

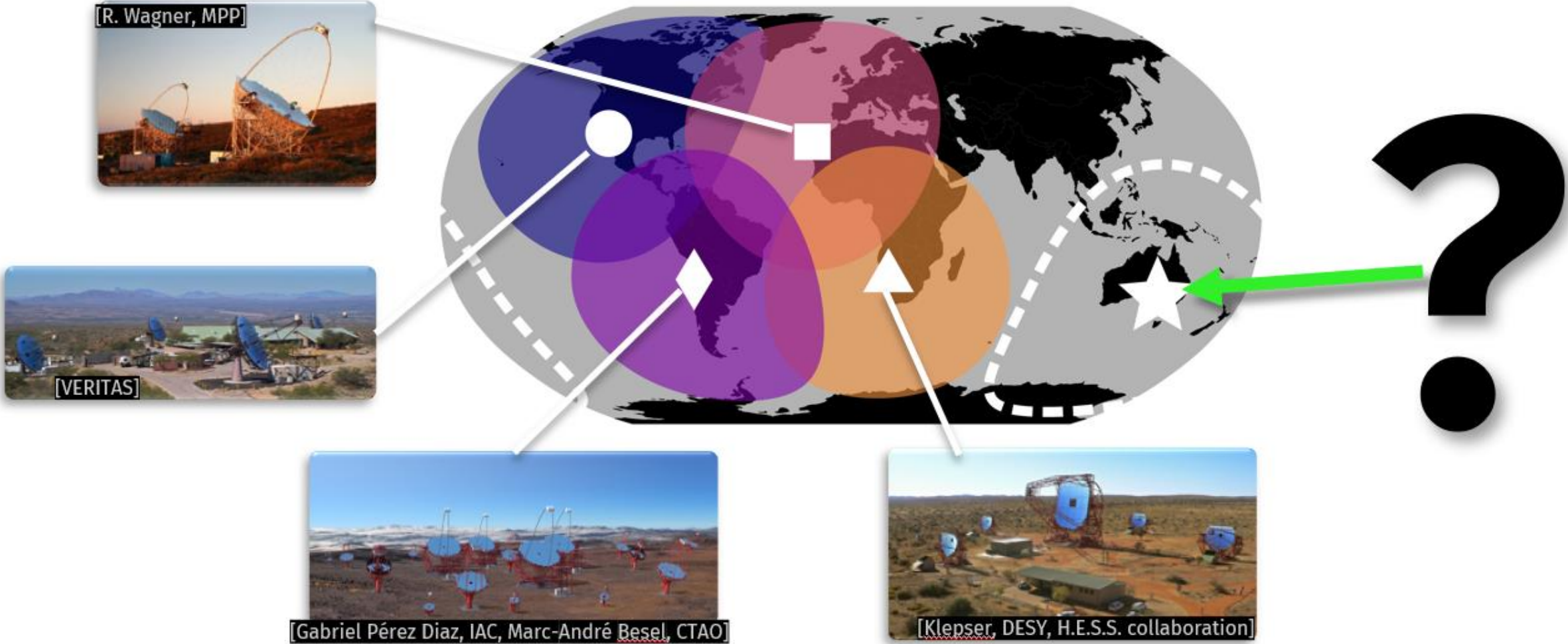
# Investigating a Stereo Trigger in a Small IACT Array

---

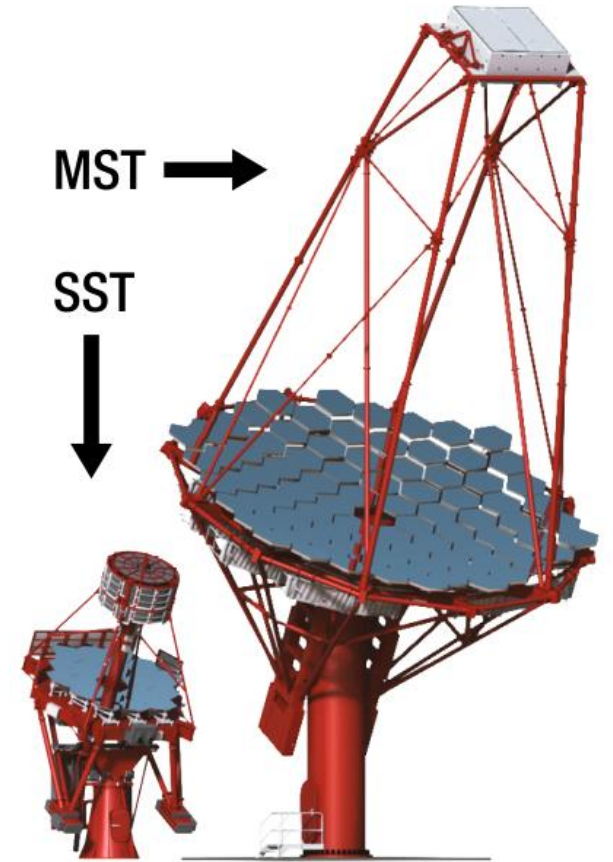
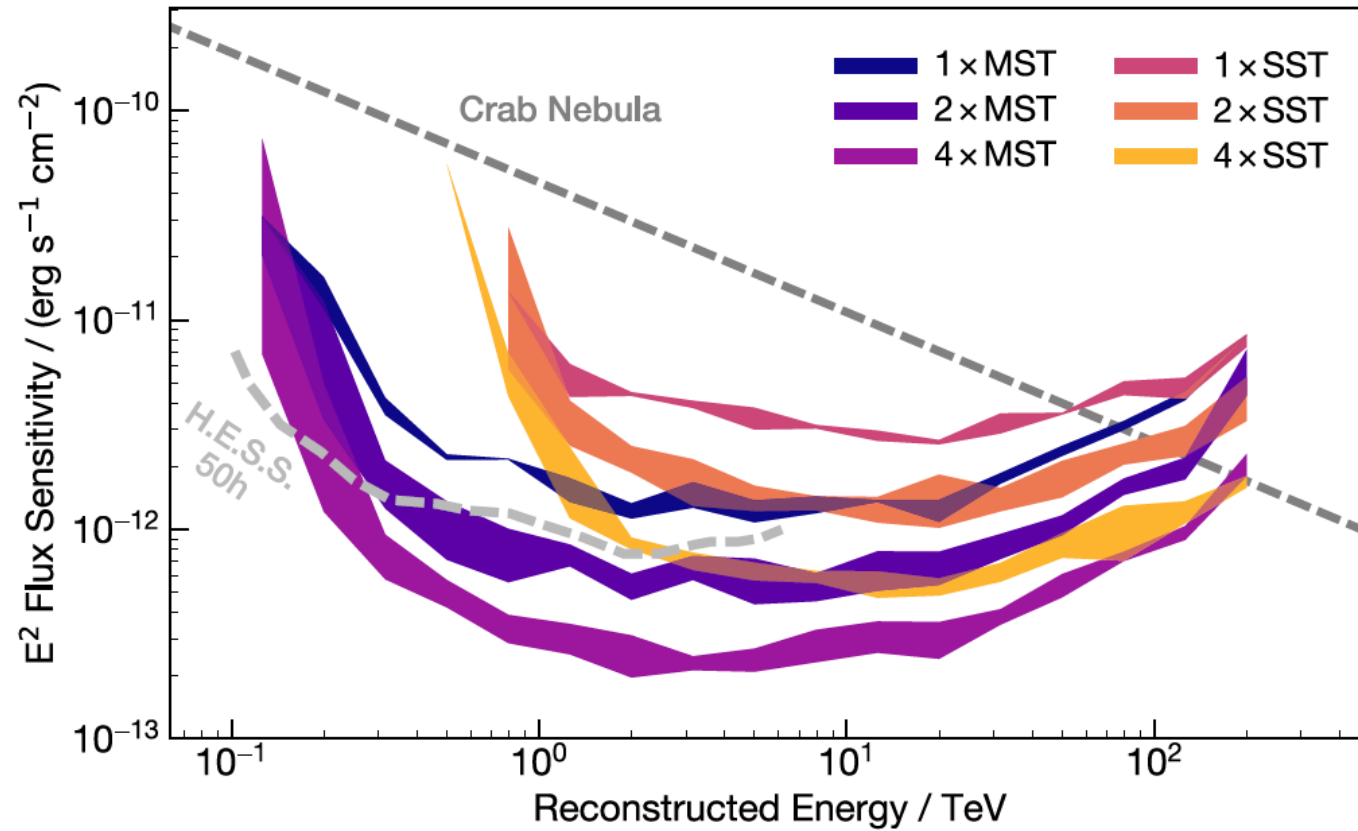
Simon Lee, Sabrina Einecke, Gavin Rowell

