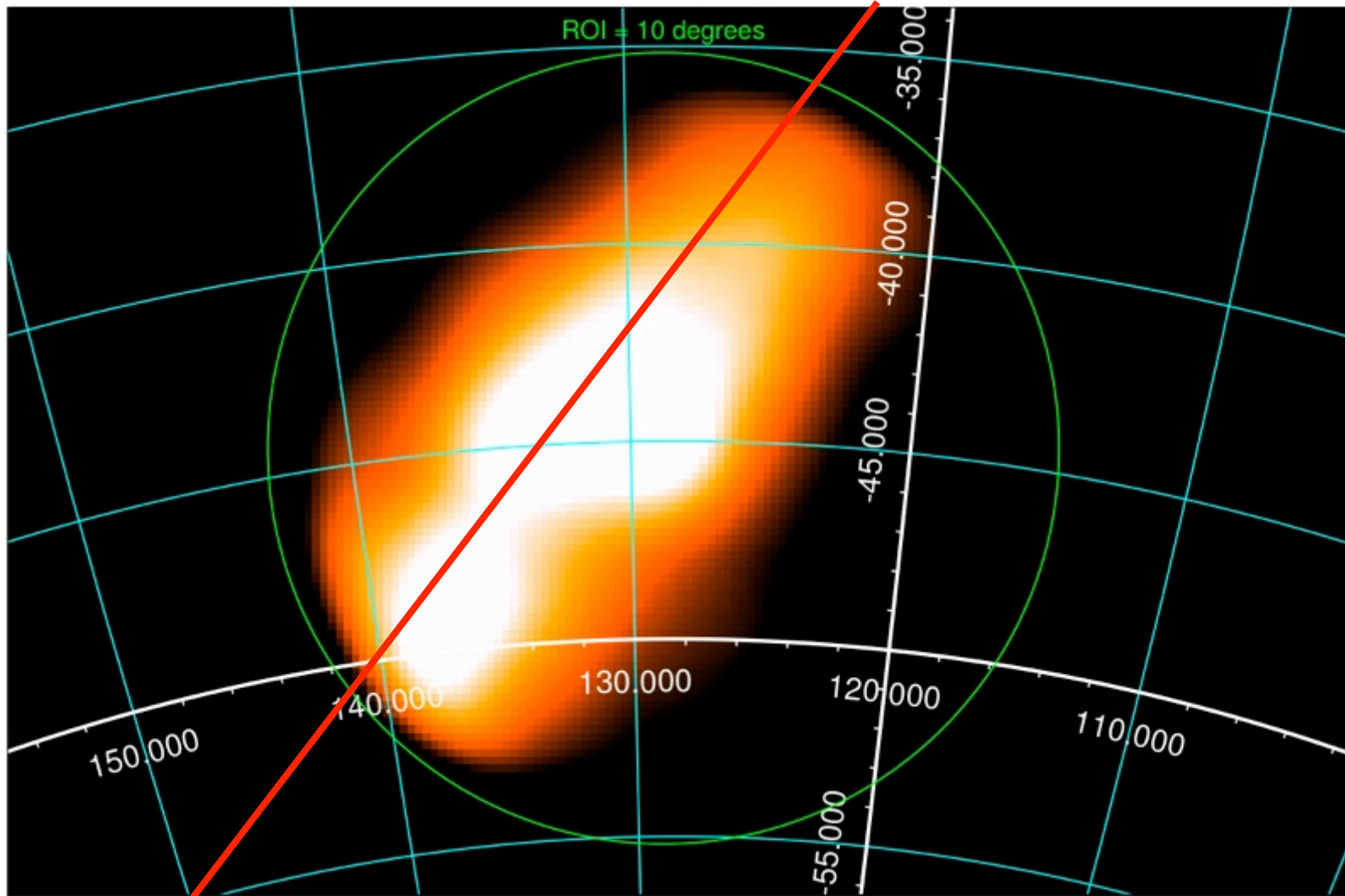
Galactic plane

Crab pulsar – on pulse



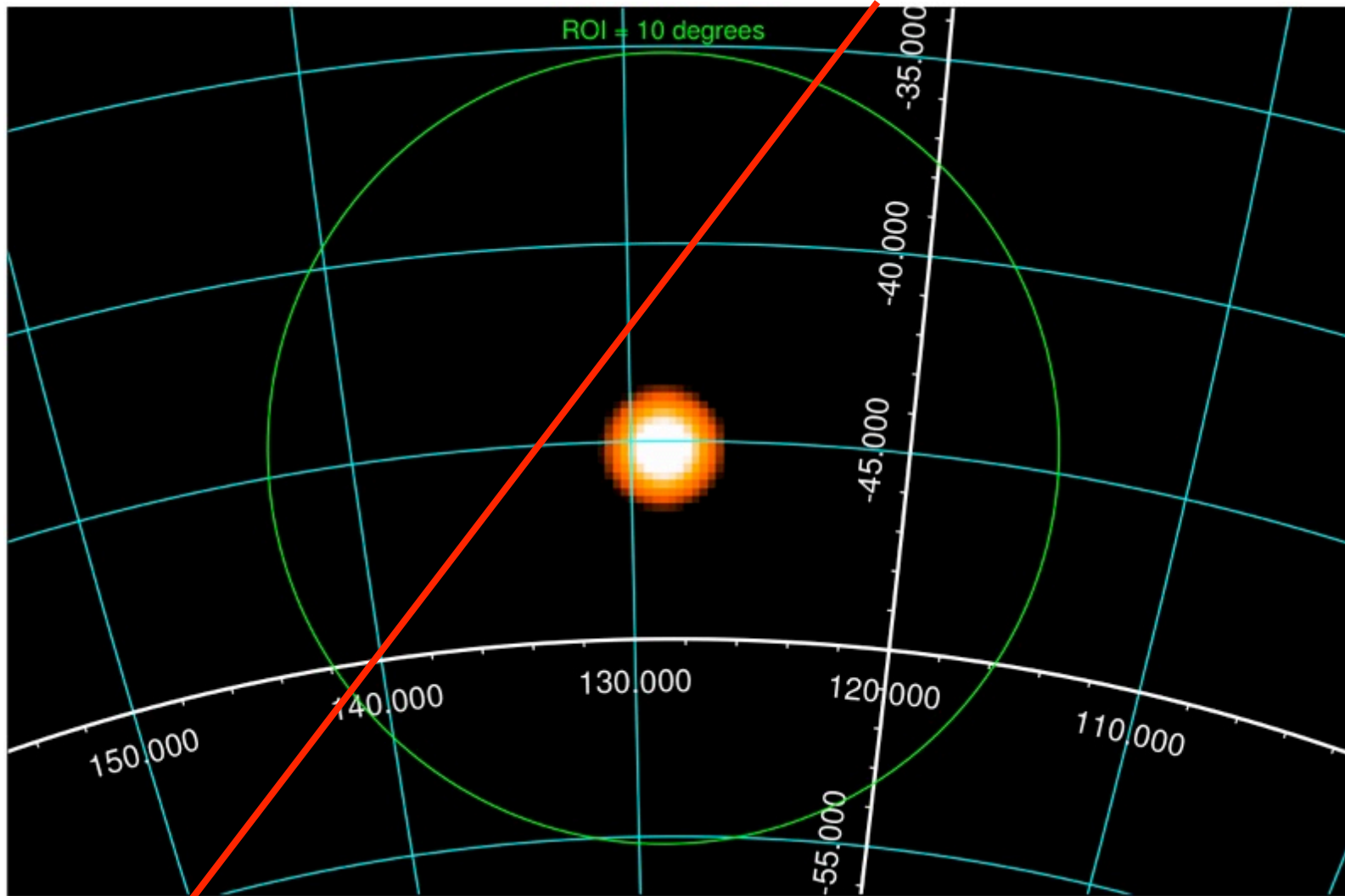
Galactic plane

Vela pulsar – off pulse



