Friedrich-Alexander-Universität
Erlangen-Nürnberg

RNO-G
Radio Neutrino Observatory - Greenland

ECAP
ERLANGEN CENTRE FOR ASTROPARTICLE PHYSICS

FAU

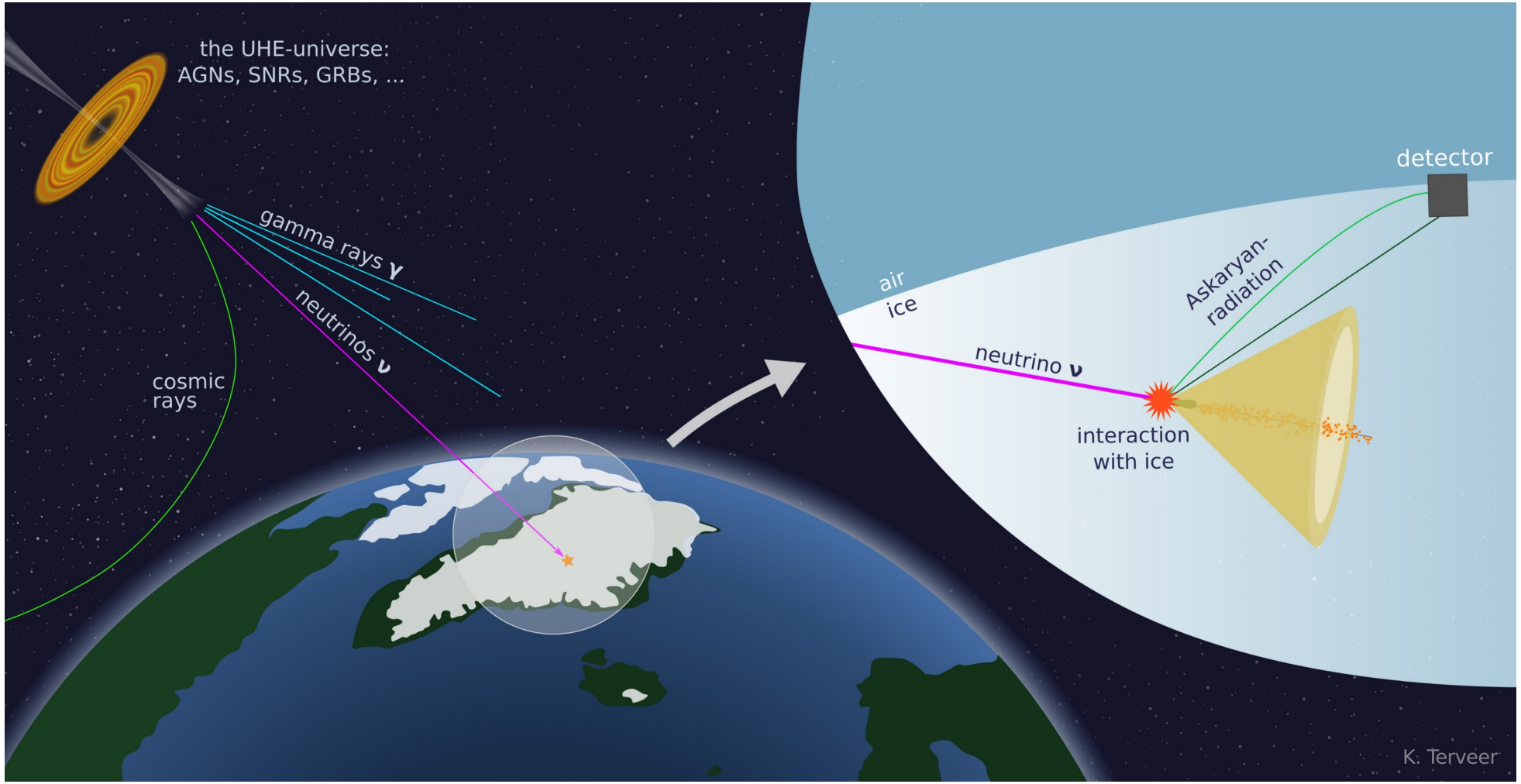
Wind-Related Background Radio Pulses at the Radio Neutrino Observatory in Greenland