CTA-Oz November 2022

# An IACT network



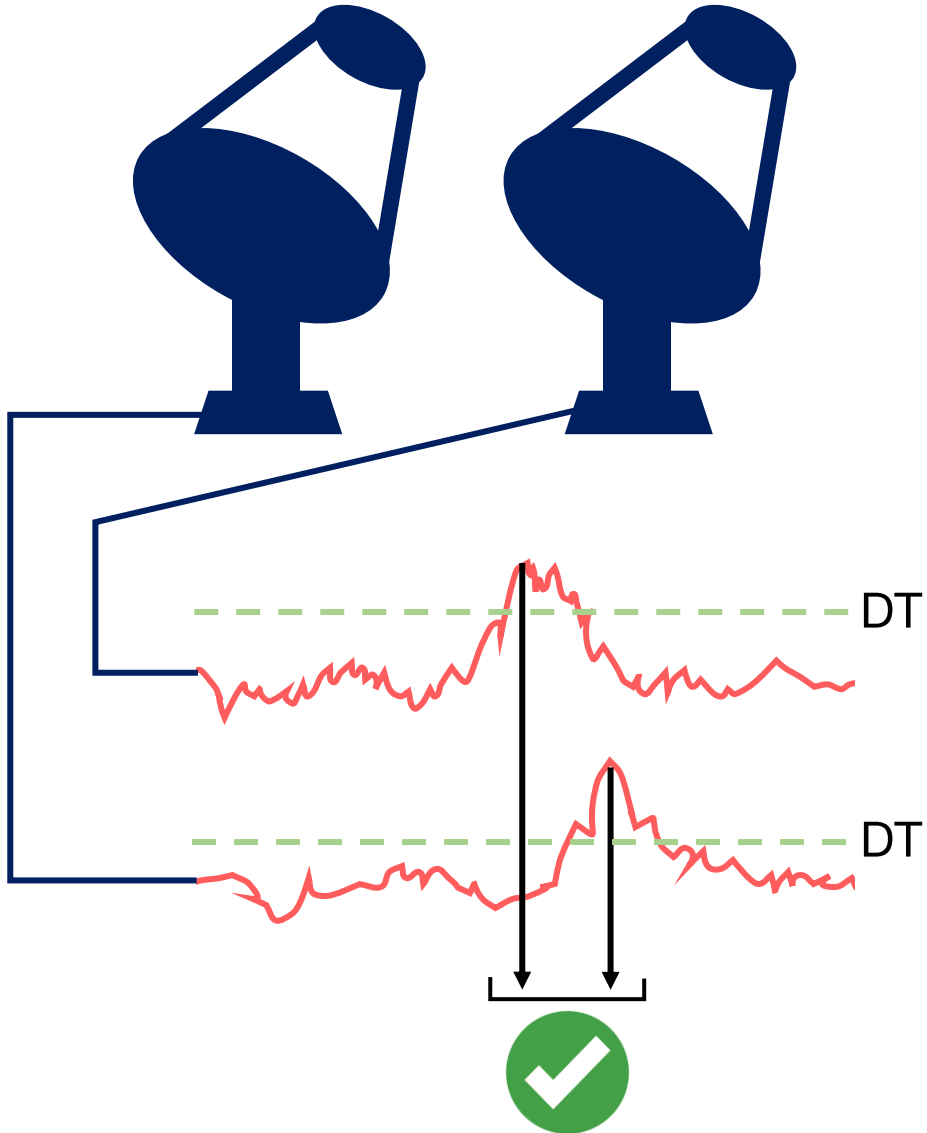
# A small IACT array



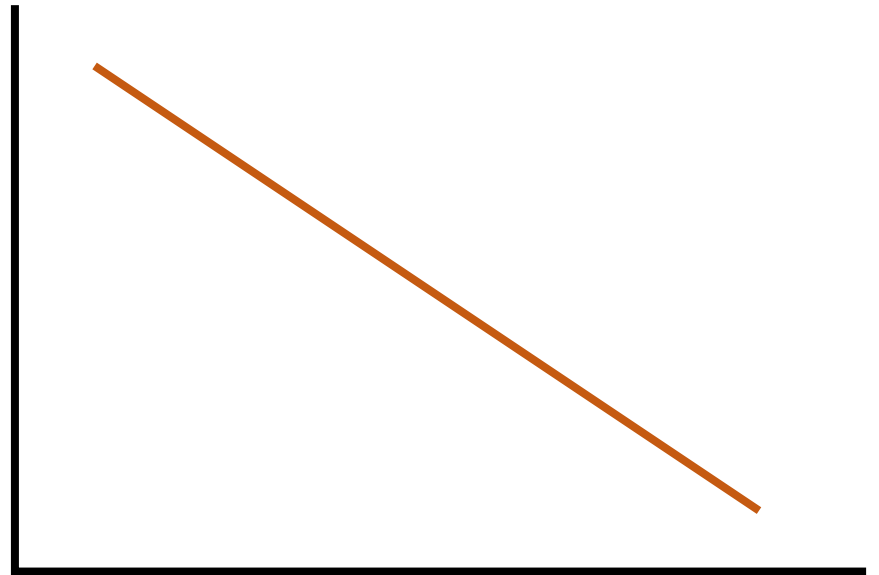
[cta-observatory.org/project/technology](http://cta-observatory.org/project/technology)

**Figure 4.** 50-hour differential point-source flux sensitivity for a  $5\sigma$  detection as a function of reconstructed gamma-ray energy. Bands represent the range of sensitivities across the studied altitudes (0 m and 1000 m) and baseline distances (80 m to 277 m). Cuts on gamma score and  $\theta^2$  were applied for each energy bin to optimise sensitivity for each array setup. No cuts on the number of telescopes triggered were applied. The H.E.S.S. 50-hour sensitivity curve is shown for comparison (Holler et al., 2015).

