A Template-based UHE Neutrino Search Strategy for the Askaryan Radio Array (ARA)

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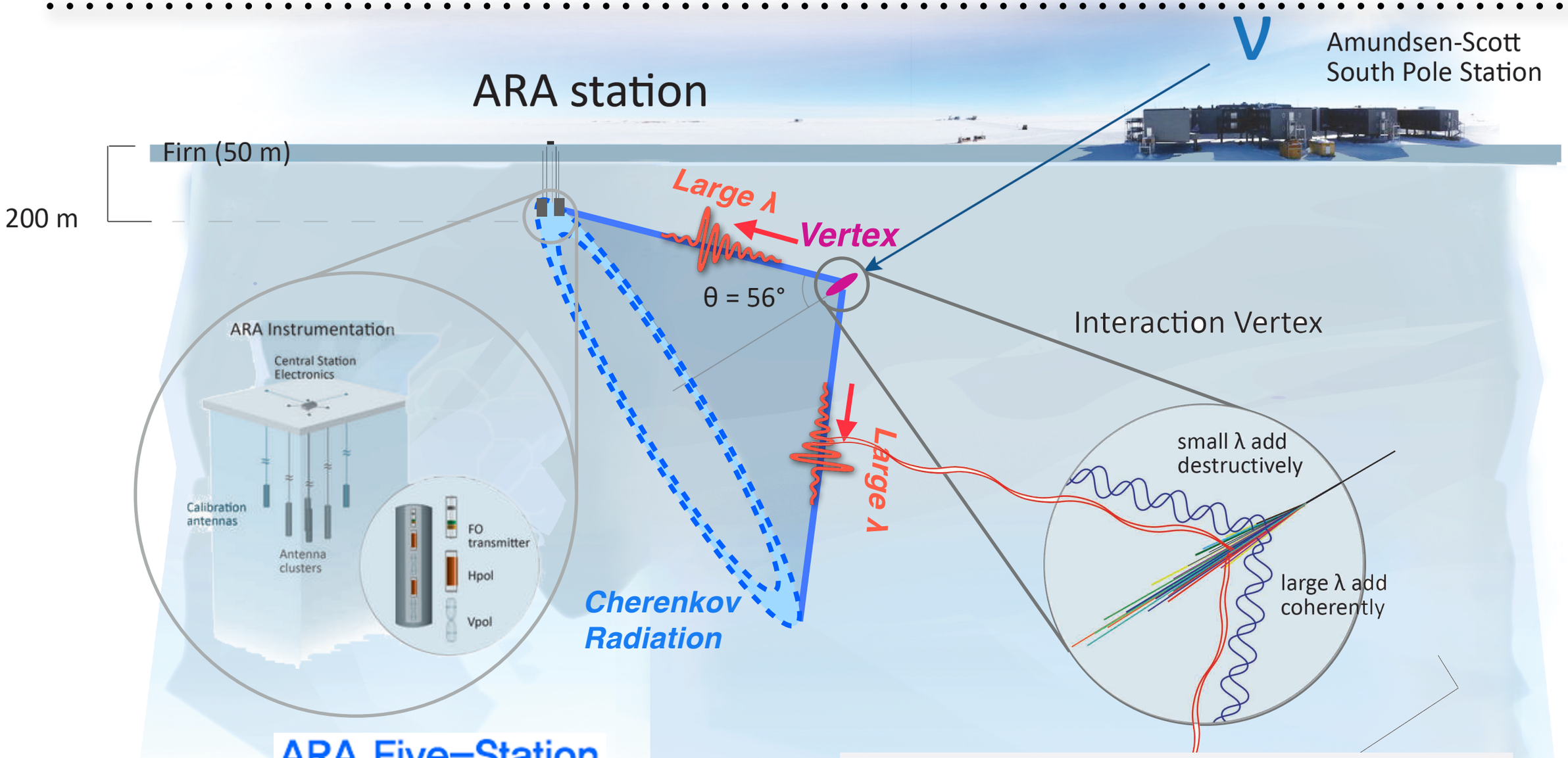
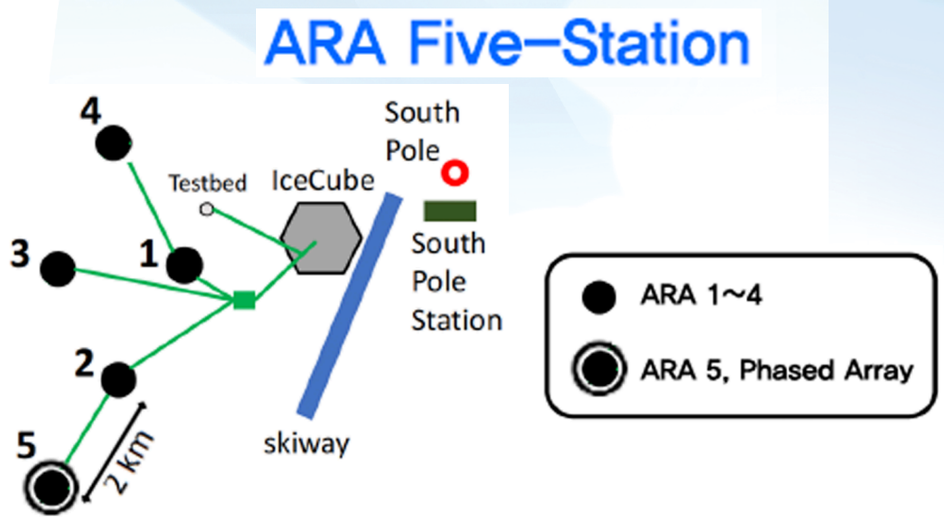
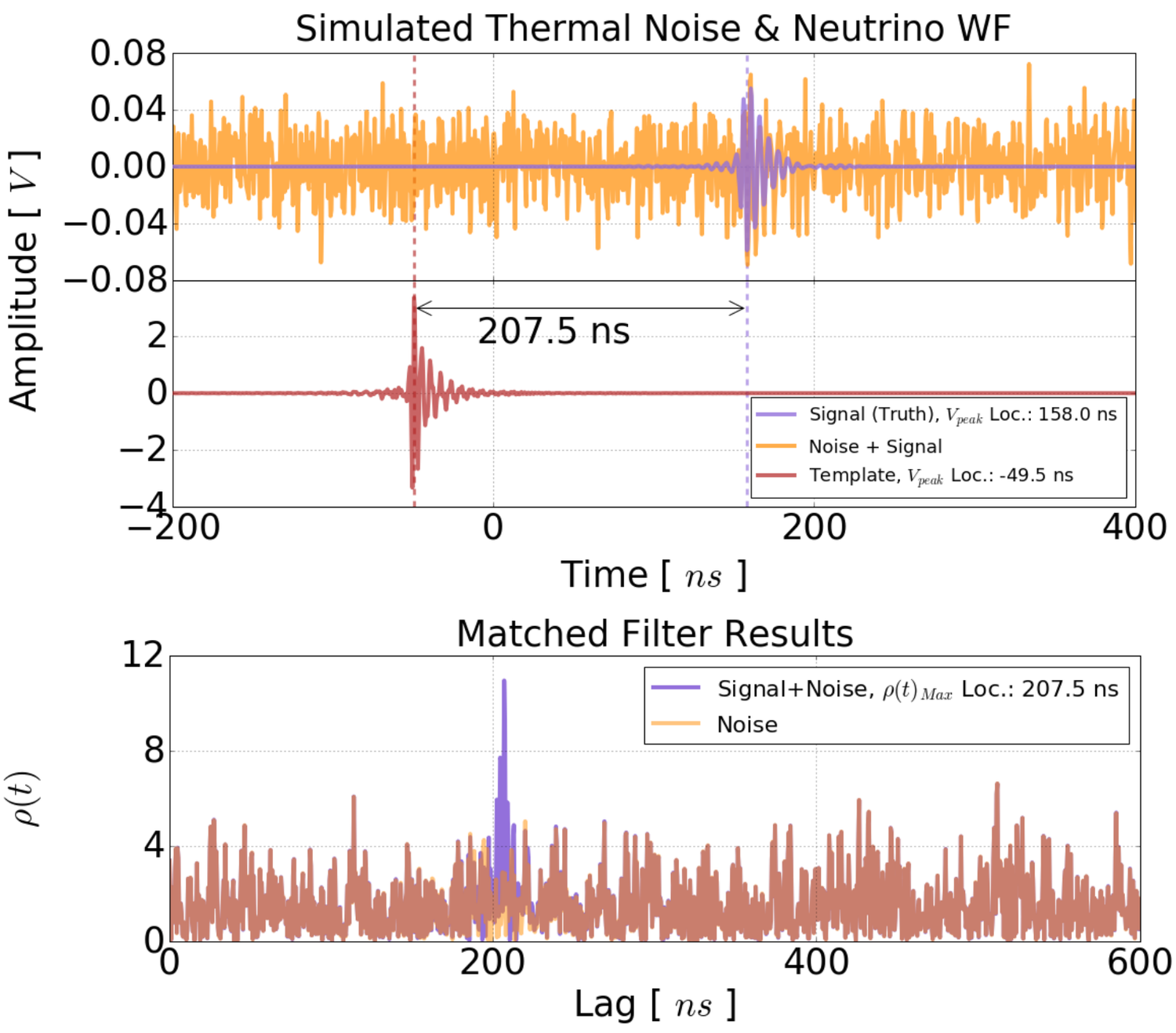
Askaryan Radio Array (ARA)