Pascal Schriefer
Erlangen, 16.03.2026

The Radio Neutrino Observatory in Greenland

The Radio Neutrino Observatory in Greenland

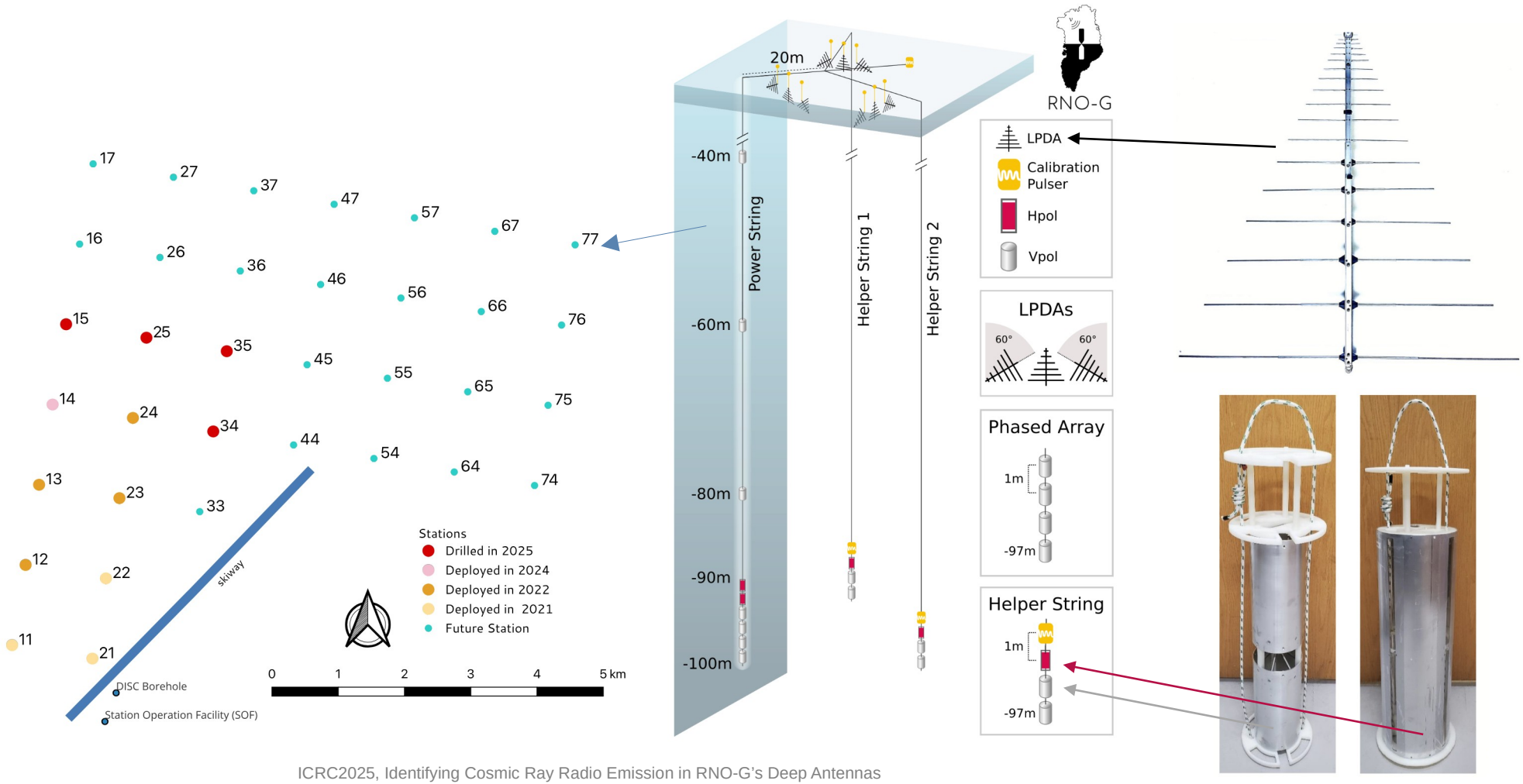
Cosmic Neutrinos



Karen Terveer, RNO-G Collaboration

The Radio Neutrino Observatory in Greenland

The Array

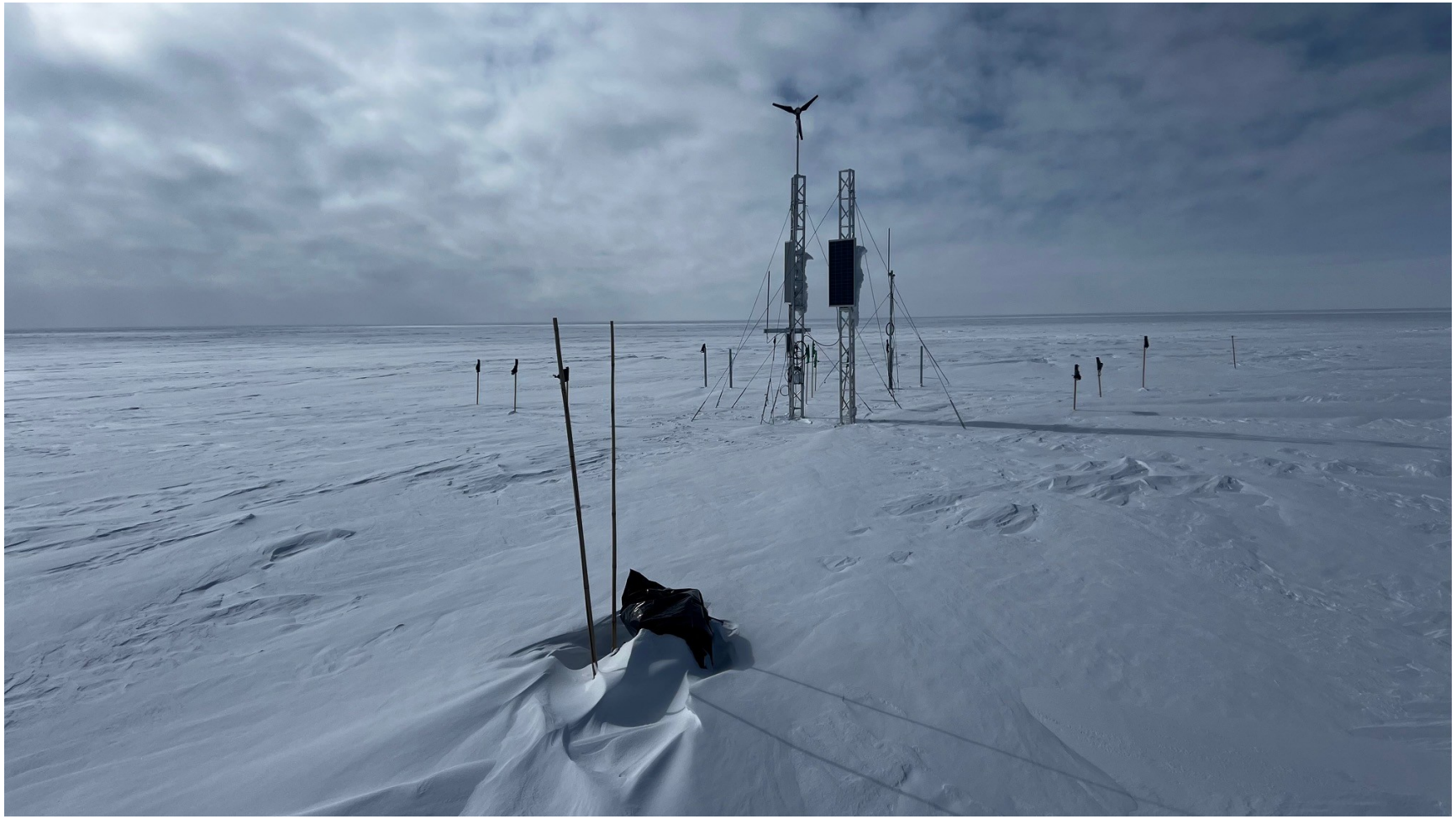


ICRC2025, Identifying Cosmic Ray Radio Emission in RNO-G's Deep Antennas

Agarwal et al., JINST 20 P04015 2025