# Stereo trigger



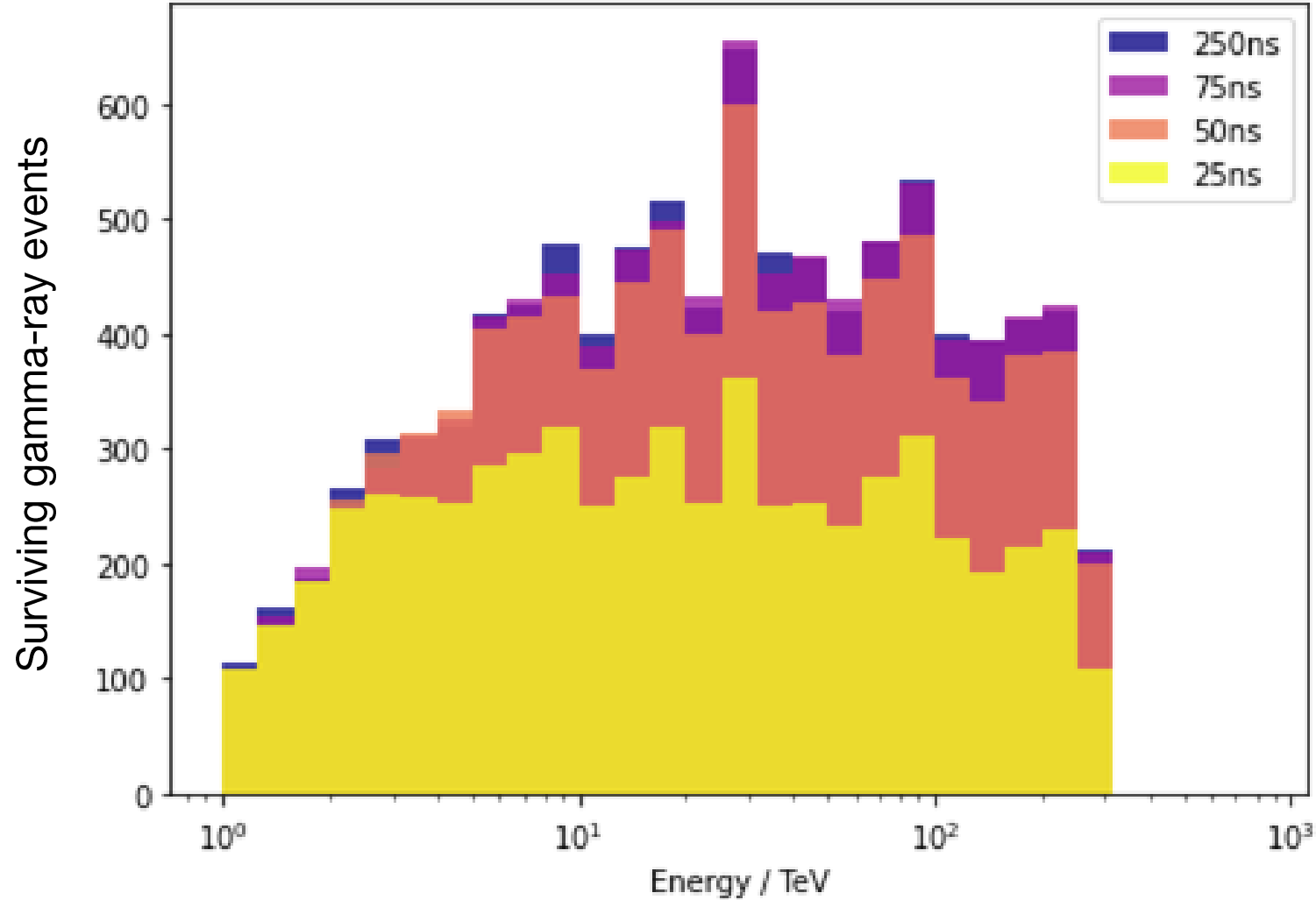
Accidental  
NSB  
trigger  
rate