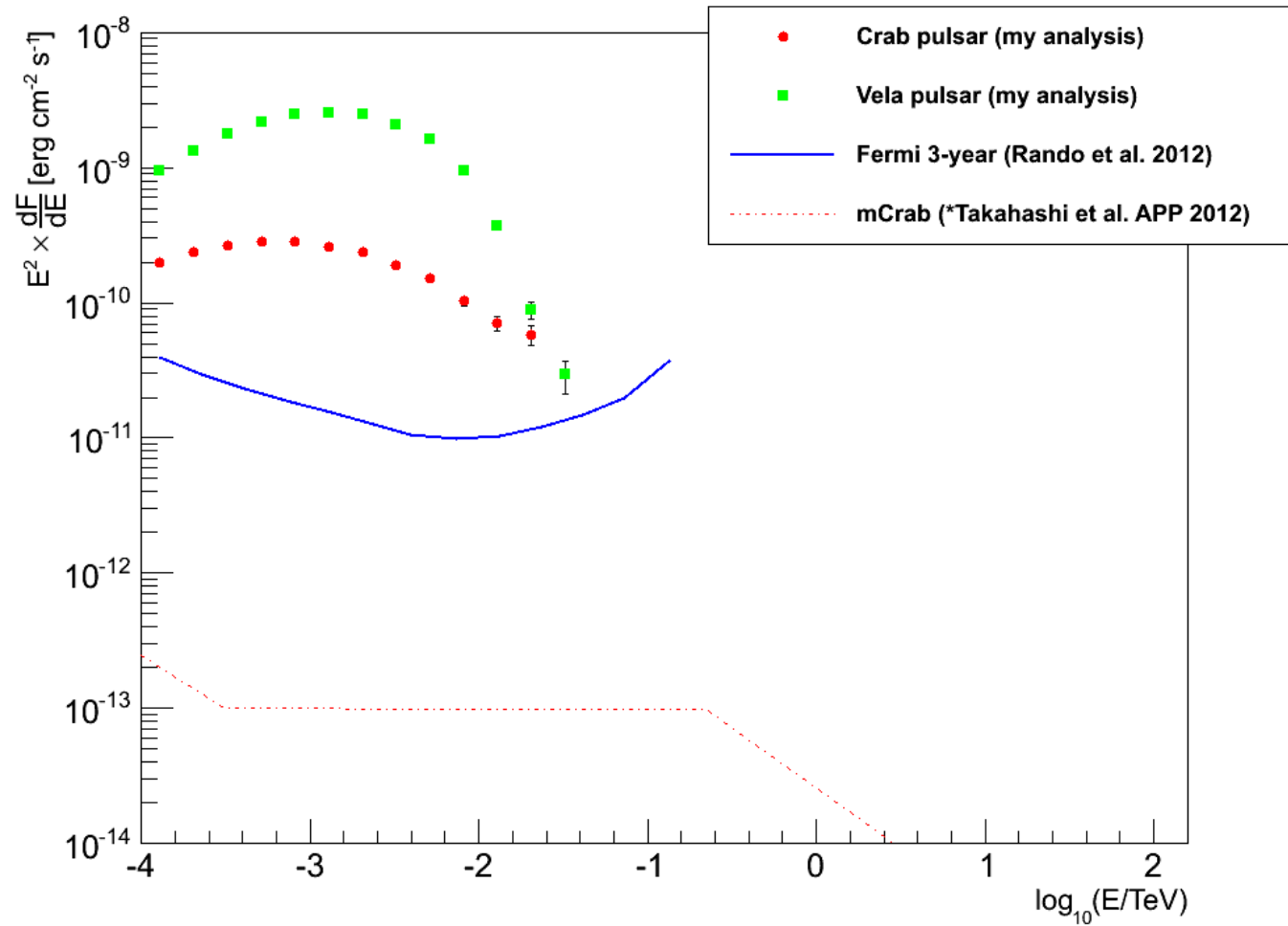
Galactic plane

Vela pulsar – on pulse

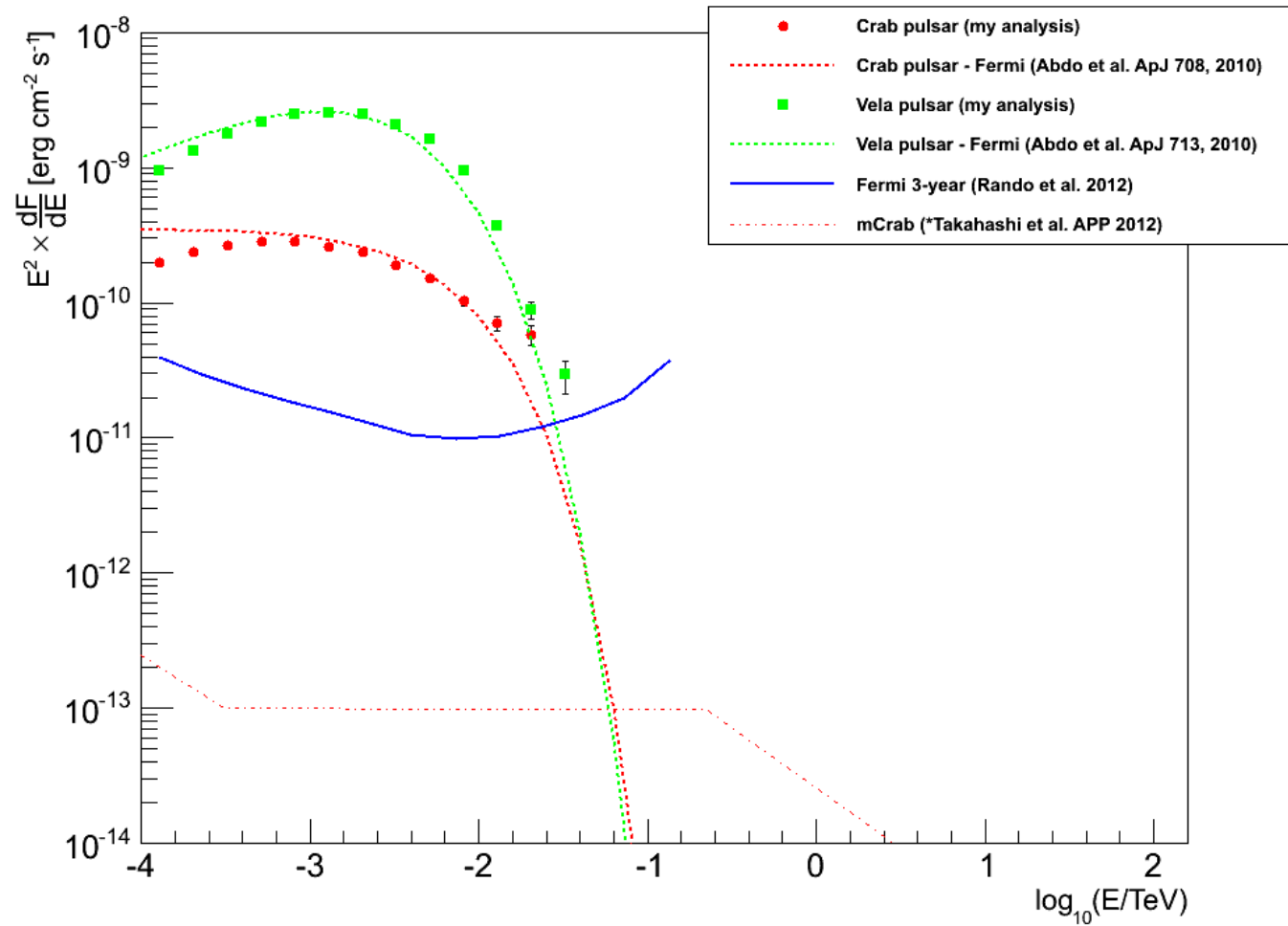


Galactic plane

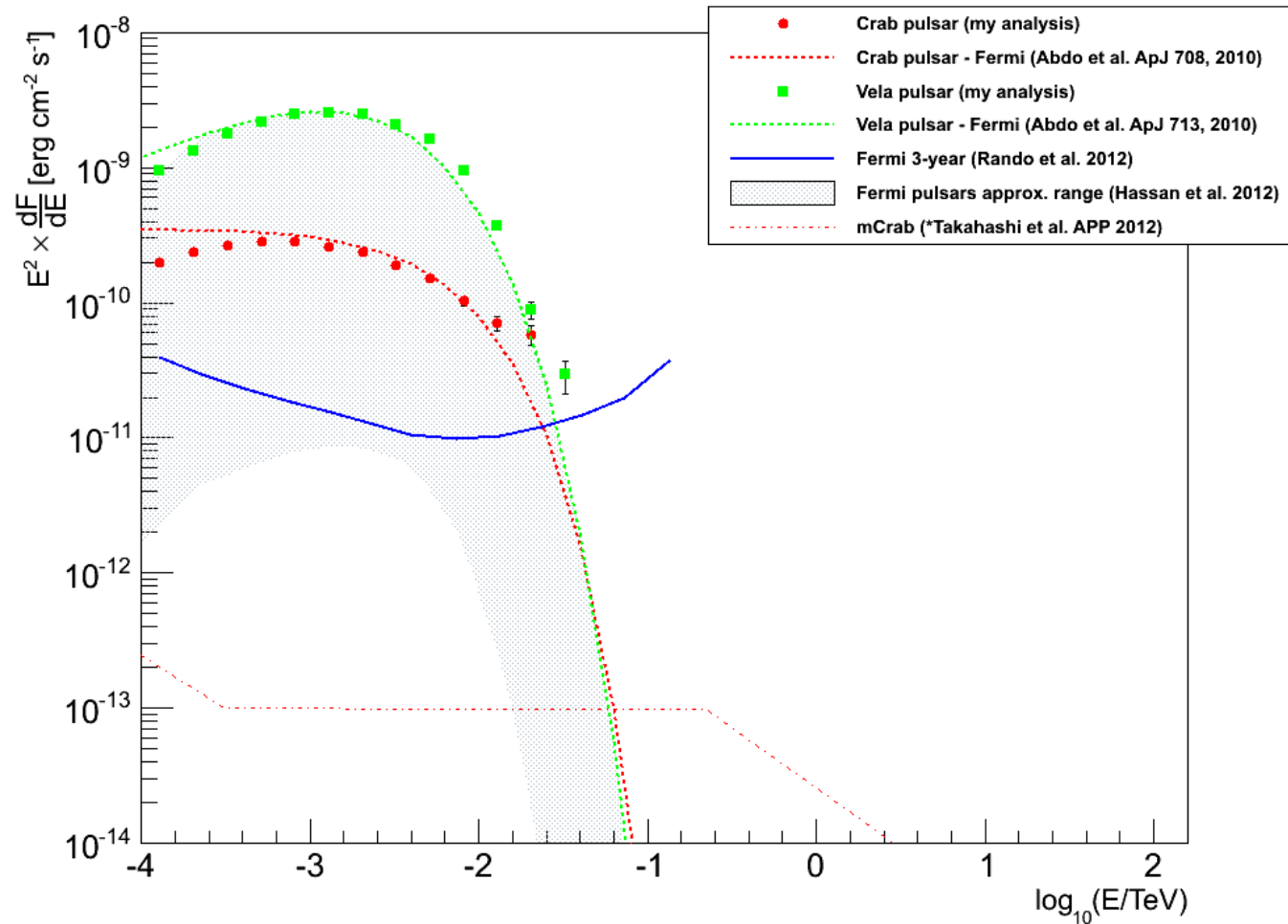