The Radio Neutrino Observatory in Greenland

Single Station

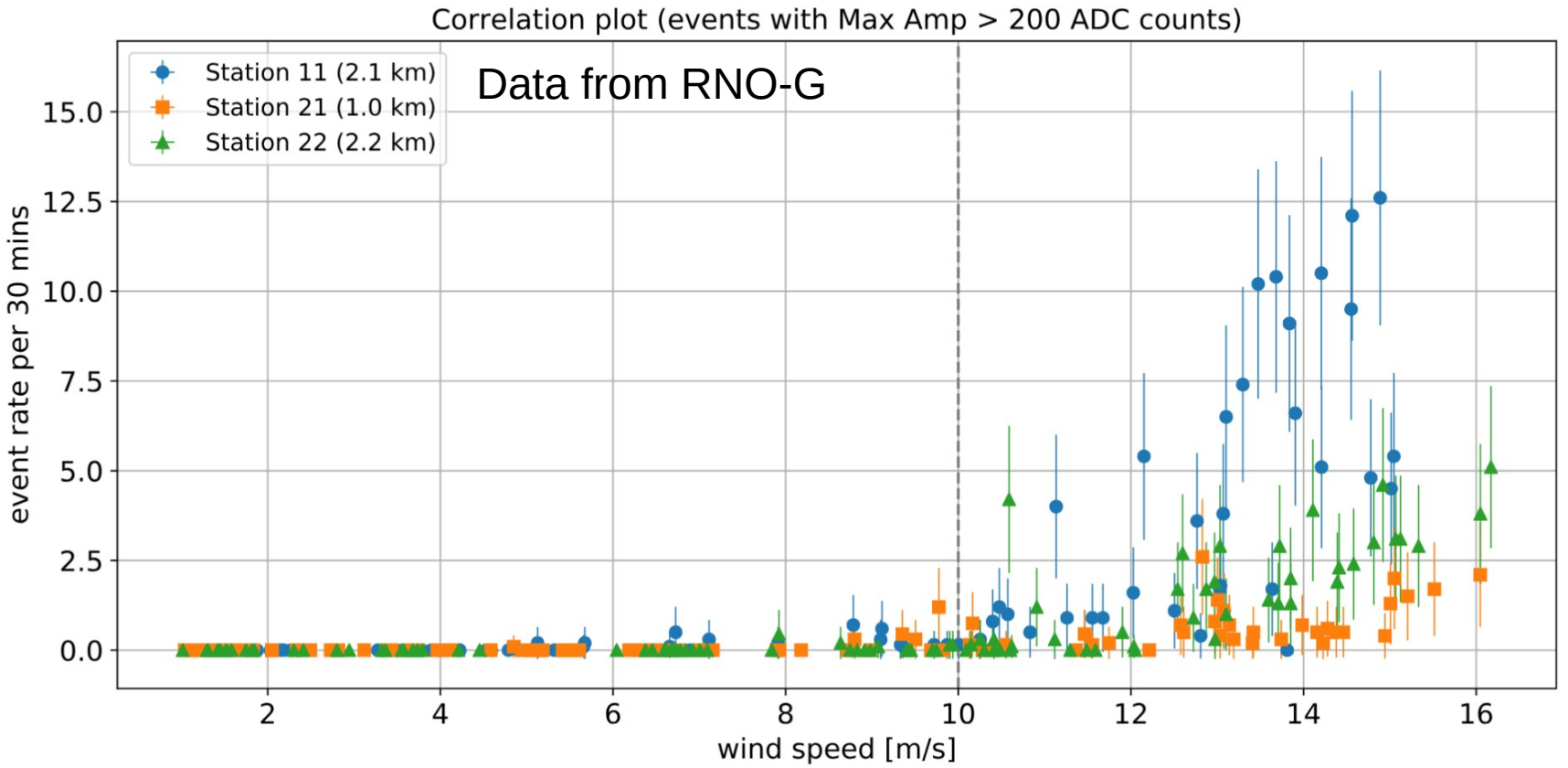


Felix Schlüter, RNO-G Collaboration

Wind-Related Background Events

Wind-Related Background Events

In-Situ Measurements

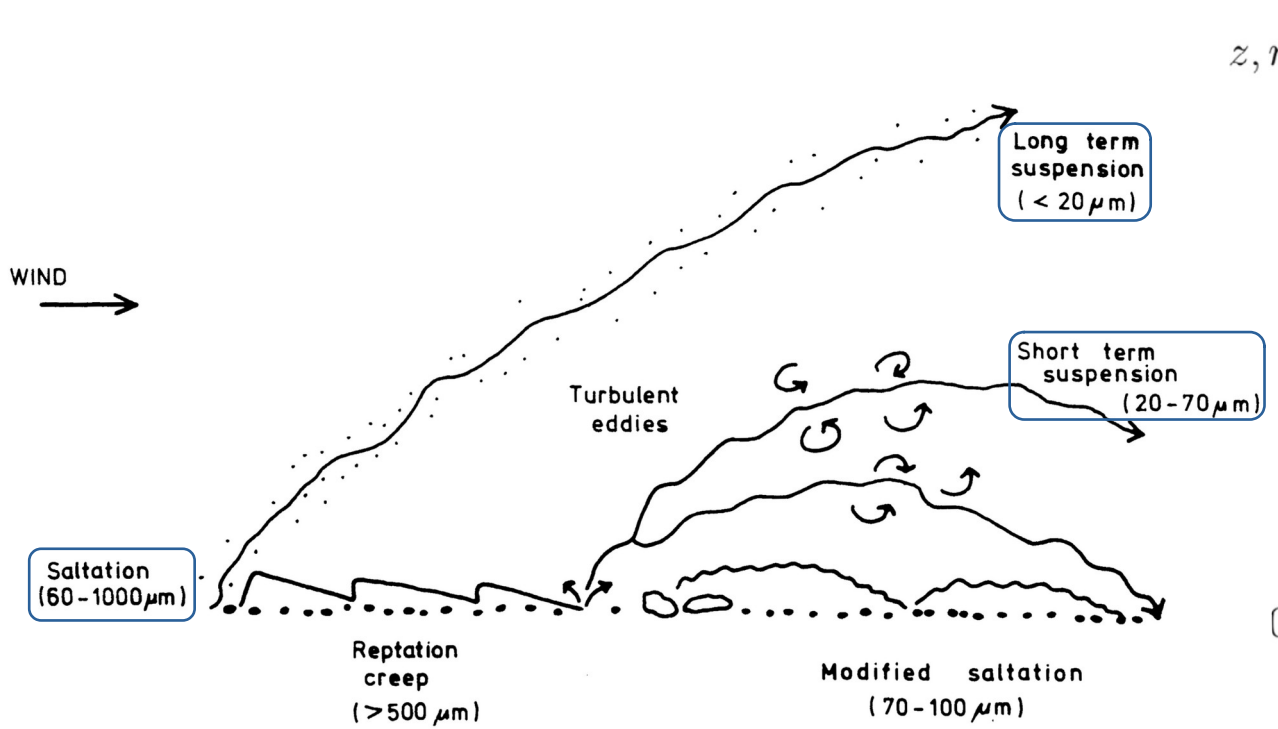


Astroparticle Physics 145 (2023) 102790

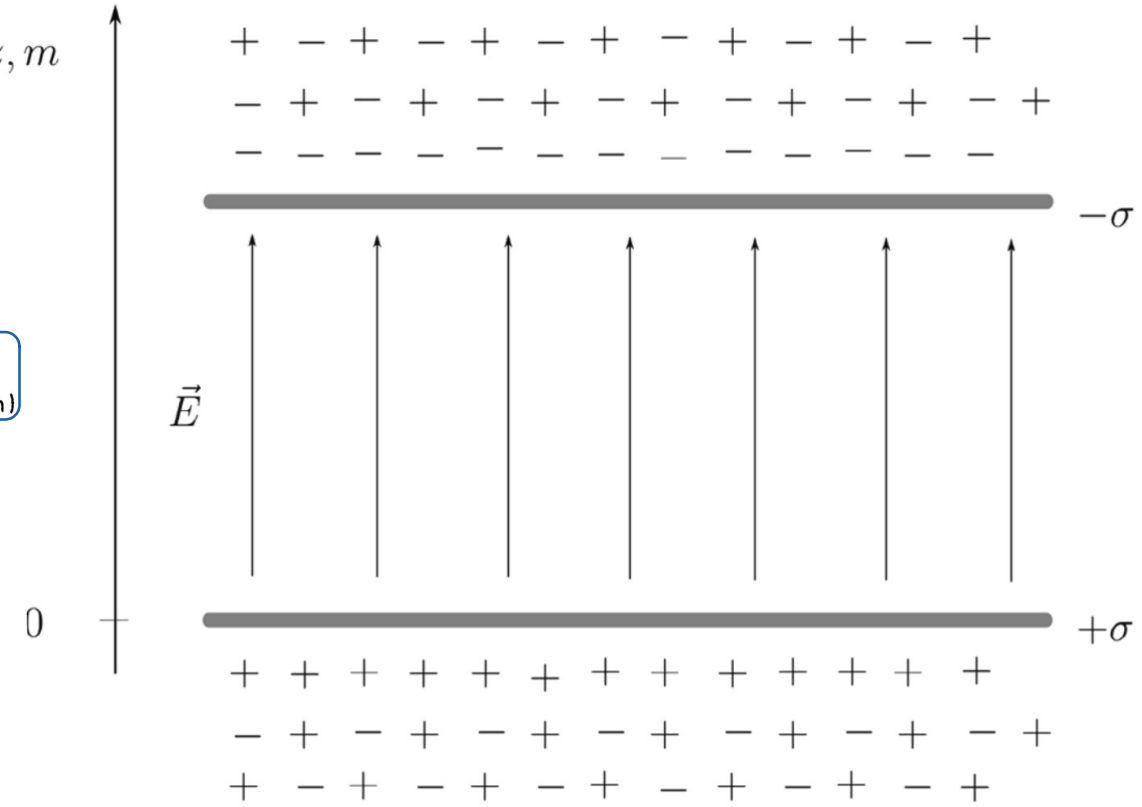
Not only RNO-G but also other at experiments: ANITA, ARIANNA, RICE, AURA, SATRA, ARA, TAROGE-M