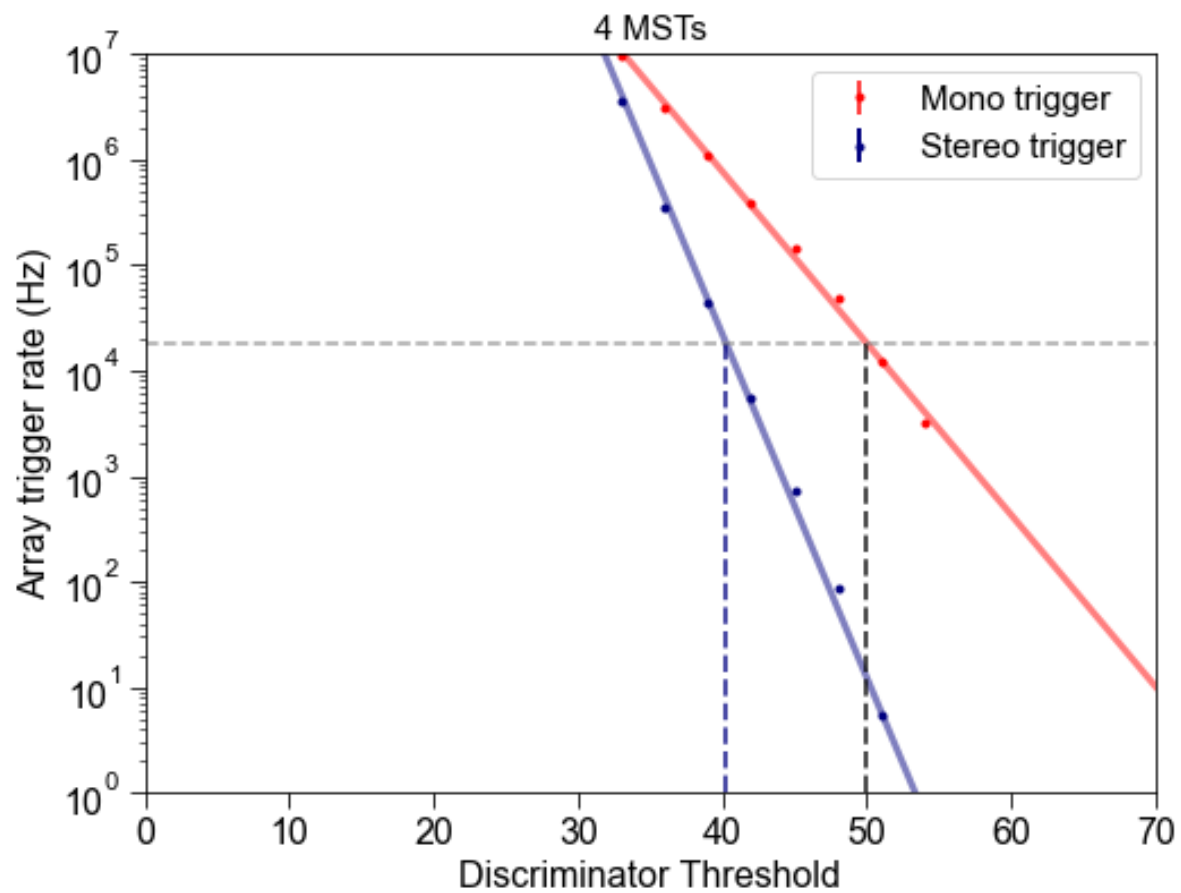
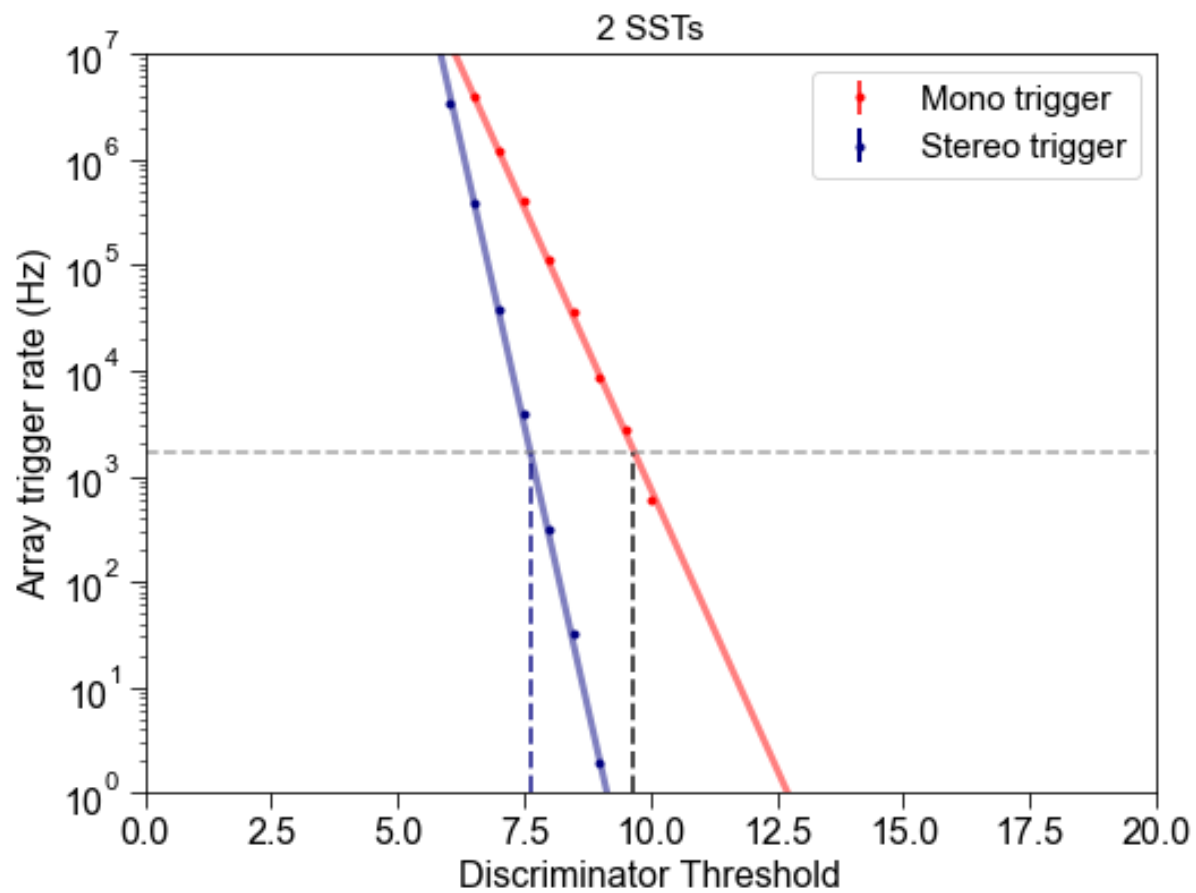
Discriminator  
Threshold