Crab & Vela spectra



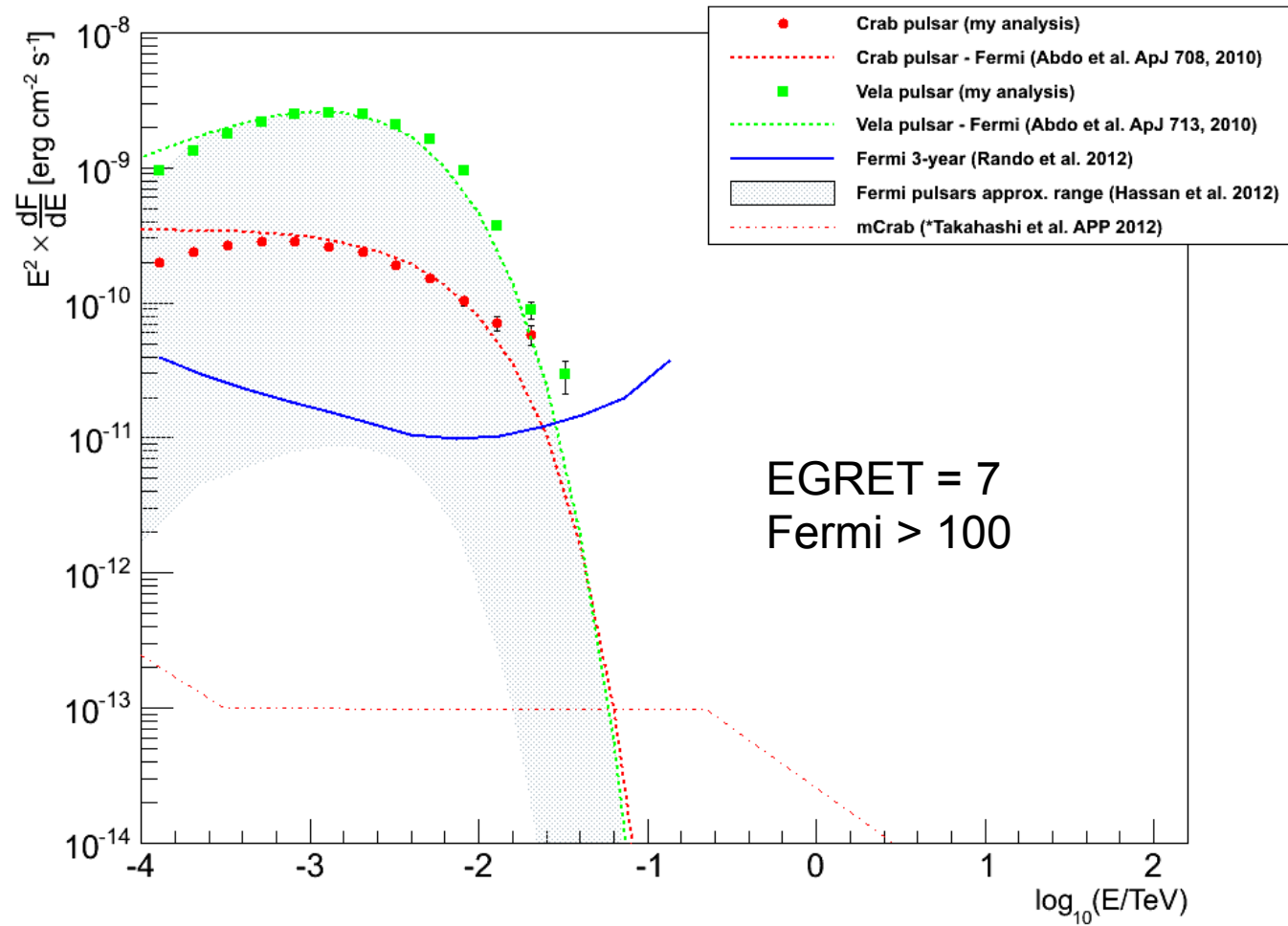
Published models



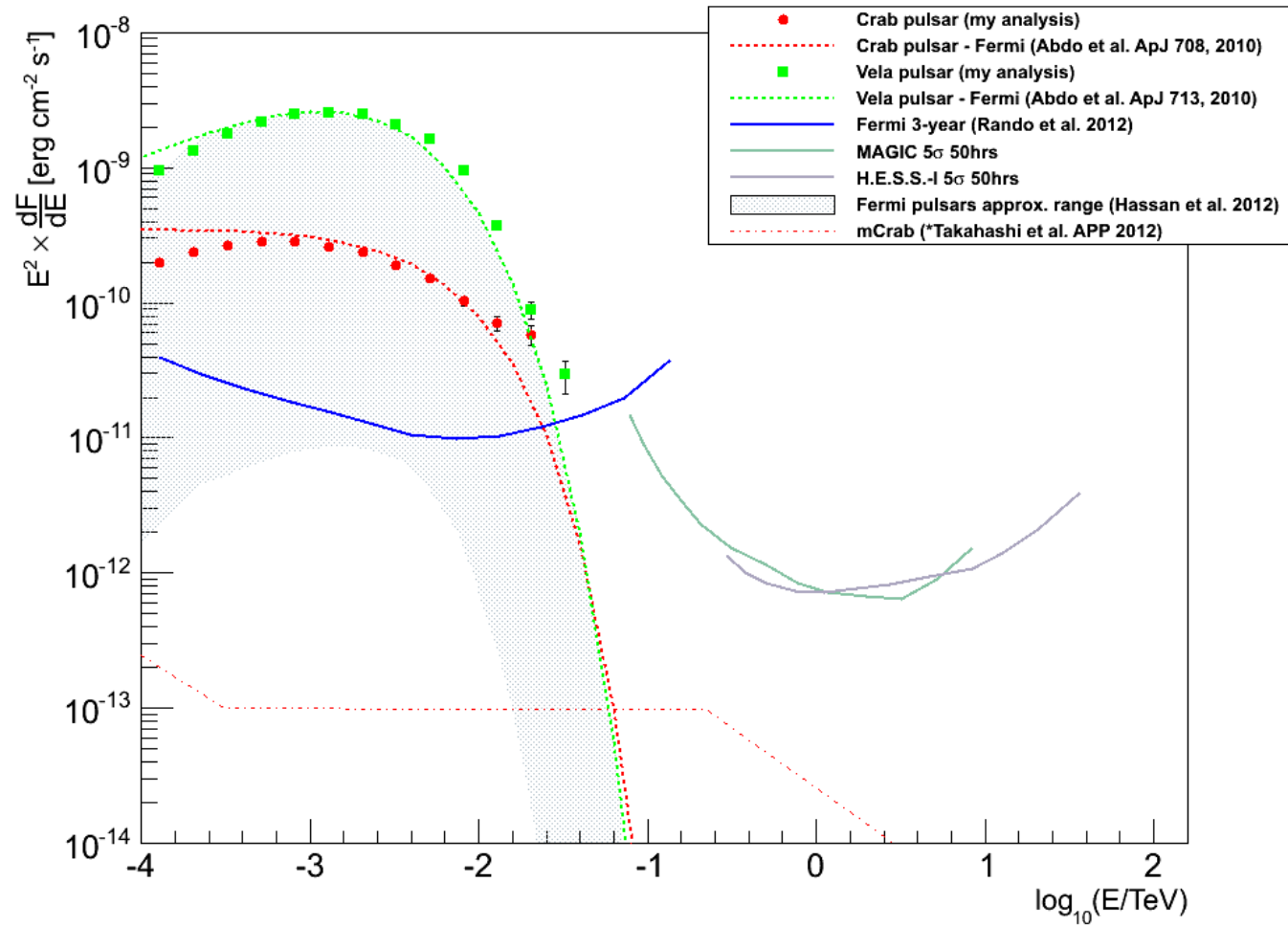
Range of Fermi γ -ray pulsars