Wind-Related Background Events

Triboelectric Effect



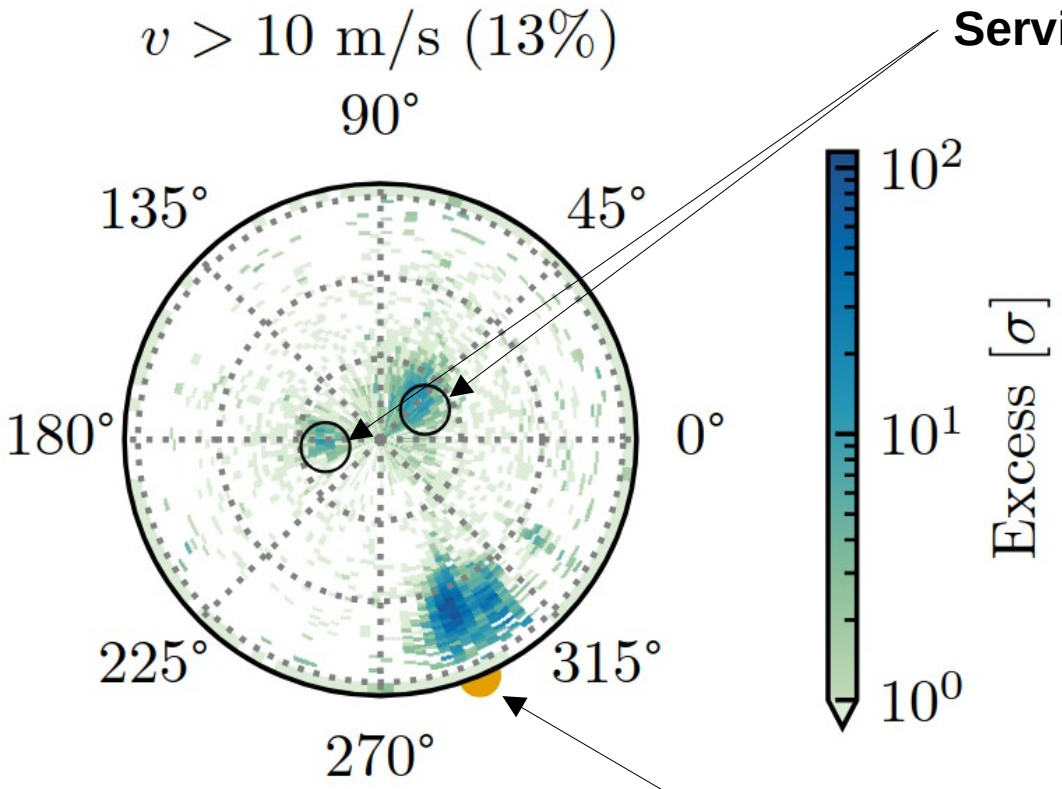
Aeolian sediment transport [Nickling and Neuman, 1994]



Adapted from Astroparticle Physics 145 (2023) 102790

Wind-Related Background Events

Direction Reconstruction



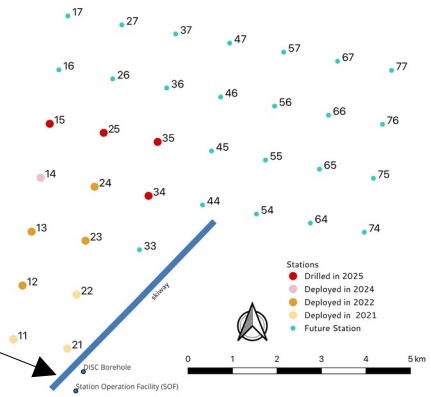
PhD Thesis, Sjoerd Bouma

Service towers with solar panels

Direction reconstruction of wind events reveals preferred direction.