# Choosing trigger window width

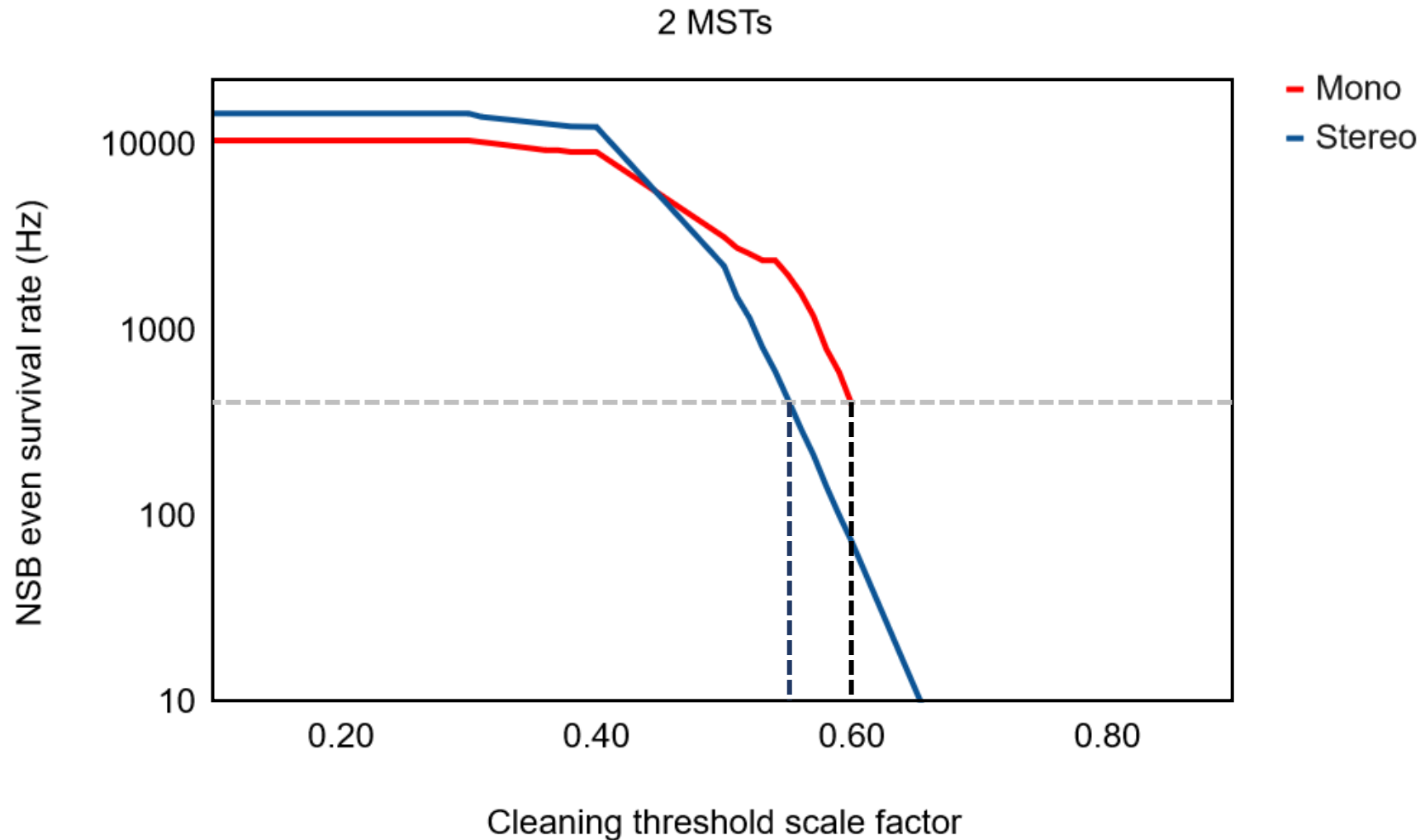
2 SSTs



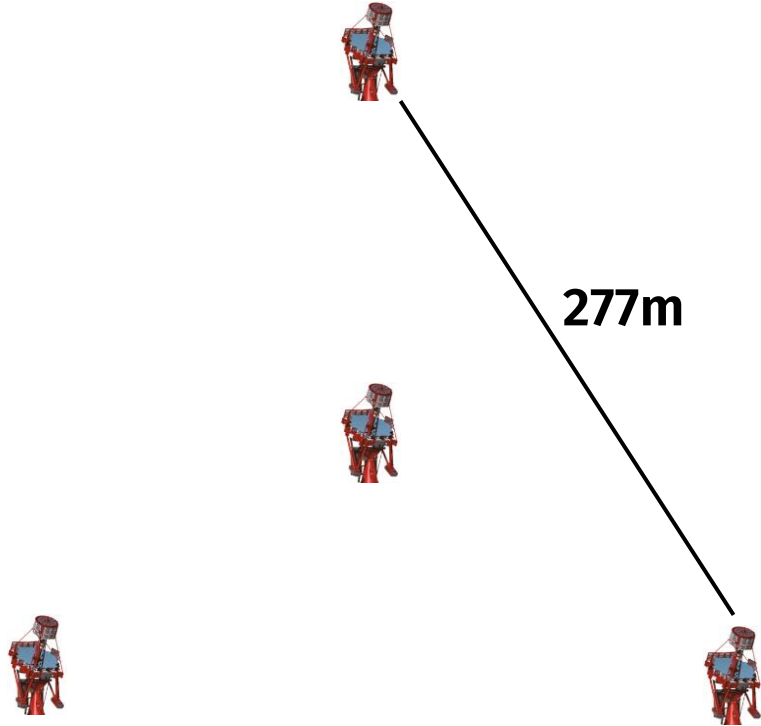
# Equating NSB trigger



# Equating NSB event survival



# Other



## Simulation range

40 GeV – 3 TeV

## Quality cuts

No. surviving pixels:  $> 5$

No. disjoint islands:  $< 4$

Leakage:  $< 0.2$

Intensity: N/A

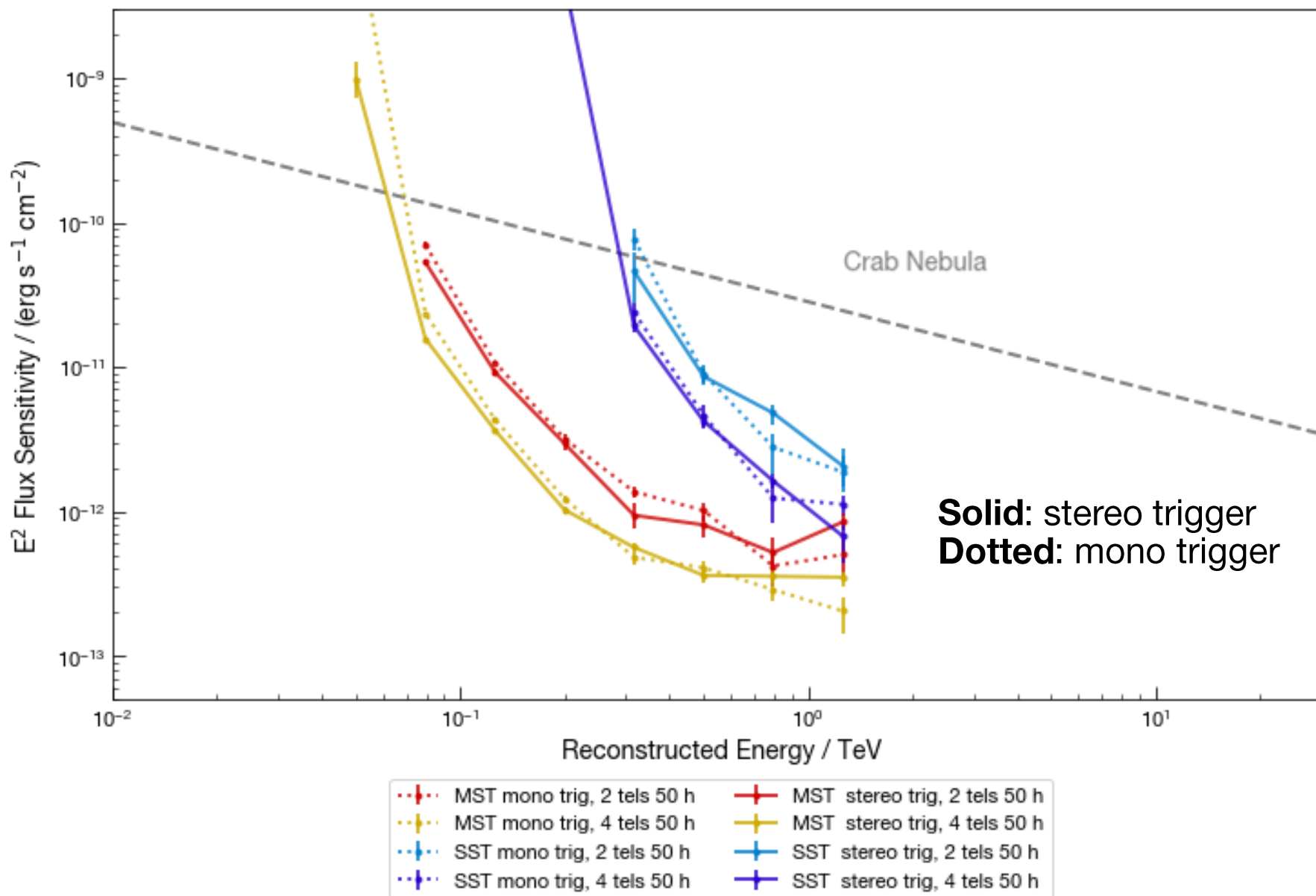
## Significance calculation

Using  $N_{\text{on}} / N_{\text{off}}$  counts

Implementing method from Knoetig 2014, valid for low background statistics ( $< 10$  events)

