Livetime and sensitivity of the ARIANNA Hexagonal Array

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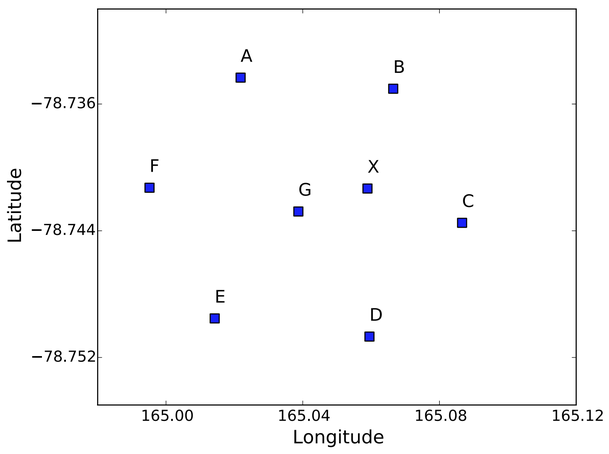
Array status and hardware



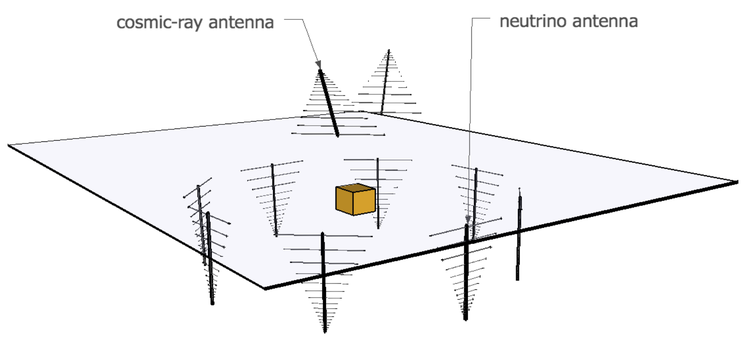
7 stations with four downward pointing antennas operational since 2014

1 station with two upward pointing antennas for background studies of lower frequencies (site X)

Communication via long-range wifi and/or Iridium sattelites

Next-generation boards for data-acquisition, SST

4 channels of 256 samples
2 Giga-samples per second
Band of 0.1 - 1 GHz
32 GB of solid state memory
Remotely programmable
12 bits of dynamic range
Power consumption less than 6 Watts per station
1 mV RMS trigger sensitivity at > 600 MHz trigger band

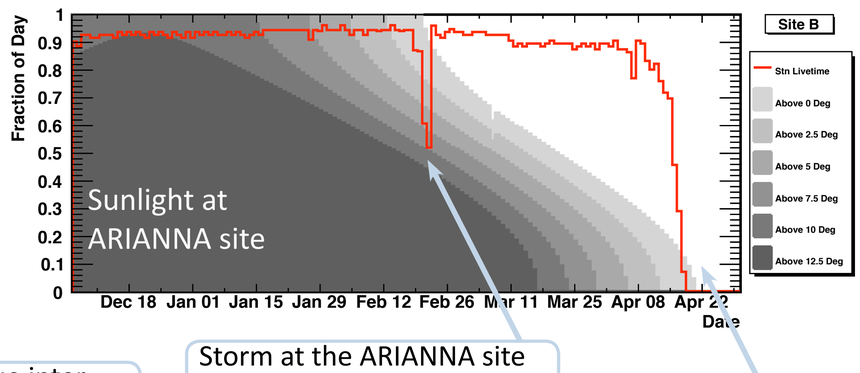


Details in [3,4]

