Contribution ID: **291** Type: **Oral**

Fiber based hydrophones for ultra-high energy neutrino detection

Wednesday 4 June 2014 11:00 (20 minutes)

It is a well studied process [1,2] of energy deposition of cosmic ray particles in water that generate thermo-acoustic signals. Hydrophones of sufficient sensitivity could measure this signal and provide a means of detecting ultra-high energetic cosmic neutrinos. We investigate optical fiber-based hydrophone technology that could potentially have several advantages over conventional hydrophones based on piezo ceramics. Optical fibers form a natural way to create a distributed sensing system in which several sensors are attached to a single fiber. The detection system in this case will consist of several sensors, an erbium doped fiber laser and an interferometric interogator. Next to the advantage of having multiple sensors on a single fiber, this technology has a low power consumption and no electromagnetic interference with other read-out electronics. Maybe even more important, fiber optics technology provides a cost-effective and straightforward way to implement a large number of hydrophones. This allows to establish a large scale experimental set-up with multi km^3 detection volume that is required for the expected low event rate of neutrino interactions at energies exceeding 10 PeV.

In this talk we will show the results of several measurement campaigns, e. g. in an anechoic bassin for calibration and hydrophone sensitivity measurements. Based on these measurements and realistic simulations we will investigate the feasibility of a potential future large scale neutrino detector based on fiber-based hydrophones.

[1] G. A. Askaryan. Acoustic recording of neutrinos. Zemlia i Vselennaia 1 p13 (1979).

[2] J. G. Learned. Acoustic radiation by charged atomic particles in liquids: An analysis. Phys. Rev. D 19 p 3293 (1979).

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Session Classification: I.e Novel Technologies

Track Classification: Sensors: 1e) Novel technologies