Potential discharges on metallic structures

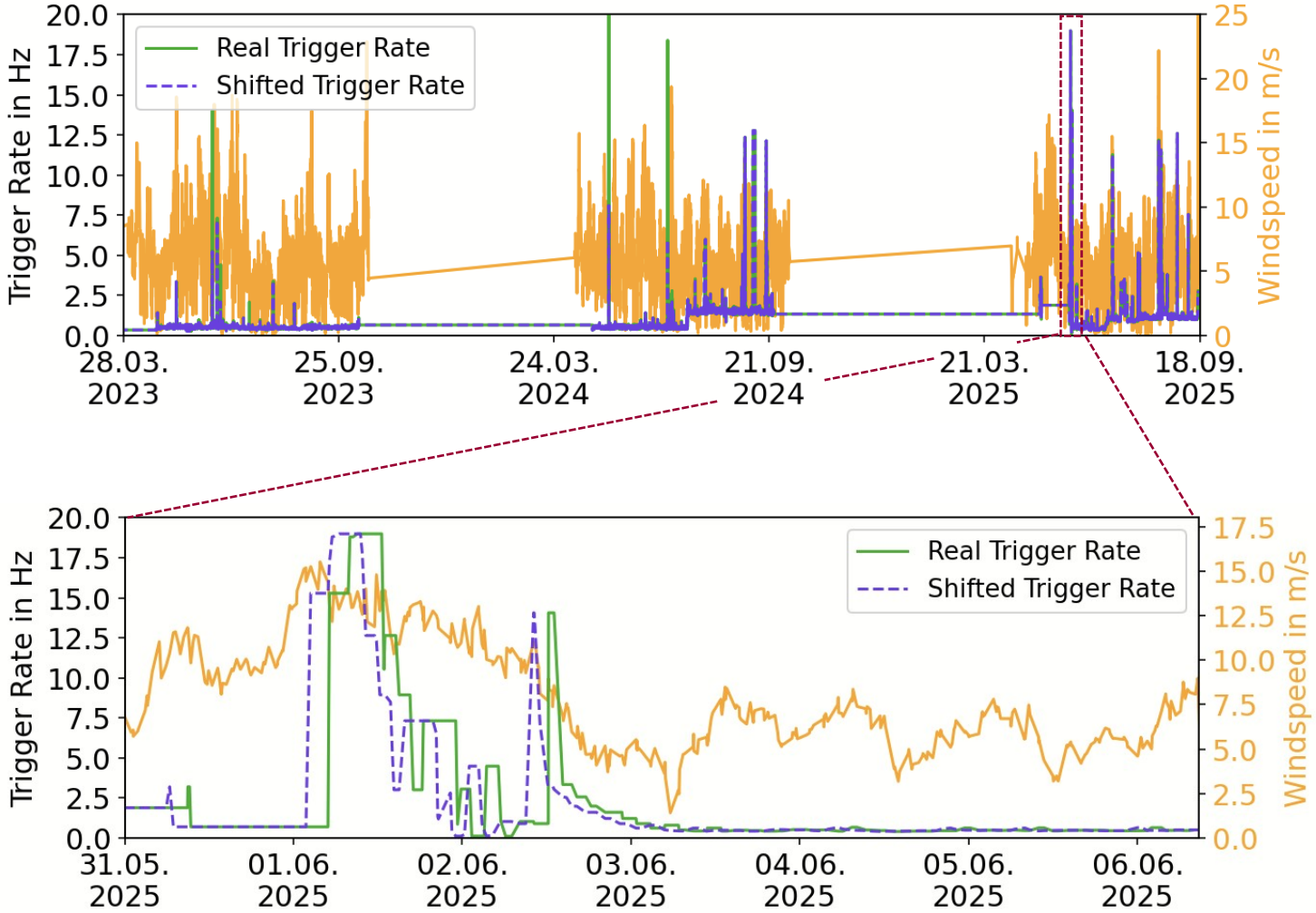
Summit Station



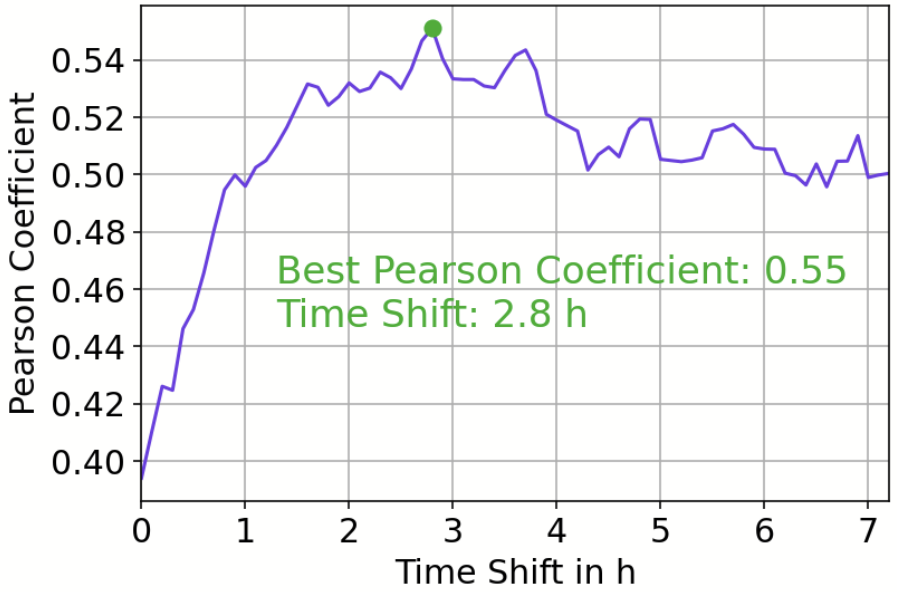
Summit Camp, Wikipedia, Dr. Hannes Grobe

Wind-Related Background Events

Time delay



Pascal Schriefer. "RNO-G's Perspective on Wind – Power Generation and Background Tagging

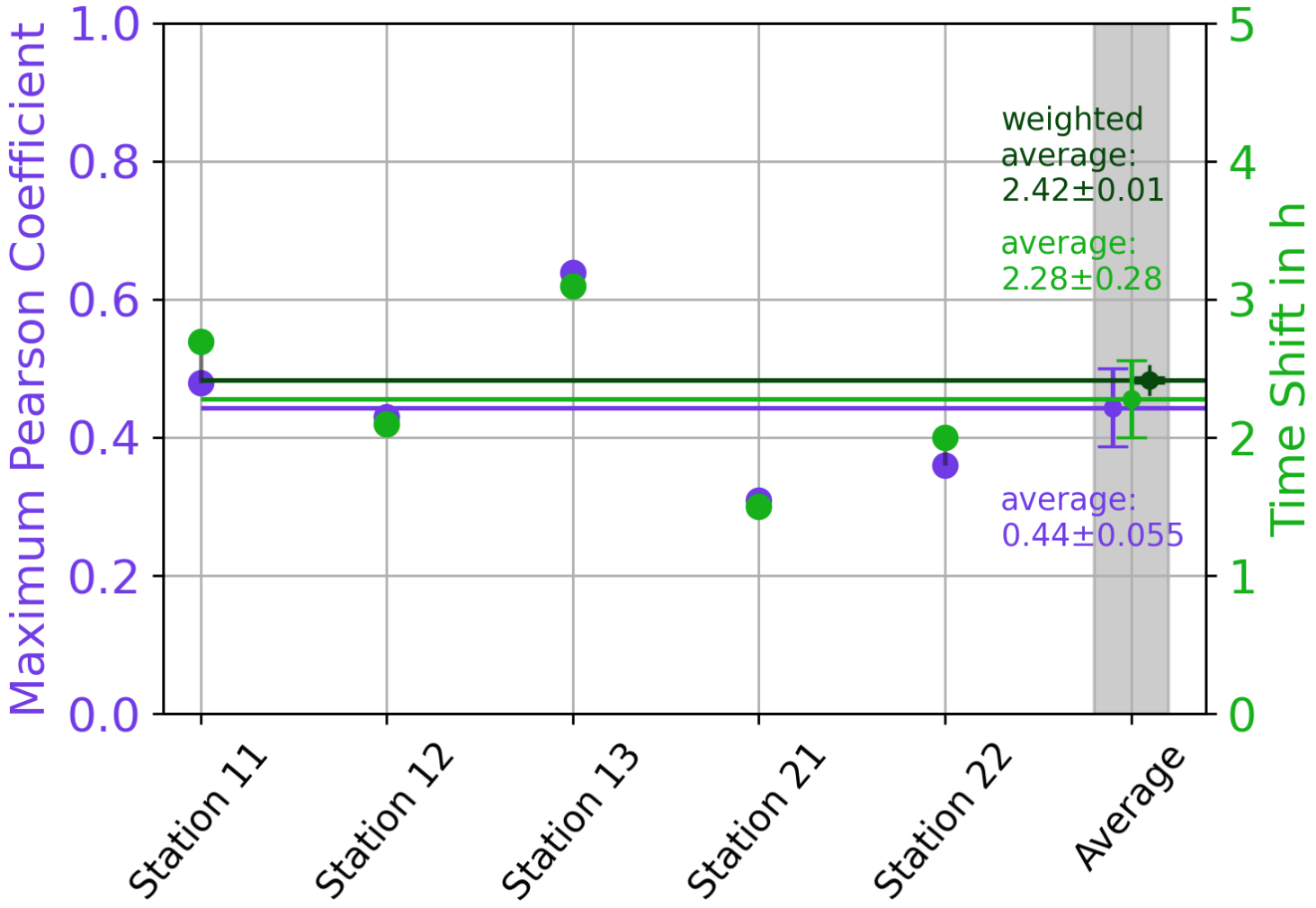


Pascal Schriefer. "RNO-G's Perspective on Wind – Power Generation and Background Tagging

Shifting the trigger data **backwards in time** yields better correlation to wind speed.
(according to the Pearson coefficient)

Wind-Related Background Events

Time delay



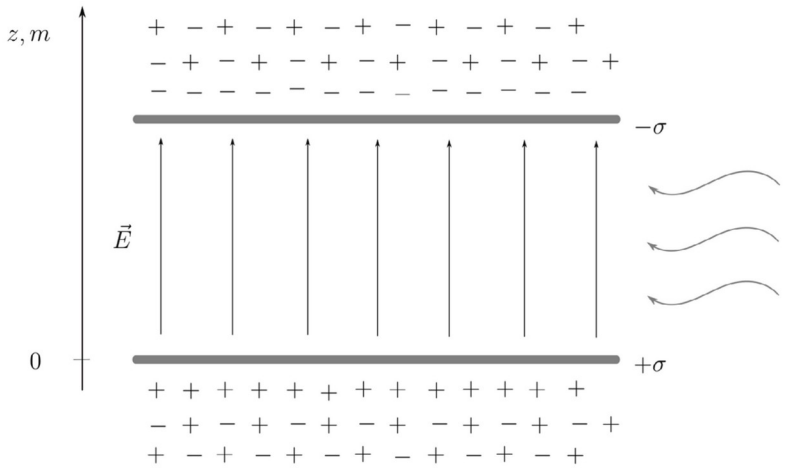
Possible reasons for time delay:

