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Keeping an ear to the ground for EeV neutrinos

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Water and ice are the favourite targets for the deployment of acoustic sensors in the search for the characteristic bipolar pressure pulses (BIP) induced by cascades following interaction of very high energy neutrinos with matter. Apparently, there were no previous attempts to try it in bedrock. The reasons are obvious. The costs of deploying a line with sensors into deep sea are considerably lower than drilling into granite. Also, while drilling one test hole in the ground seams feasible, the concept of building a network of such holes covering the required area of around 100 km2 appears to be completely unrealistic. On the other hand, if the required network of deep boreholes in a bedrock were available, there would be a number of strong arguments to explore such a possibility. As the speed of sound in rock is 4 times higher than in water and taking into account differences in the expansion coefficient and in the specific heat capacity, one would expect that the characteristic BIP signal in rock would be 5 times stronger than in water. Also, the attenuation length should be noticeably longer. The ideal place to put this new approach to a test is the Pyhäsalmi mine in Finland – the deepest metal mine in Europe, with the ore deposit located within a cylindrical volume surrounded on all sides by a strong nearly-monolithic rock. Over the many years of explorations, the mine has drilled a network of boreholes reaching far out and deep down in the futile search for new ore deposits. These boreholes, with very well documented geological profile, would be now available for scientific research. In my presentation I would expand on that idea and introduce the infrastructure of CallioLab constructed and used for a variety of new projects. Also, I would present a realistic scheme to reach the required deployment area of around 100 km2 at a reasonable cost and on a realistic timescale.

Primary authors: TRZASKA, Wladyslaw Henryk (University of Jyvaskyla (FI)); TRZASKA, Wladyslaw Henryk

Presenter: TRZASKA, Wladyslaw Henryk (University of Jyvaskyla (FI))

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