- **ARA** is designed to detect UHE neutrinos above 10^{16}eV by utilizing the Askaryan effect.
- The radio transparent ice in Antarctica, with attenuation length of ~1 km for **radio wave**, provides an optimal environment for constructing a large detector

The Matched Filter Method for ARA



Key Matched Filter Eq.

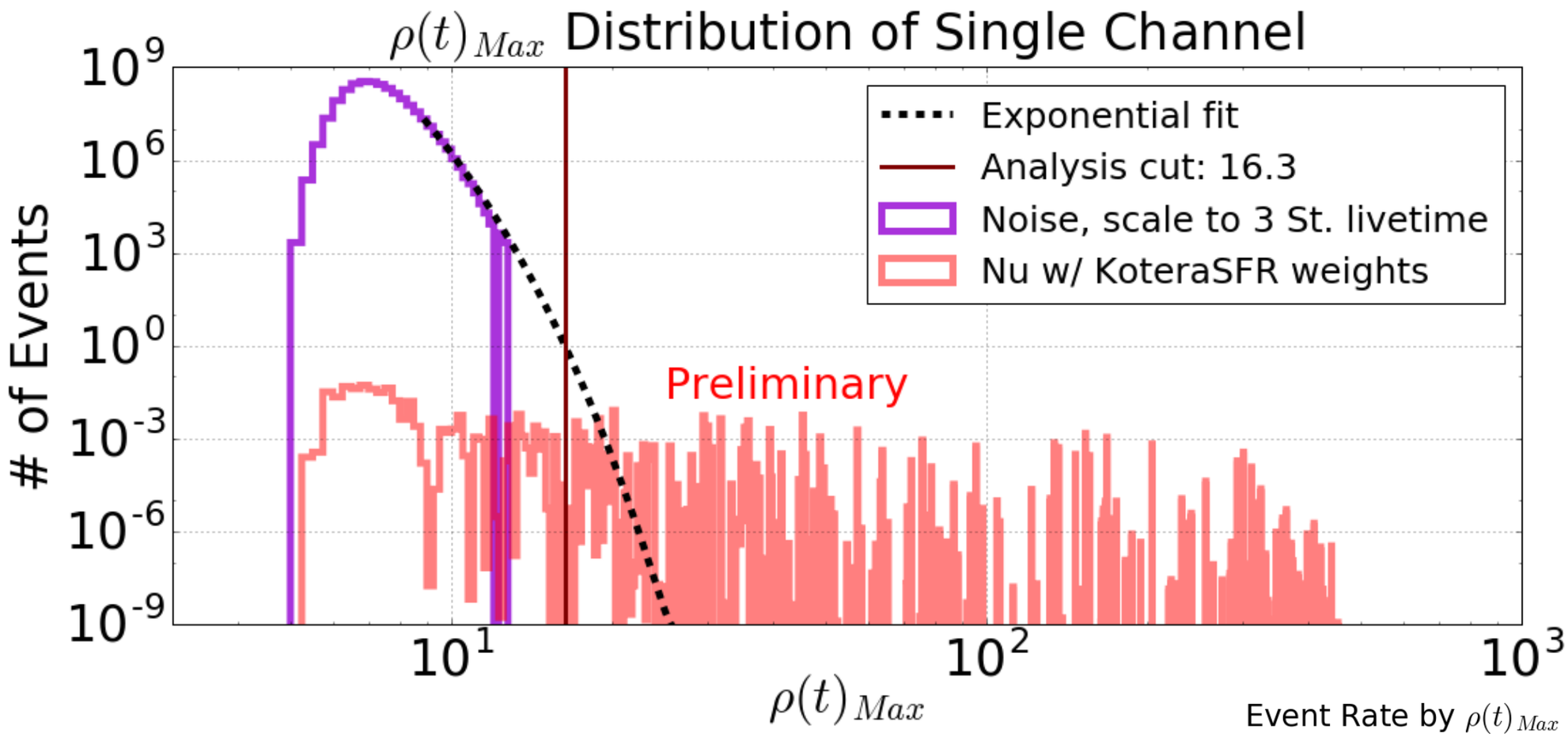
$$C(t) = 4\int_0^\infty \frac{D(f)T^\star(f)}{P_n(f)}\,df$$