- Snow drift takes time to develop
- Charge build-up is not instant

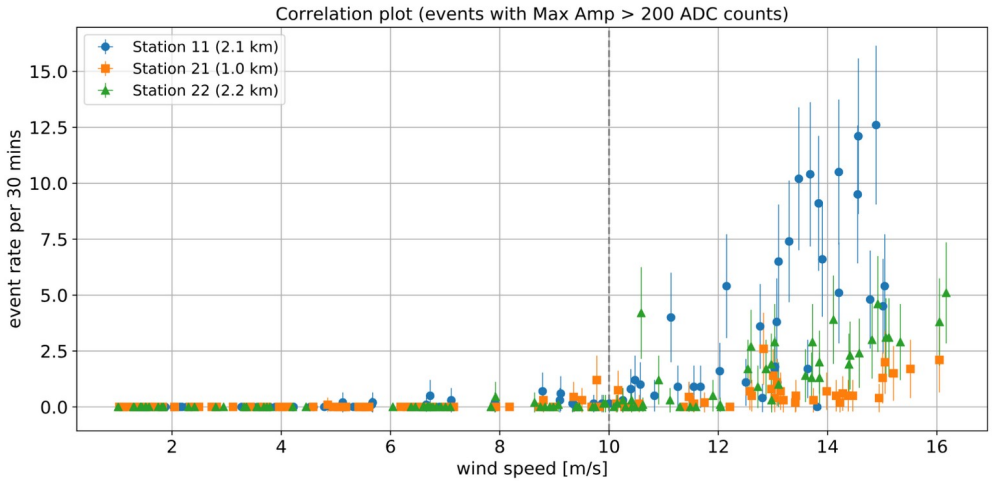
Wind-Related Background Events

Summary

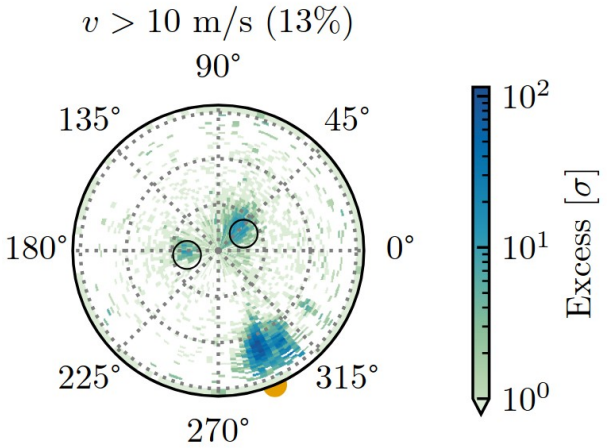
Triboelectric Charge Generation



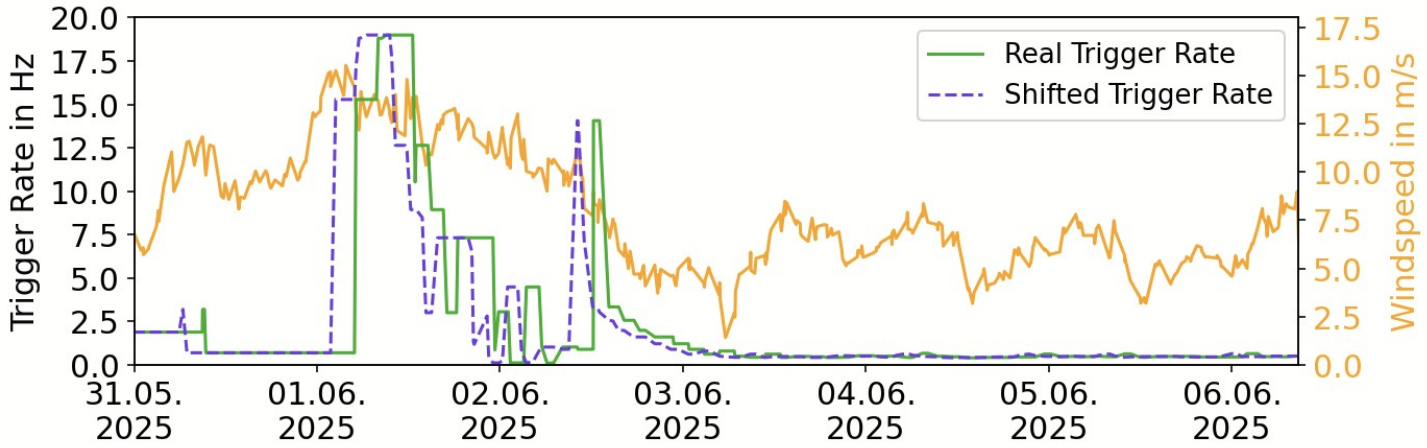
Event Rates During High Winds



Direction Reconstruction



Time Delay Phenomenon



Acoustic Background Tagging V2.0

Summary

<u>End goal:</u> Find a way to eliminate or exclude neutrino-like wind events

- Ideally, there is correlation between acoustic noise and radio noise.

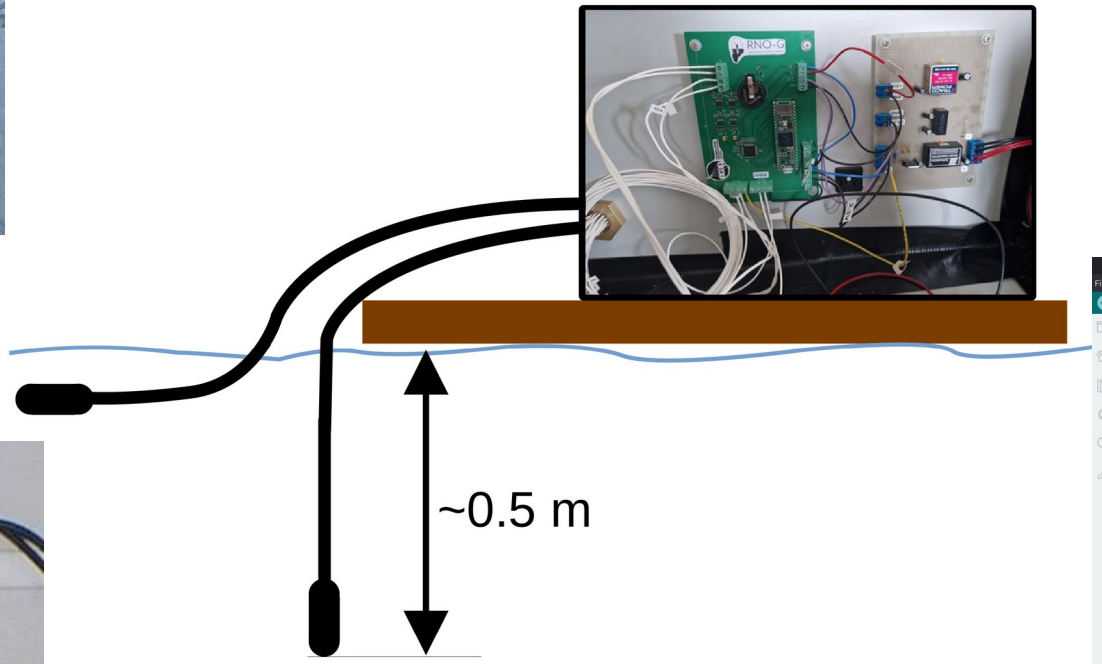
  → Helps to identify wind events in the detector.