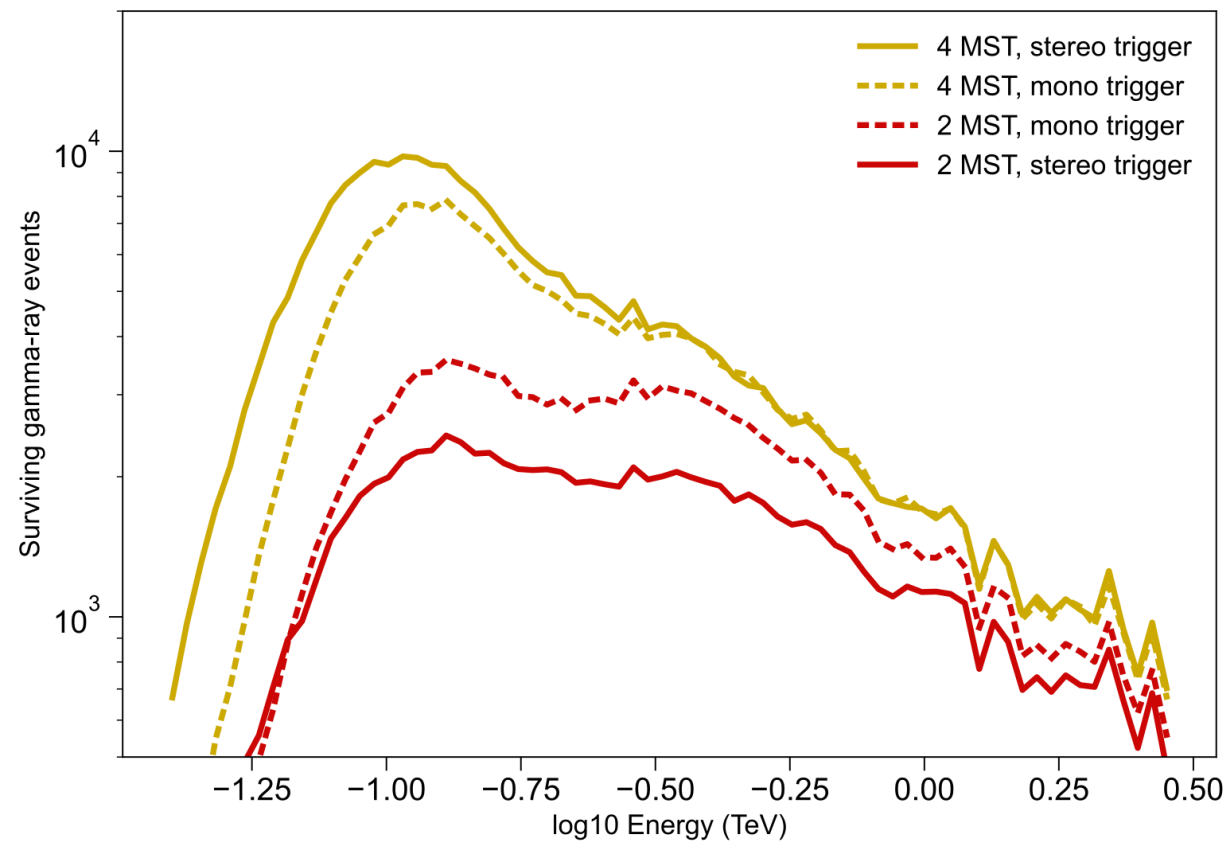
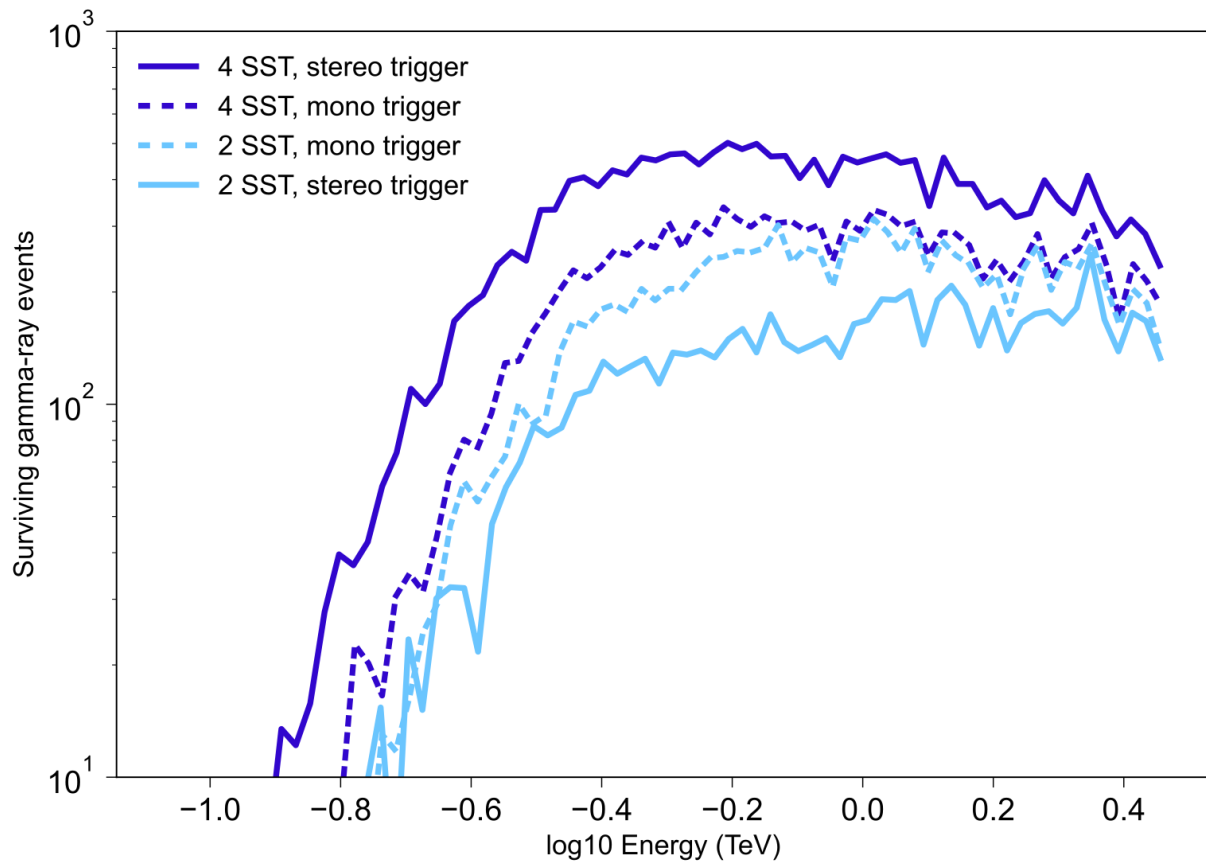