Operations

Livetime with battery

Livetime > 90%, limited by communication windows



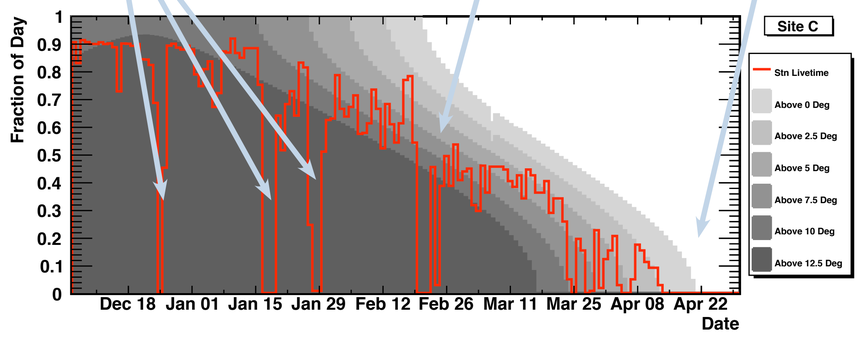
Rare hardware issue interrupted running of stations, fixed remotely in February

Storm at the ARIANNA site
Repeated failure to establish wifi communication

No sunlight after April 21st

Livetime without battery

Enourmous gain in livetime by using a backup battery



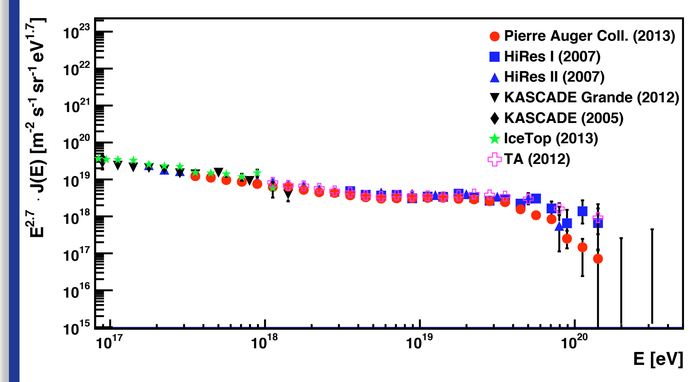
Plans for next season

Install batteries and newest boards at all stations inside the electronics boxes
Run solely on Iridium communication to study prospects of low power operation
Improve on cosmic ray identification, study antenna sensitivity in ice
Explore potential of lower frequencies (> 50 MHz)

Future plans

Build the full ARIANNA: extend array to 1000 stations
Every station will be an autonomous and independent neutrino detector

Cosmic Rays



Ultra-high energy cosmic protons will generate neutrinos in interaction with the Cosmic Microwave Background

ARIANNA is designed to detect neutrinos at these energies ($> 10^7$ GeV) [1,2]

ARIANNA is also sensitive to radio emission of air showers

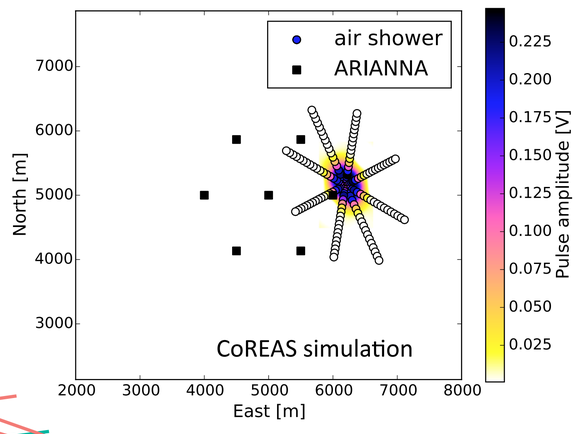
Important/only background at site on the Ross Ice Shelf

Extensive Monte Carlo study underway to determine thresholds for air shower detection

Threshold depends on energy and the distance to the shower maximum

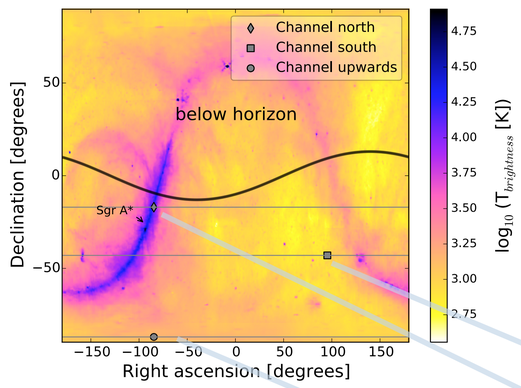
Upward facing antennas as additional veto for air showers installed