$$\sigma^2 = 4\int_0^\infty \frac{|T(f)|^2}{P_n(f)}\,df$$

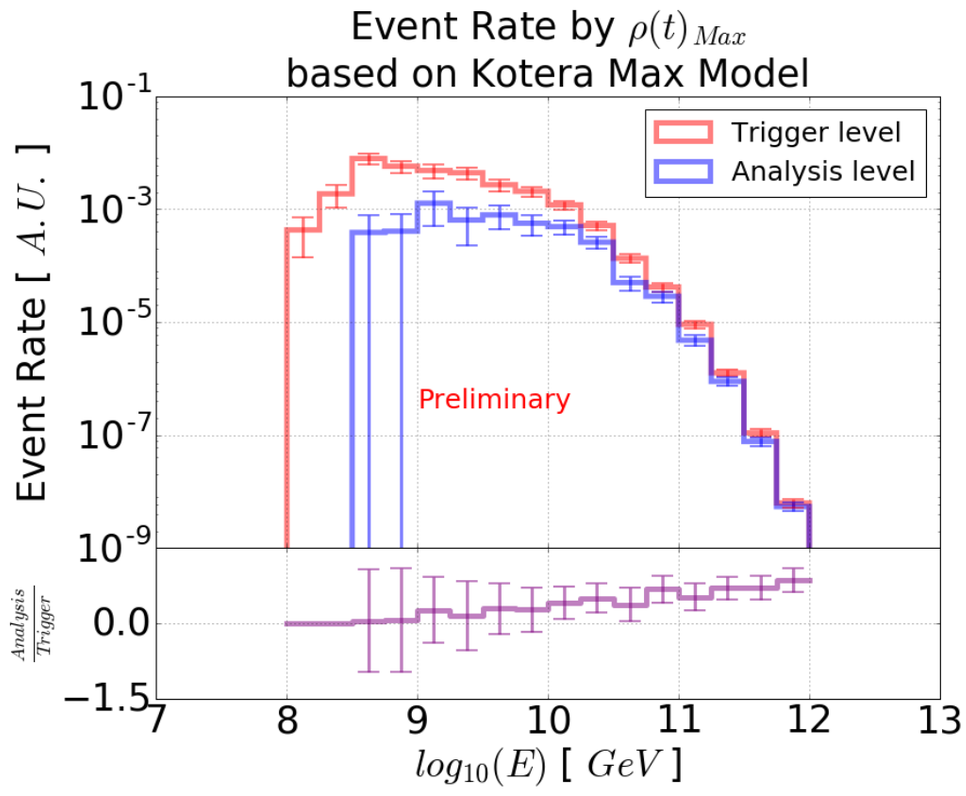
$$\rho(t) = \frac{|C(t)|}{\sigma}$$

- **The matched filter method** using a neutrino template, inspired by LIGO, is designed to distinguish **low signal-to-noise ratio (SNR)** signals from the noise waveforms.
- ρ(t) is the weighted correlation value, which is a measure of the **similarity** between the hidden signal and the template in each **lag** time.

Analysis Cut and Event Rate



- The analysis cut is set by the estimated three-station livetime (A2,3 6years, A5 2years).
- The cut is imposed on each antenna channel.
- The neutrino simulation is weighted by the Kotera neutrino flux model, and applied to the matched filter method.



Summary

- The matched filter method gives a strategy to search for low-SNR signal in a radio detector.
- The actual data will be tested against the simulated neutrino template.
- Please check more detail on the poster
- Thank you!