# Results: Sensitivity



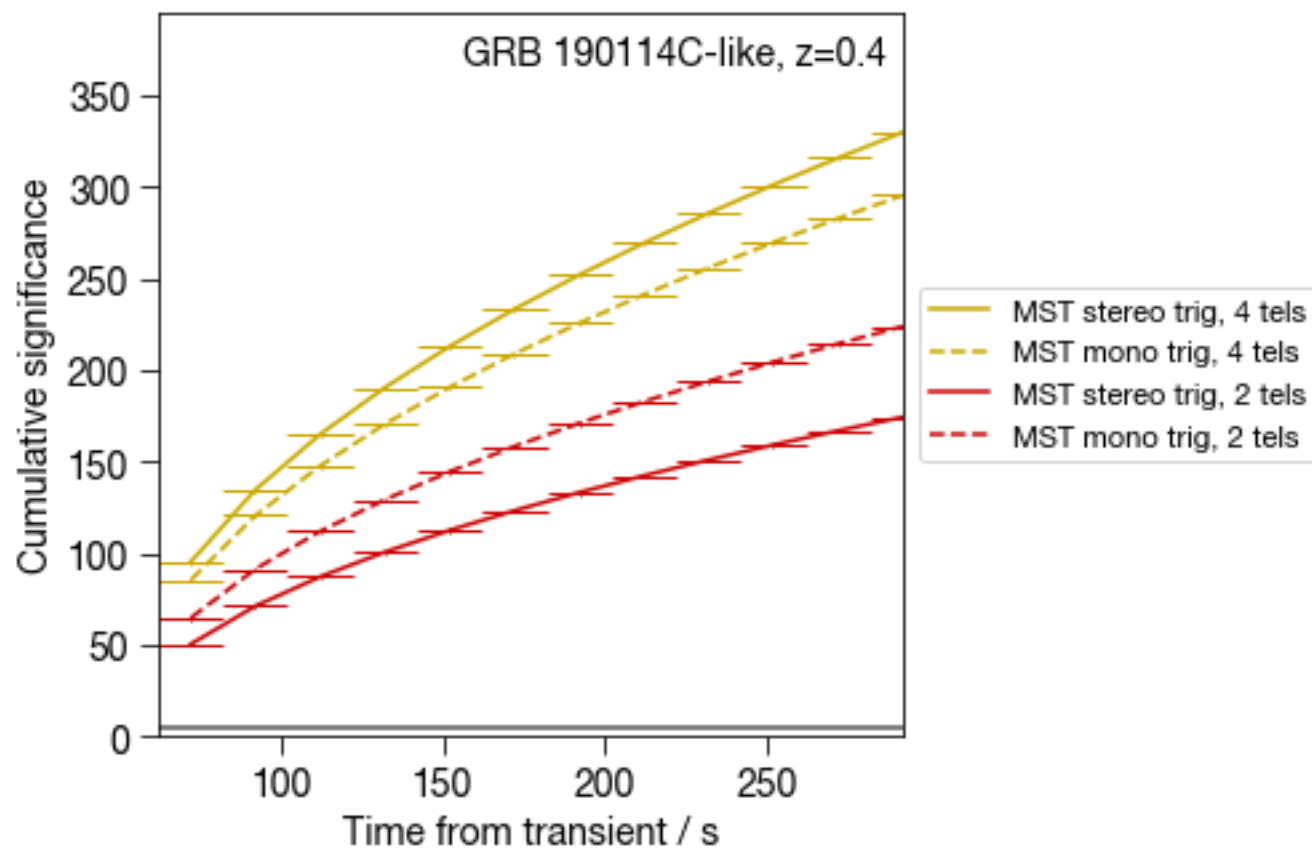
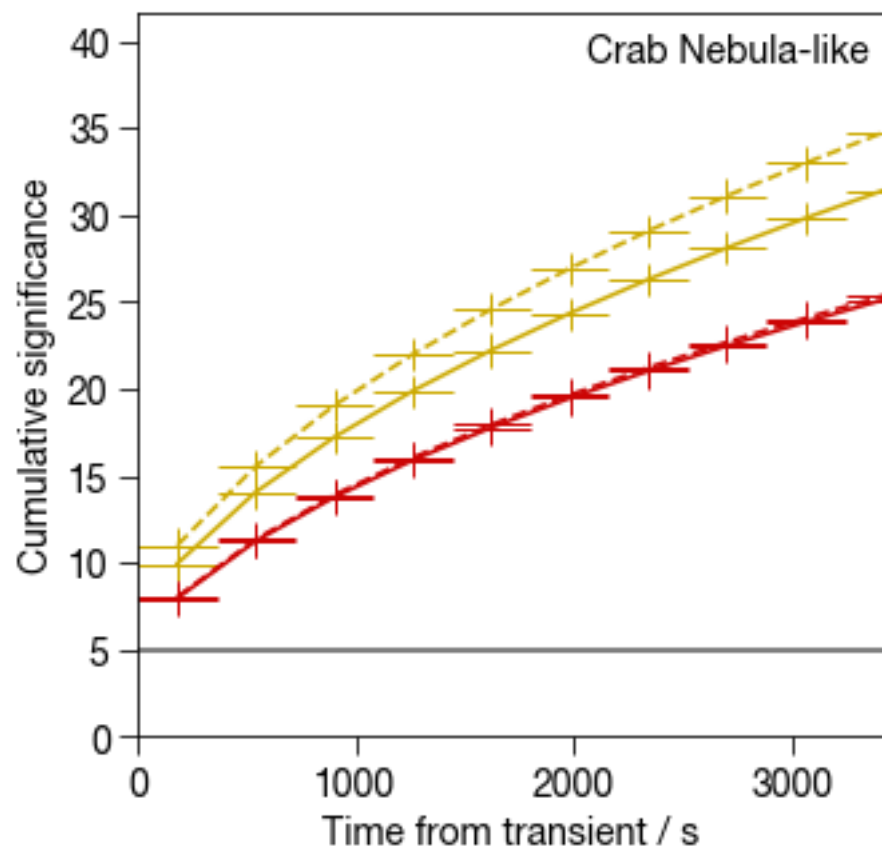
# Results: Energy threshold