First cosmic ray candidates identified



Simulations:
CORSIKA 7.4005, QGSJET-II-04, FLUKA

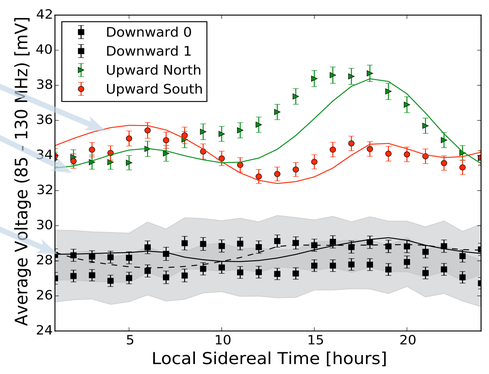
Background emission

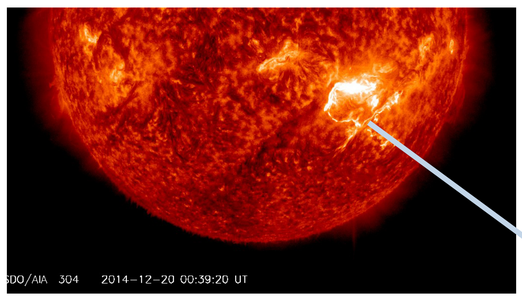


Antenna detects different areas of Galactic emission during one day

Variation a result of folding the Galactic emission pattern with antenna sensitivty

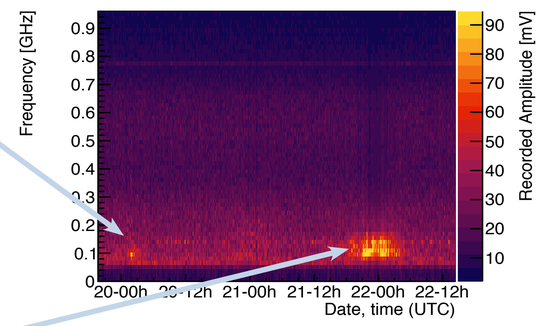
Downward pointing antennas see no fluctiation due to position and back-lobe suppression

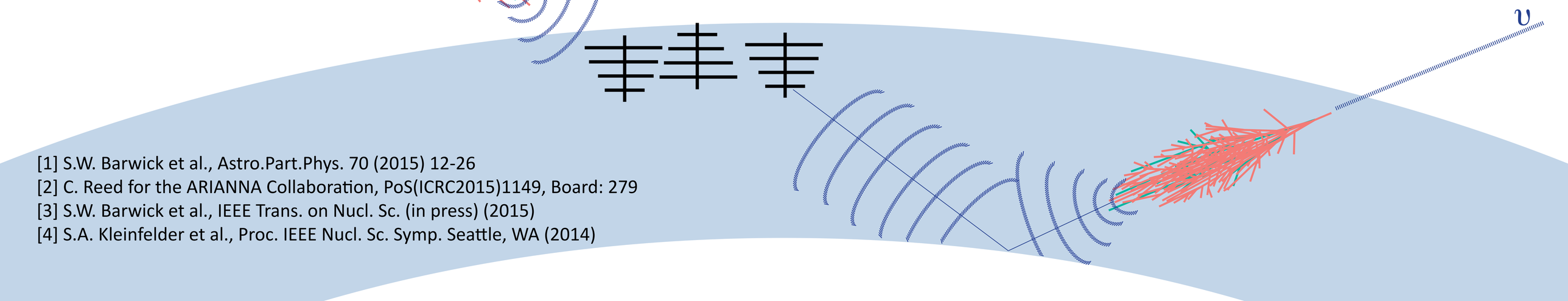




Strong solar burst of December 2014 visible in ARIANNA antennas

Burst caused Aurorae that are also visble





[1] S.W. Barwick et al., Astro.Part.Phys. 70 (2015) 12-26
[2] C. Reed for the ARIANNA Collaboration, PoS(ICRC2015)1149, Board: 279
[3] S.W. Barwick et al., IEEE Trans. on Nucl. Sc. (in press) (2015)
[4] S.A. Kleinfelder et al., Proc. IEEE Nucl. Sc. Symp. Seattle, WA (2014)