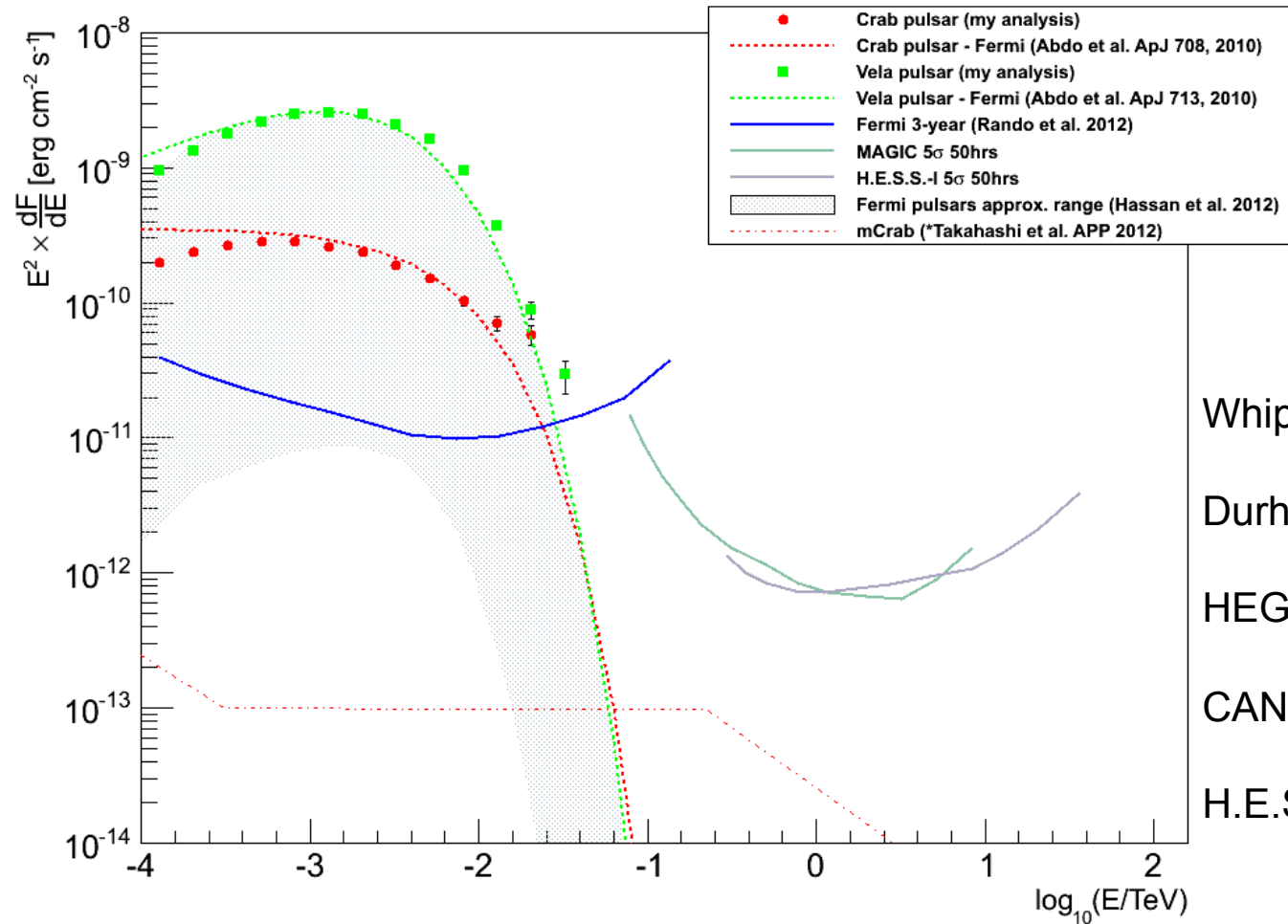
Detected γ -ray pulsars



Ground-based sensitivities



Ground-based historical



Whipple = 0

Durham Mk1 & 2 = ?