**Solid:** stereo trigger  
**Dotted:** mono trigger



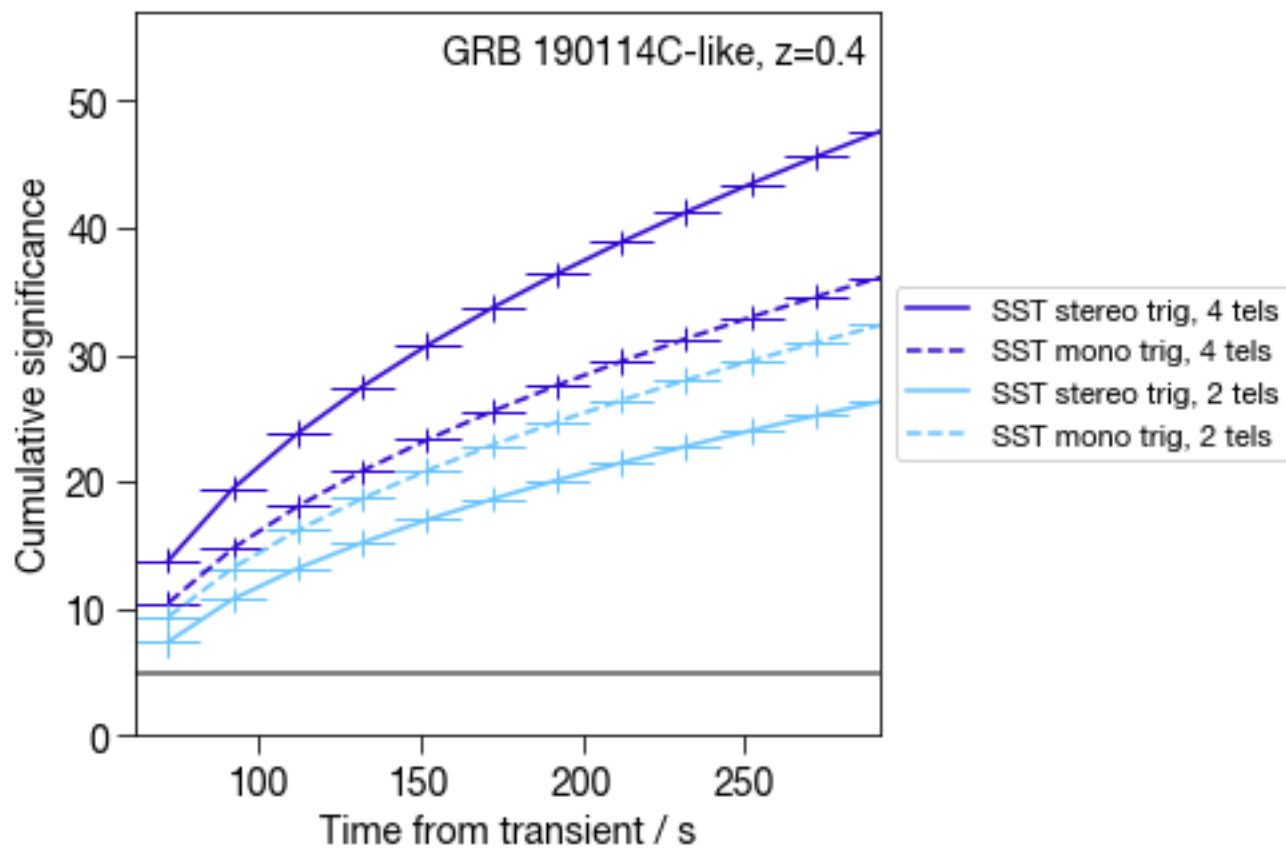
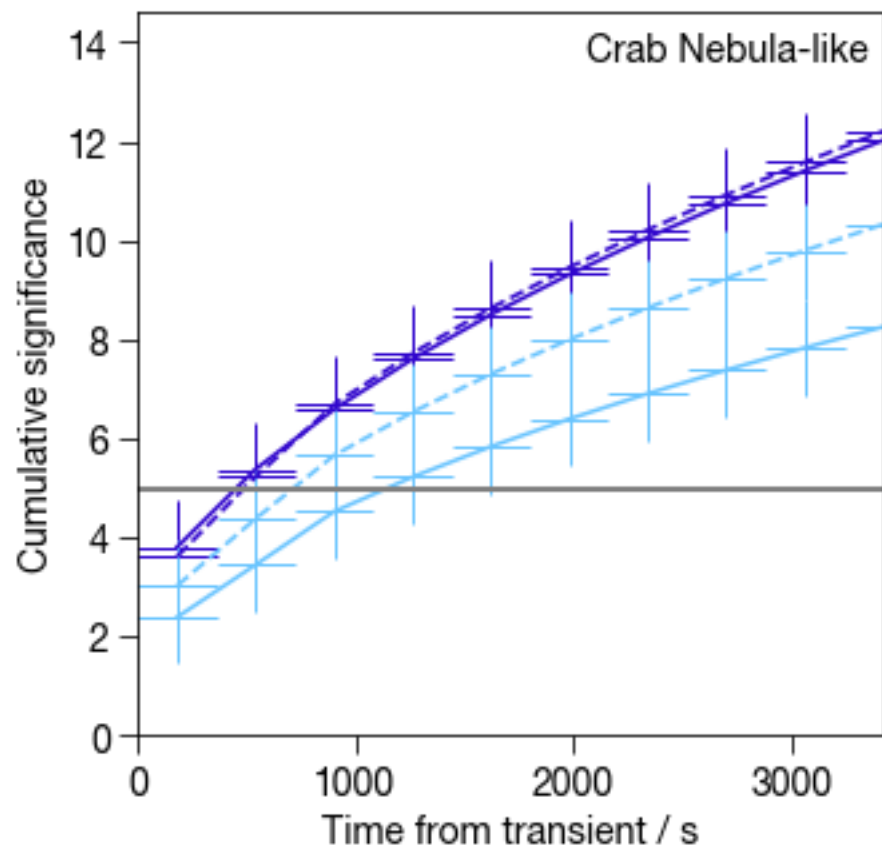
# Results: Detection significance, MST

**Solid:** stereo trigger  
**Dotted:** mono trigger



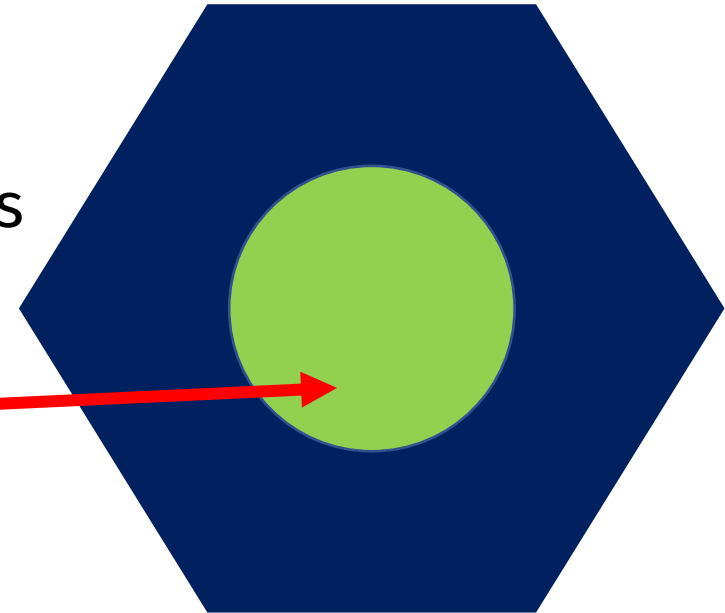
# Results: Detection significance, SST

**Solid:** stereo trigger  
**Dotted:** mono trigger



# Conclusion

- We studied the effect of implementing a stereo trigger on the small IACT array designs from our previous work
- Cleaning thresholds were also decreased, lowering energy threshold across the board
- For 4-telescope arrays, it showed improved low-energy sensitivity and detection significance low-energy events
- Looking at implementing a topological trigger: trigger event only if trigger pixel within a specific area



Thankyou