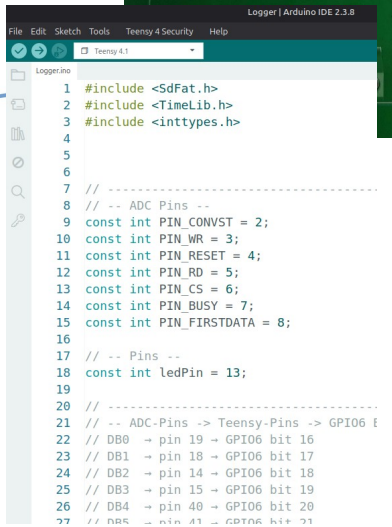
- Wind speed does not have perfect correlation with trigger/event rates. Both [high wind - regular trigger rate] periods as well as sudden, unreasonably high event rate spikes with no increase in wind speed exist.

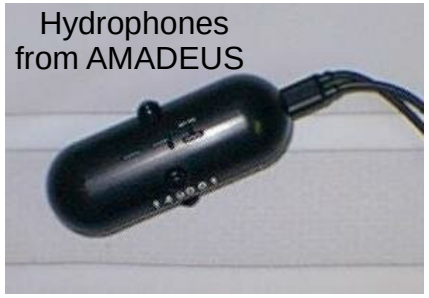
  → There might be other factors in play than purely wind speed. i.e. Humidity, temperature, or other processes entirely.

Acoustic Background Tagging

Ongoing Research

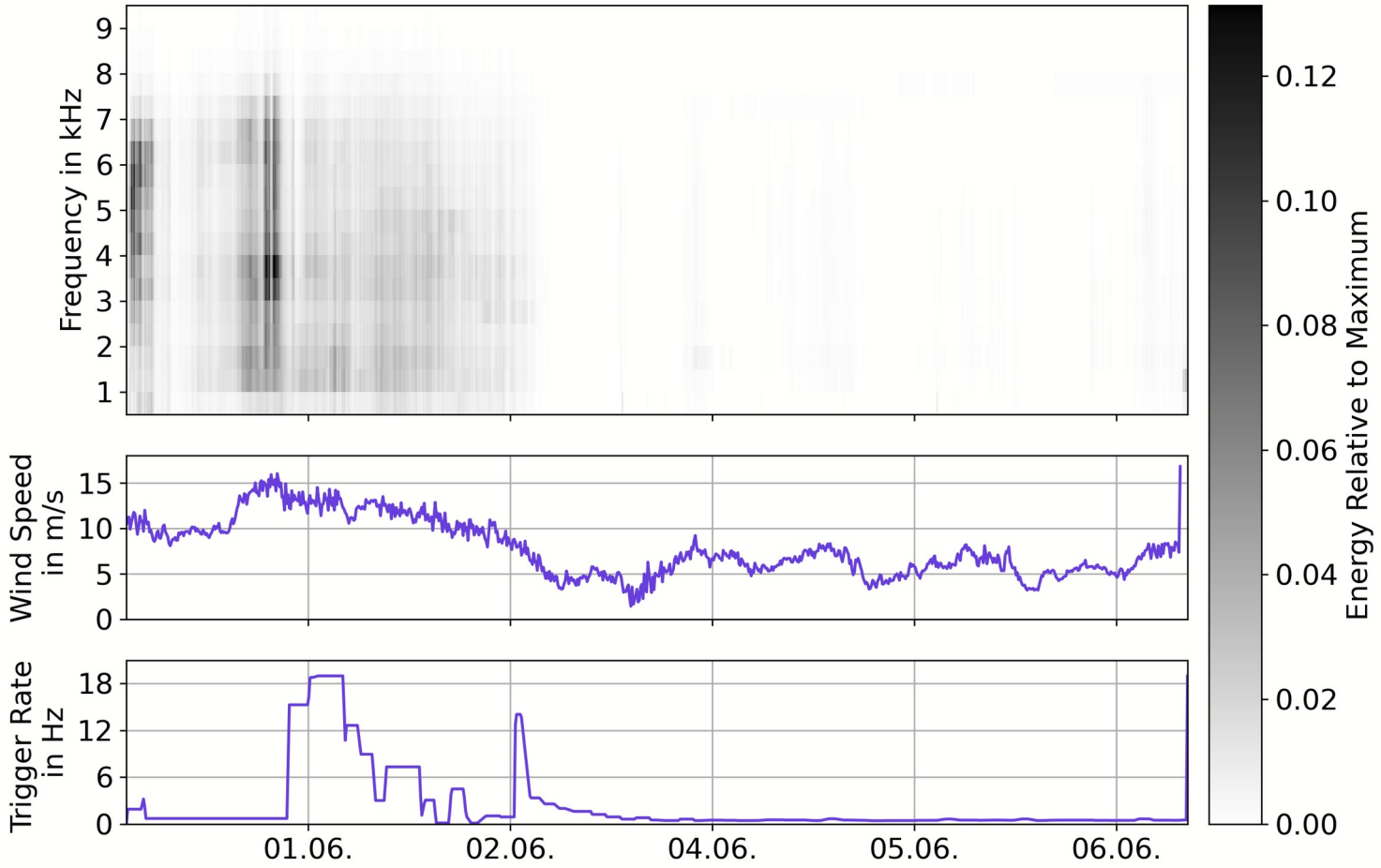






Acoustic Background Tagging

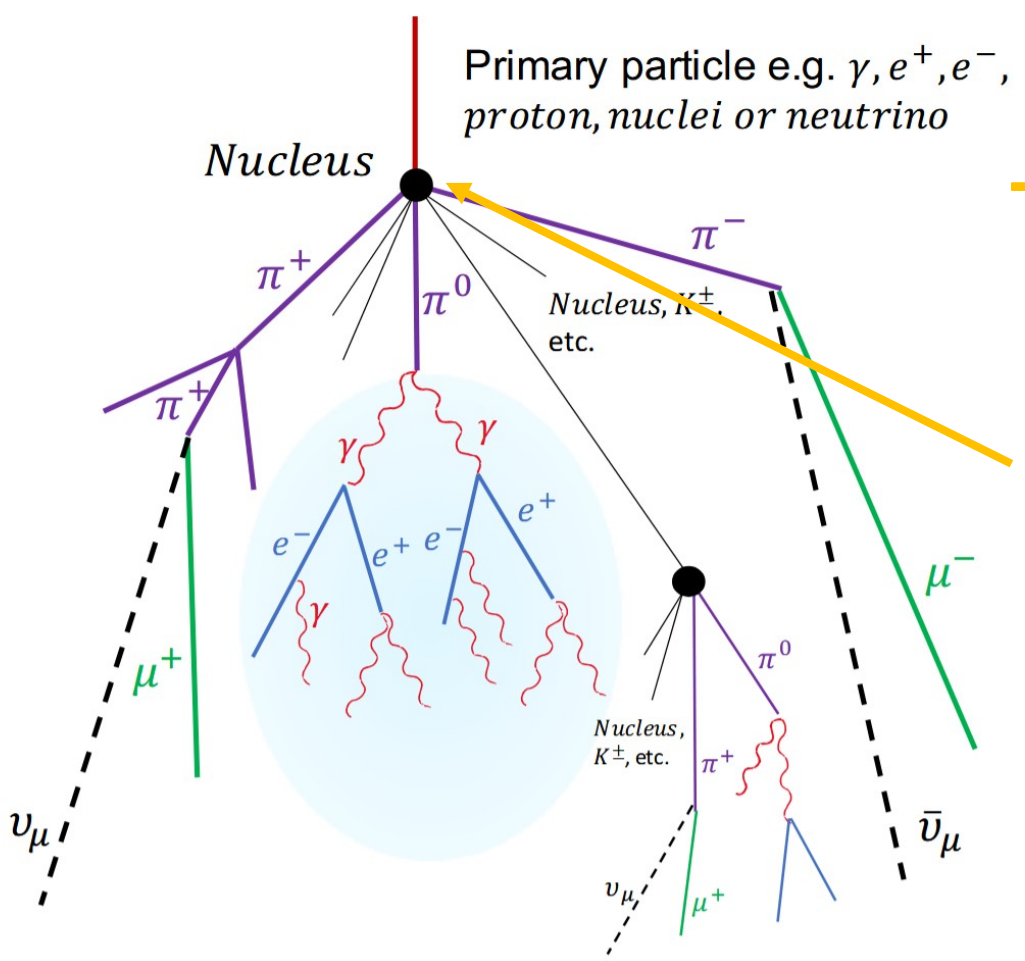
Ongoing Research



Pascal Schriefer. “RNO-G’s Perspective on Wind – Power Generation and Background Tagging