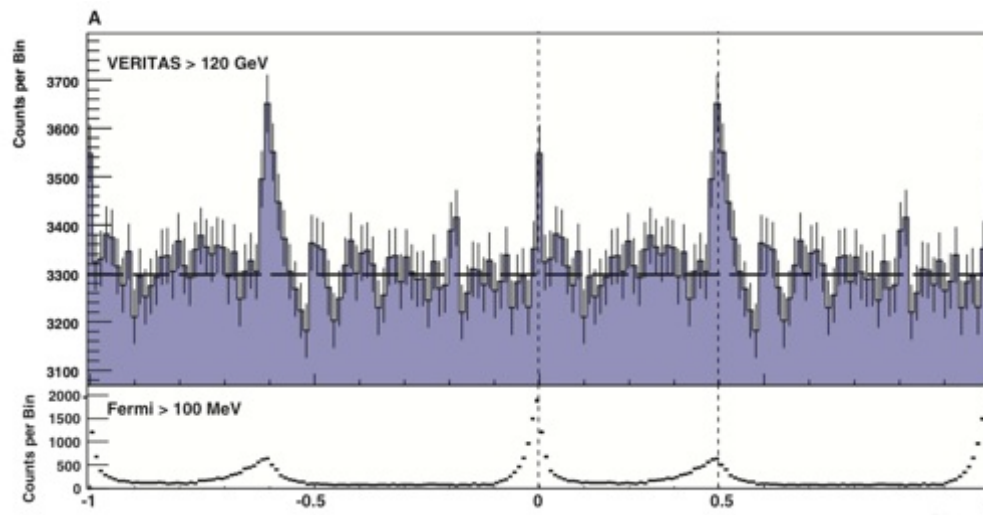
HEGRA = 0

CANGAROO = 0

H.E.S.S. I = 0

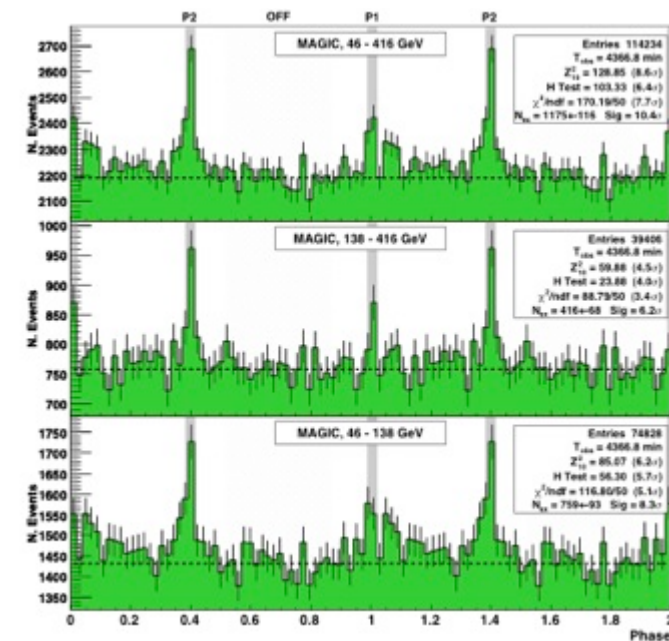
Ground-based detections

VERITAS



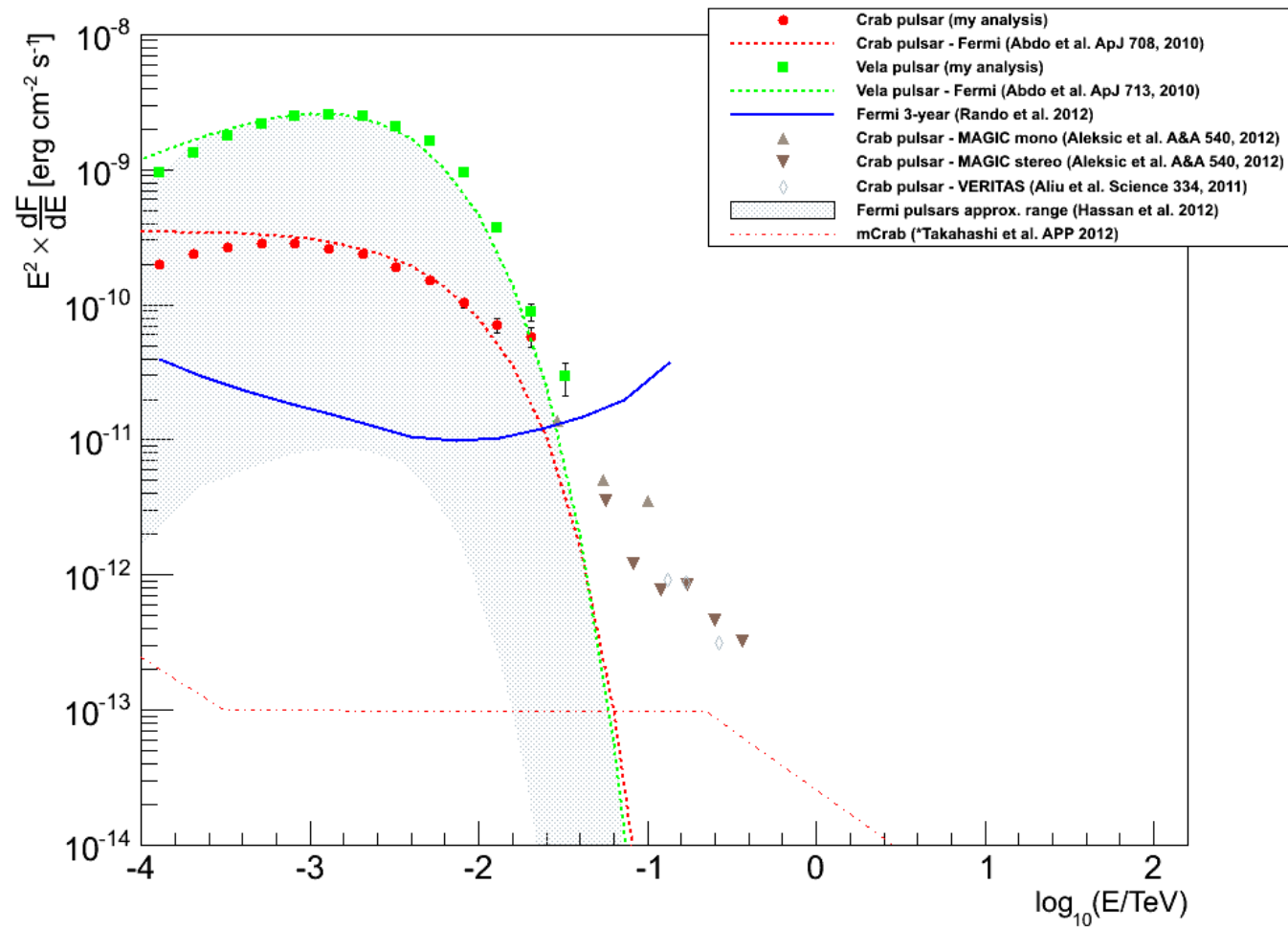
Credit: Crab pulsar - VERITAS (Aliu et al. Science 334, 2011)

MAGIC - Stereo

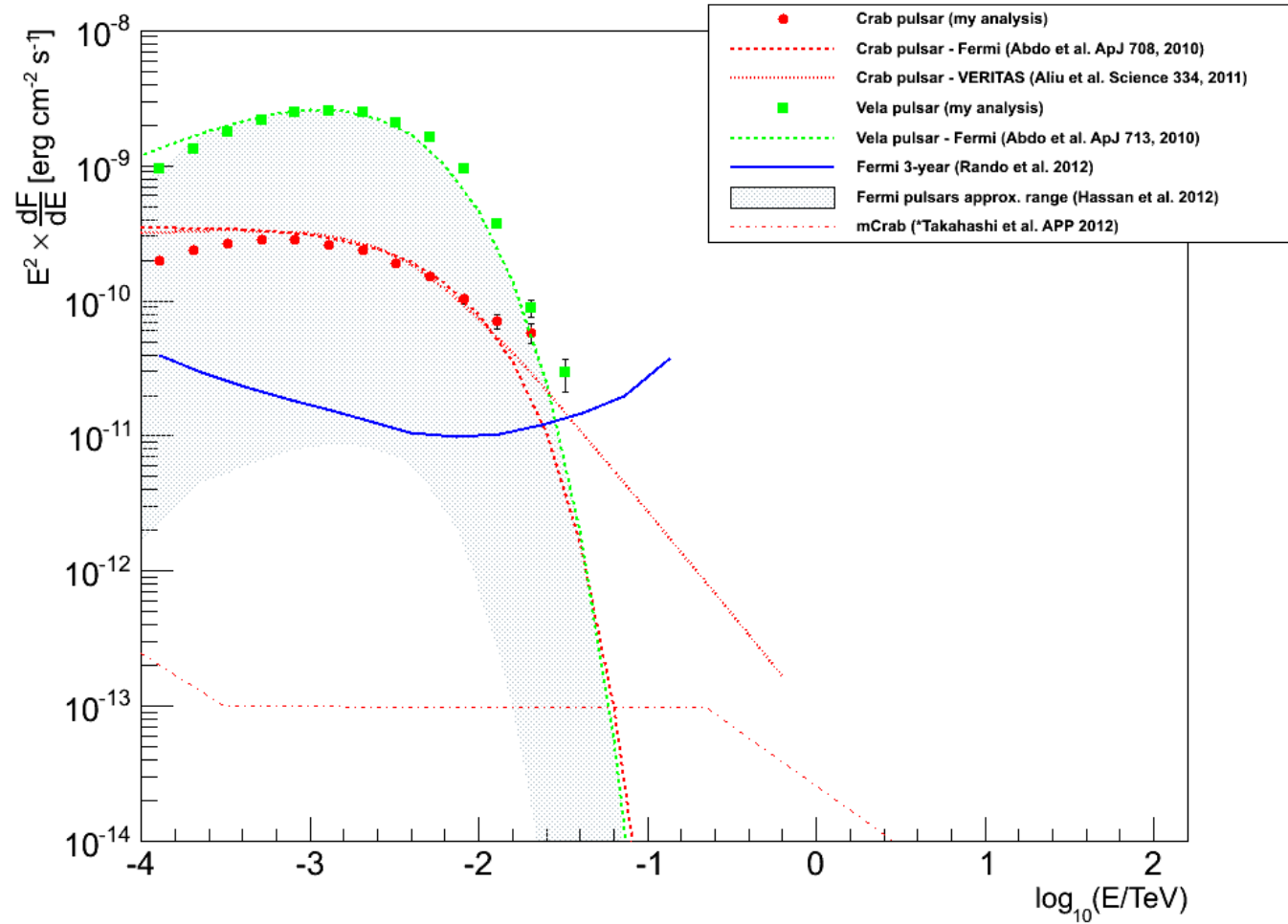


Credit: Crab pulsar - MAGIC stereo (Aleksic et al. A&A 540, 2012)

