The Acoustic Detection of Ultra High Energy Neutrinos: \((E>10^{18}\text{eV})\) is Neutrino Astronomy at the highest energies. Cosmic Ray air shower experiments such as AUGER have reported several CR events in excess of \(1\text{EeV}\). It is likely that there will be a neutrino counterpart to such a signal, which is in principle energetic enough to thermally heat the medium in which it may interact, producing a coherent pressure wave detectable on commercially available, broad band transducers. The ACORNE collaboration utilises the RONA underwater acoustic range off the coast of Northwest Scotland as a ‘test bench’ for development of readout and analysis. Furthermore the collaboration is developing sensor calibration technologies and Monte Carlo simulation tools for predicting the performance of large-scale (>1km\(^2\)) arrays of underwater hydrophones.

**Neutrinos Interacting on Earth:** can scatter off the constituent quarks in nucleons of seawater or ice (left). The development of the resulting particle cascade \(X\) is instantaneous with respect to the signal transit time resulting from thermoacoustic emission. Hence the pressure wave is coherent along the cascade axis and thus confines the signal region to a narrow pancake (right) in analogy with the diffraction of light through a narrow slit. (99% of the energy at \(1\text{EeV}\) is deposited within \(L\approx20\text{m}, R\approx10\text{cm}\)).

**The RONA underwater acoustic range:** comprises 8 wideband hydrophones with a flat -158dB/V/µPa response from 0.01-65KHz distributed about a rectangle of dimensions 1.2x0.2km. Readout is 16bit @ 140kHz. Omnidirectional sensitivity.

**Hydrophone Calibration:** relies on production of the characteristic bipolar signal. A single element has been used to generate an omnidirectional neutrino-like pulse (above left) via a 5th order RC circuit model of the emitting transducer. The next phase of calibration development is to use between 8 and 10 transducers in a line array to recreate the ‘pancake’.

**ACORNE Simulation work:** A modification has been made to the CORSIKA air shower program for simulation of UHE neutrino induced particle cascades in water and ice. [arxiv:0704.1025]. Integrating the cascade energy density yields the resultant thermoacoustic pressure pulse (left). Understanding the energy deposition close to the cascade axis is vital since this is where the bulk of the pressure signal comes from (~90% within 2cm@ \(E_{\nu}=1\text{EeV}\)).

**Large-scale hydrophone array simulations:** For a hypothetical array, one can interpret the performance (i.e. the ratio of events detected to events generated) as a limit on the neutrino flux based on there being no detections made for a given period of observation. The flux limit for a cubic kilometre array of 1000 hydrophones is shown (left) with along with some measured and model fluxes.

**The ACORNE DAQ philosophy:** is all unfiltered data to shore. This permits the greatest flexibility for digital linear phase filtering and matched filter development. 18TB of (FLAC compressed) raw data are under analysis.

**Offline analysis:** 13 dimensional phase space to explore: Pulse Width Pulse Periodicity Relative Energy Pulse Multiplicity Dominant Frequency Sinusoidalness Bipolarity Standard Deviation Skewness Kurtosis Asymmetry of Standard Deviation Asymmetry of Skewness Asymmetry of Kurtosis Prioritisation/optimisation of parameters underway....