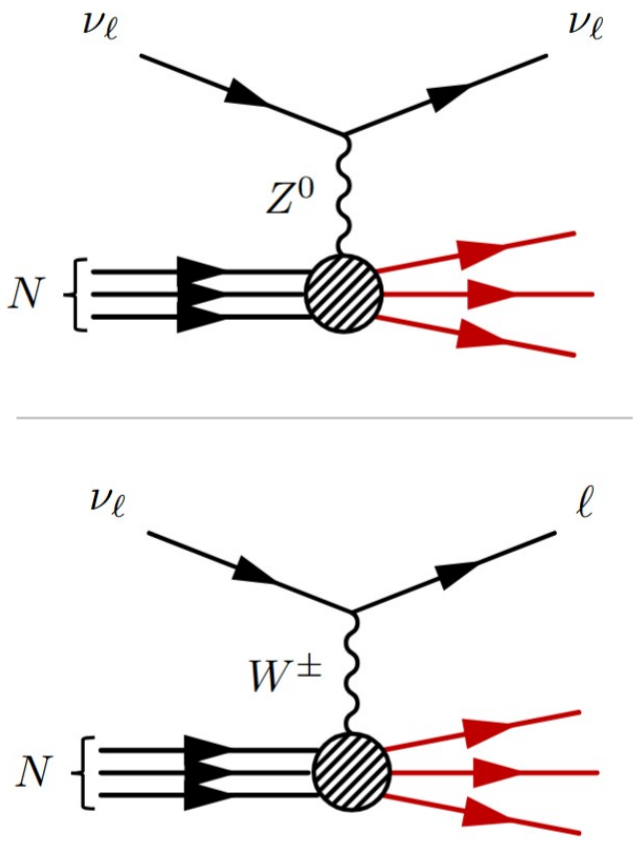
The Radio Neutrino Observatory in Greenland

Detection Method



Lilly Marie Pyras. “Cosmic Rays and the Radio Neutrino Observatory Greenland (RNO-G)”. PhD thesis.

Deep Inelastic Scattering



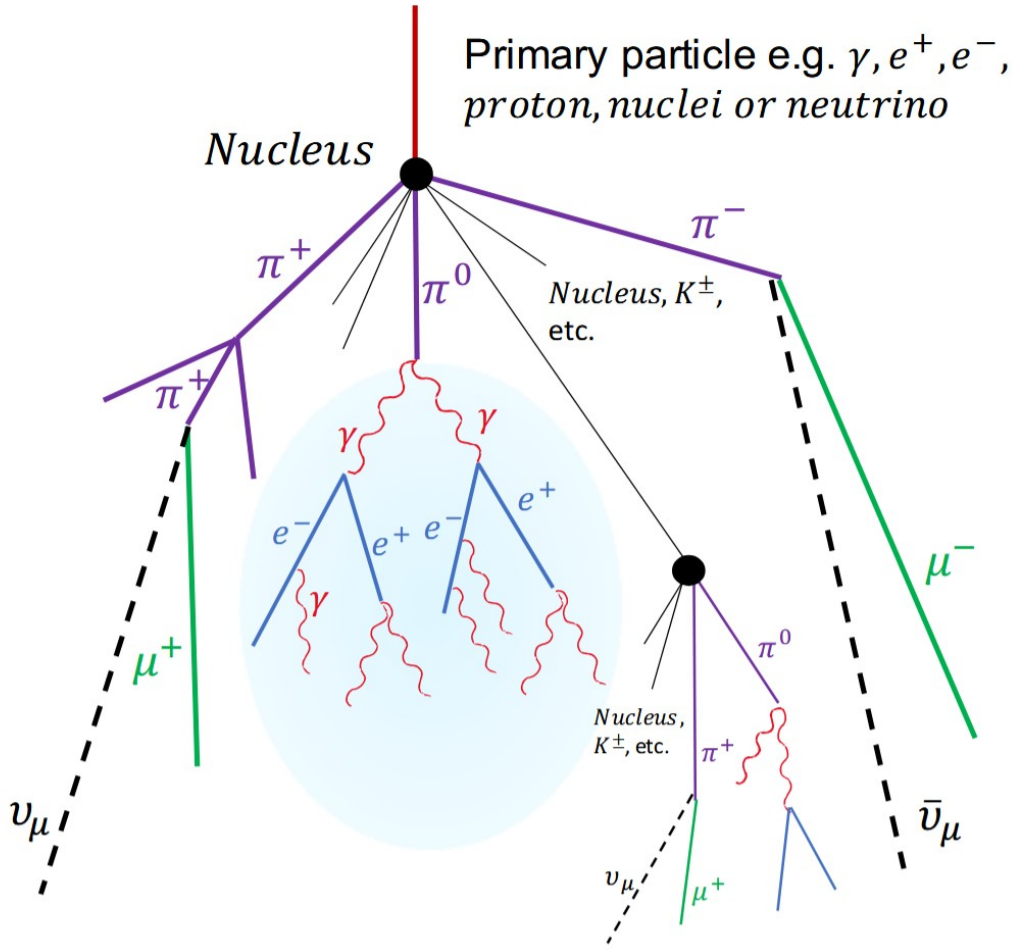
Neutral Current Interaction (NC)

Charged Current Interaction (CC)

Lilly Marie Pyras. “Cosmic Rays and the Radio Neutrino Observatory Greenland (RNO-G)”. PhD thesis.

The Radio Neutrino Observatory in Greenland

Detection Method



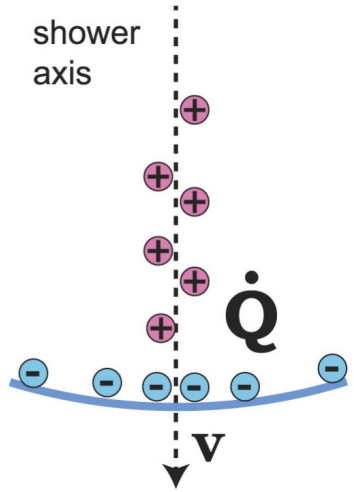
Lilly Marie Pyras. “Cosmic Rays and the Radio Neutrino Observatory Greenland (RNO-G)”. PhD thesis.

Interactions at shower front:

Bhabha Scattering: $e^+ + e^-_{\text{medium}} \rightarrow e^+ + e^-$

Compton Scattering: $\gamma + e^-_{\text{medium}} \rightarrow \gamma + e^-$

Møller Scattering: $e^- + e^-_{\text{medium}} \rightarrow e^- + e^-$



Lilly Marie Pyras. “Cosmic Rays and the Radio Neutrino Observatory Greenland (RNO-G)”. PhD thesis.