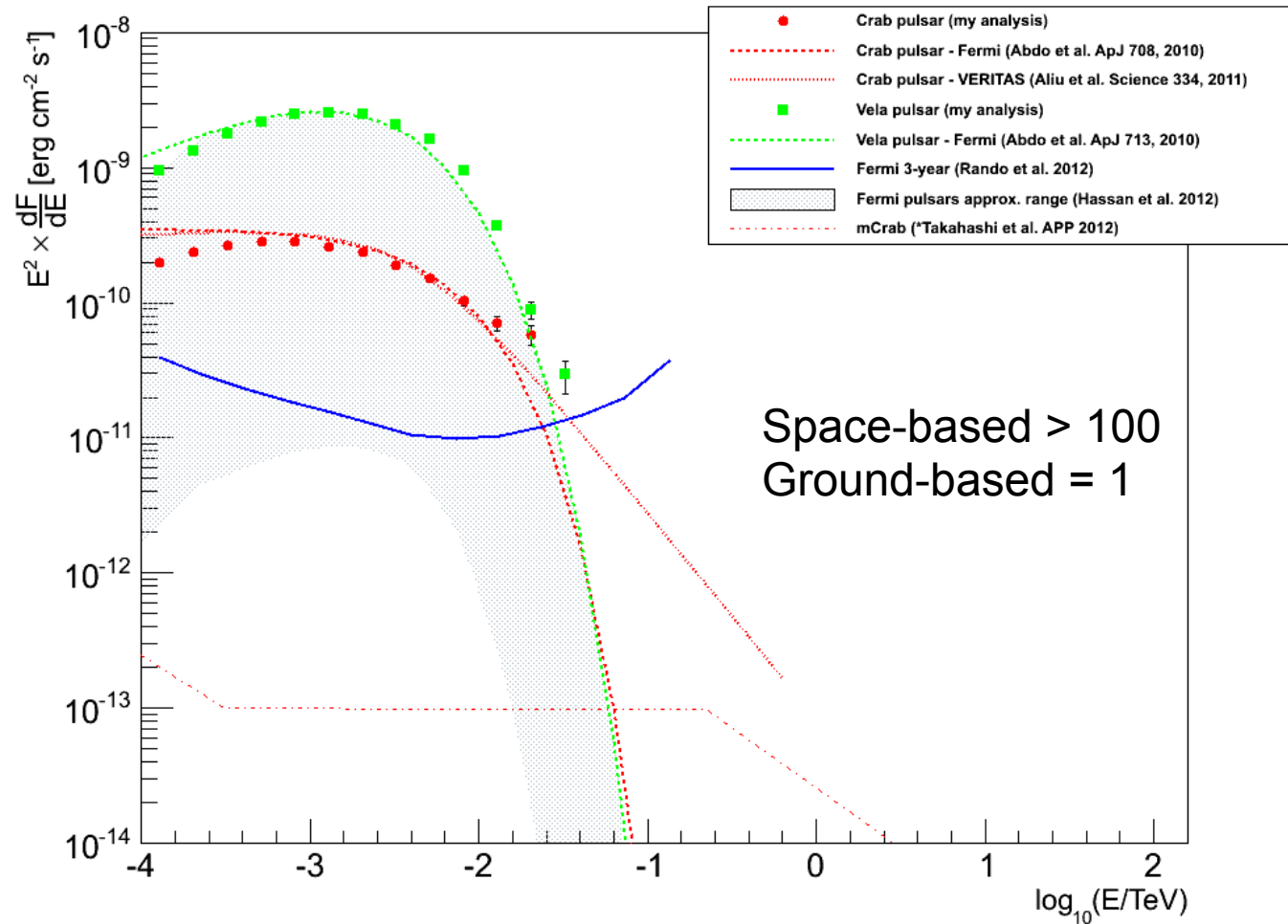
Ground-based spectra



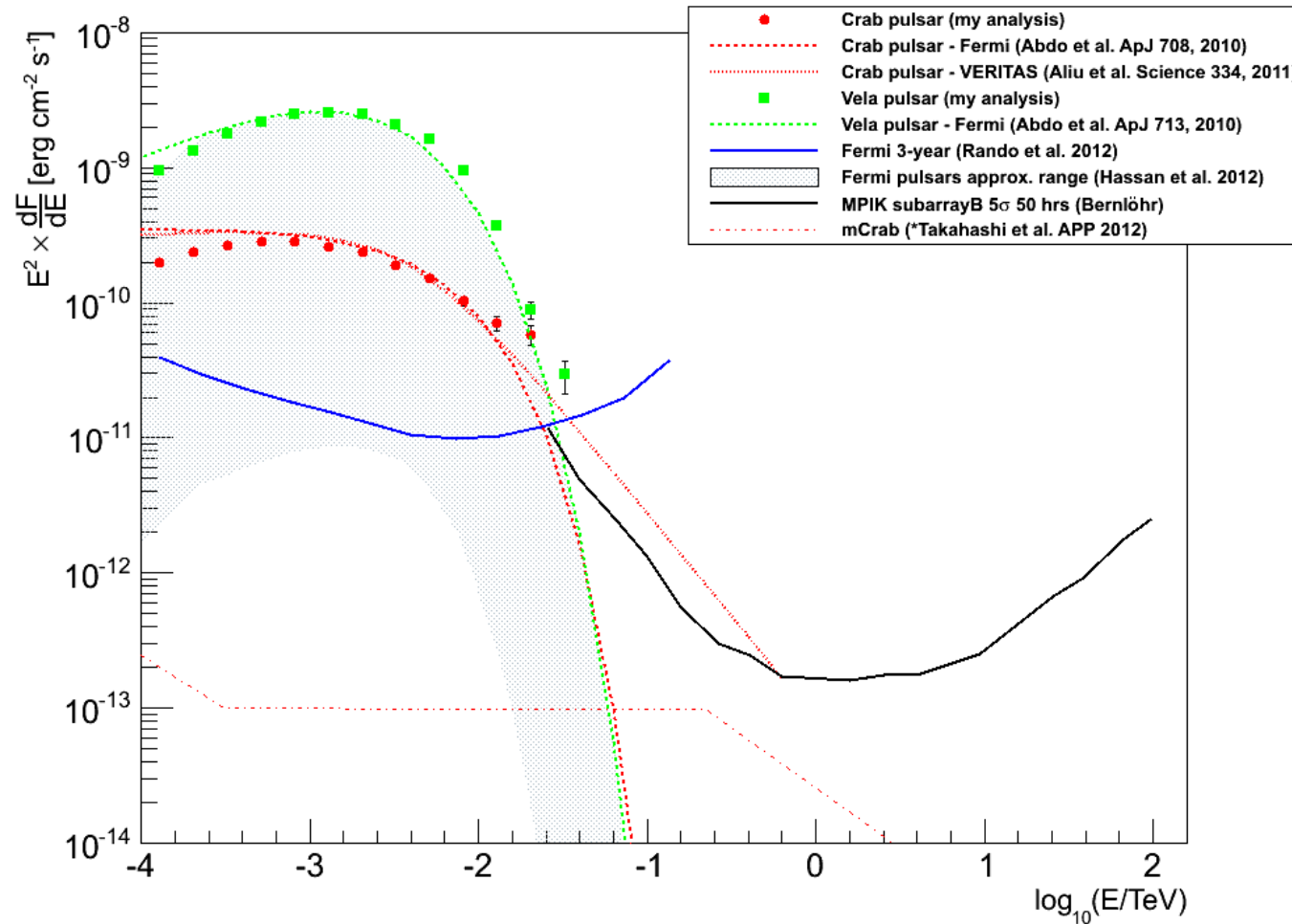
Power-law tail



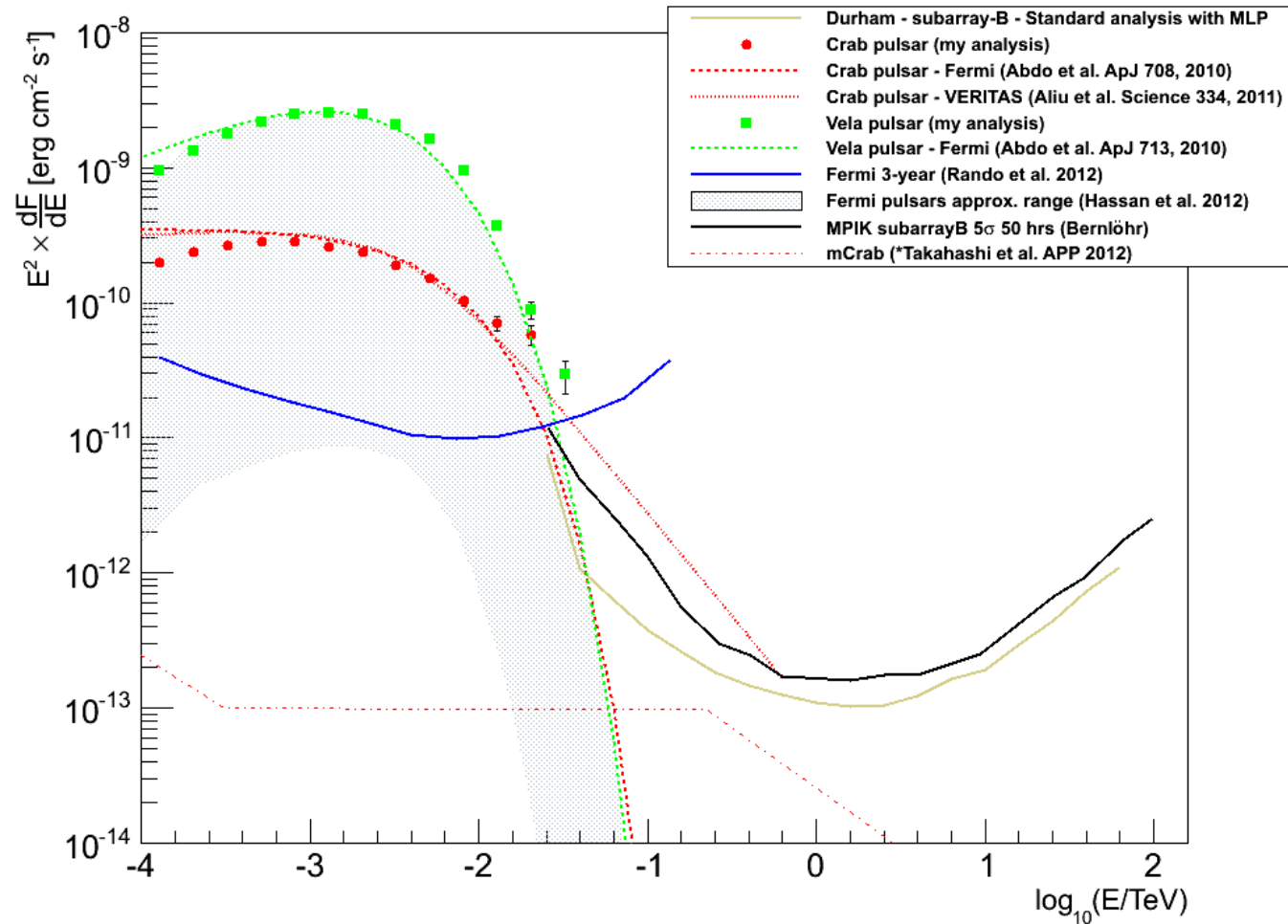
Current situation



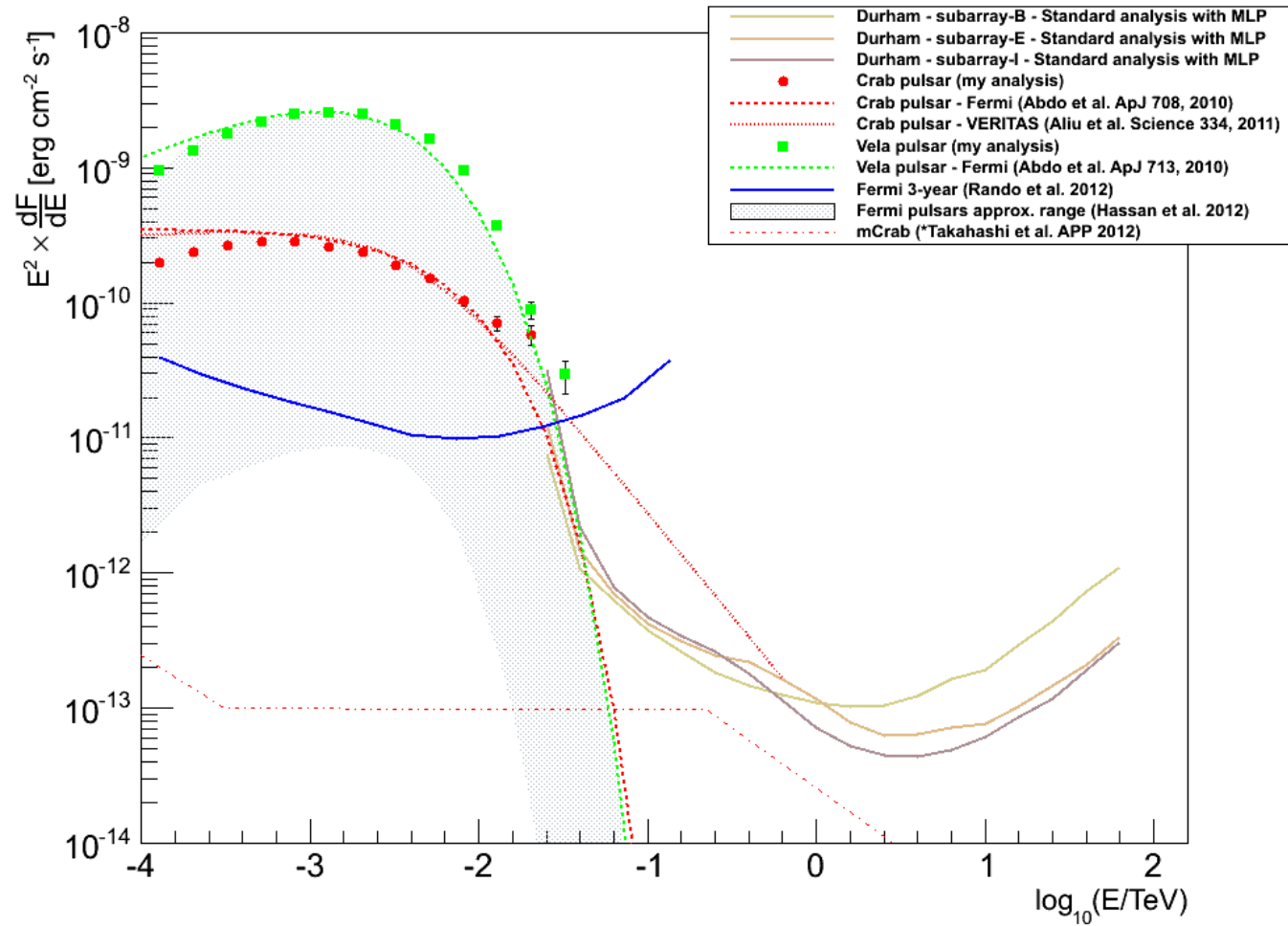
CTA standard analysis



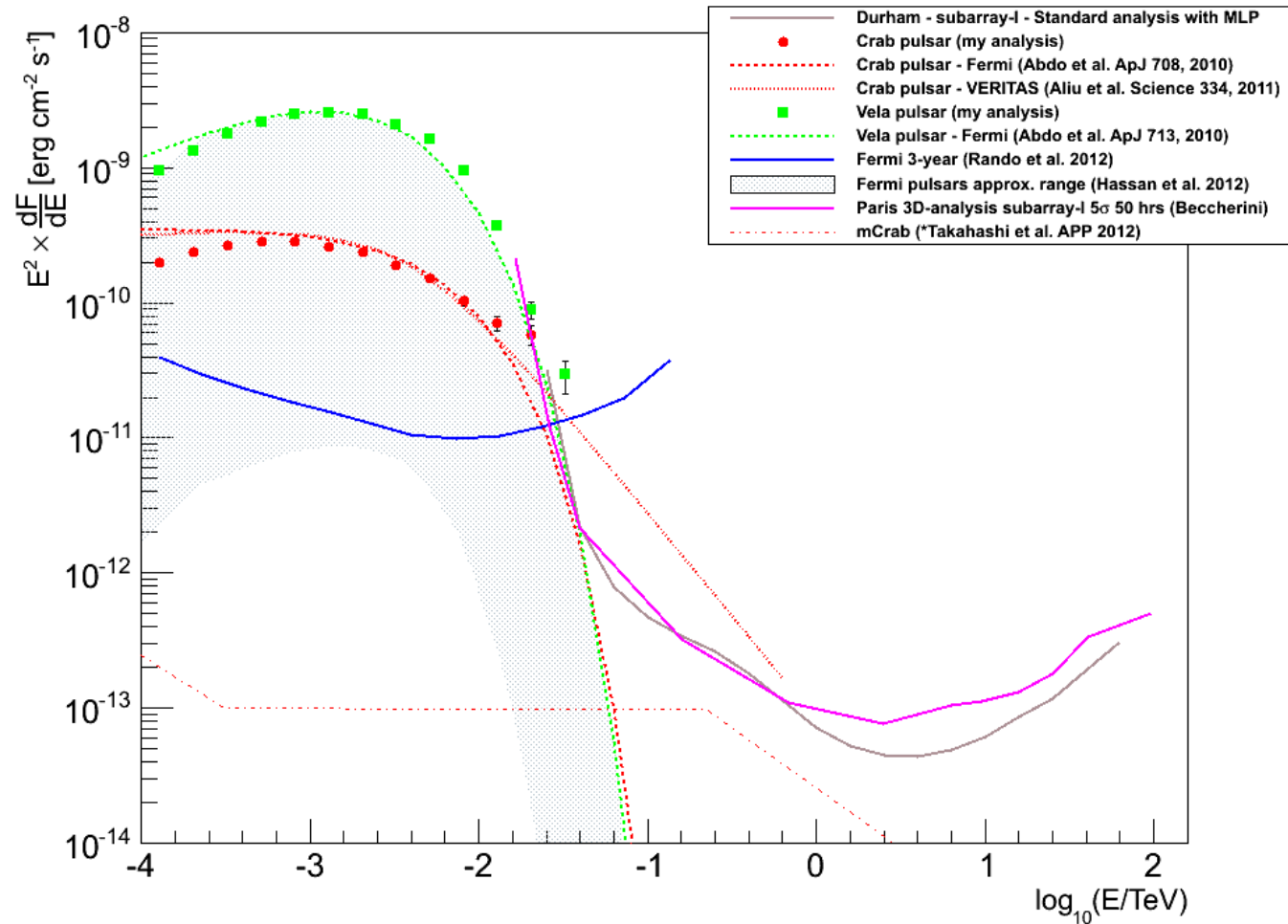
CTA improved rejection



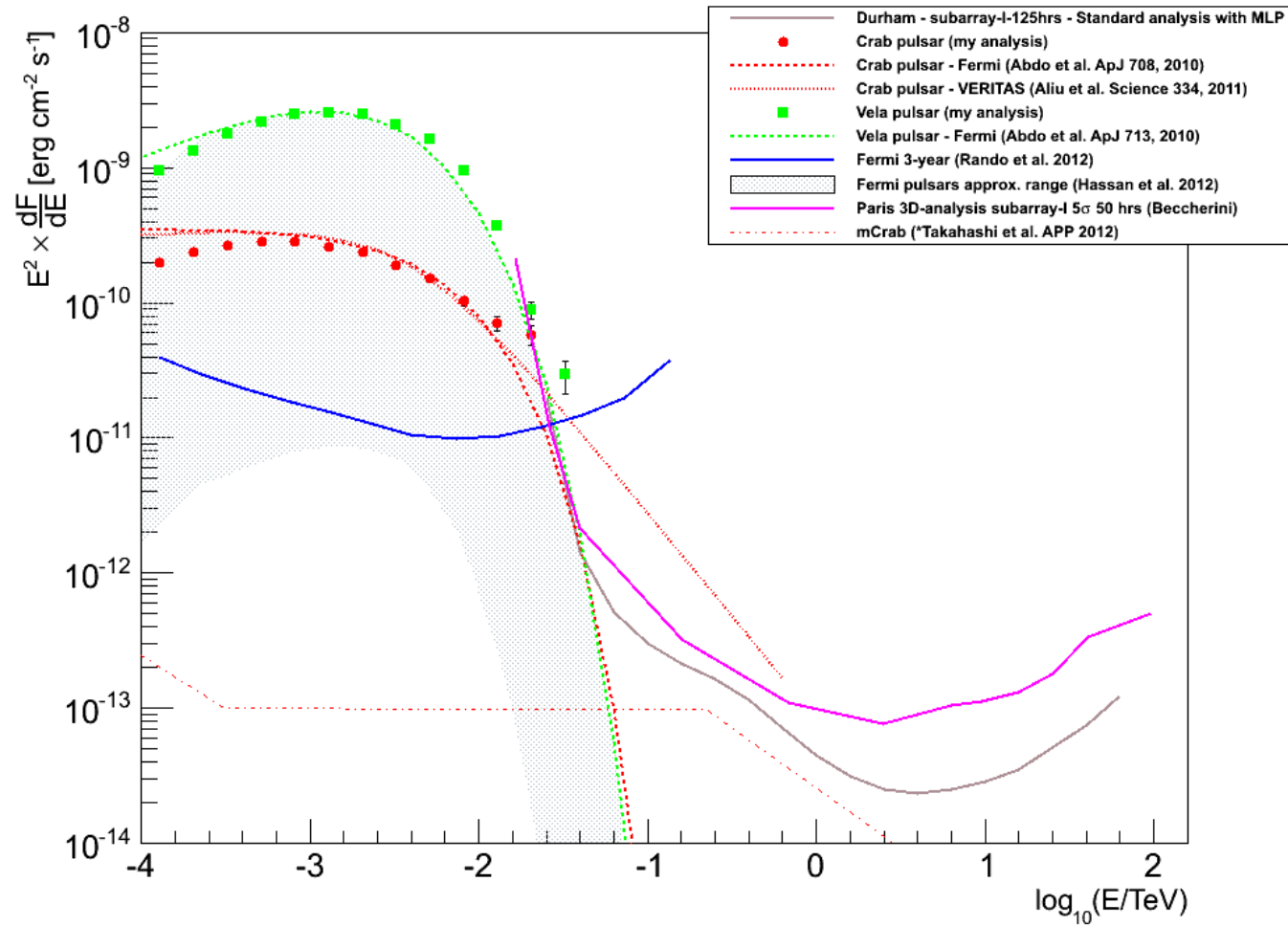
CTA subarrays B, E and I



CTA new reconstruction



Longer integration times



γ -ray pulsar conclusions



- Large number of Galactic γ -ray pulsars
- First ground-based detection of pulsed γ -ray emission from the Crab
- Potential to investigate cut-off / power-law tail energy regime

Caveats:

- Results based on point source simulations $\Gamma=2$
- No systematics taken into account

Questions:

- Cost of LSTs versus sensitivity gain below 100 GeV?
- Is the Crab pulsar a bit special?

Future work



- **Latest Fermi results? 2nd Pulsar cat.**
- **Determine the number of γ -ray pulsars detectable for each CTA subarray i.e. cut-off range and assuming power-law tails**
- **Derive CTA sensitivity performance for a pulsed source**
- **Include H.E.S.S. –II findings**
- **Analyse archive H.E.S.S. data**