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# High Energy Neutrinos to See Inside the Earth

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High energy neutrino astronomy with Neutrino Telescopes (NTs) is one of the most promising research lines in astroparticle physics. This perspective has stimulated the construction of a $km^3$ under-ice neutrino detector (IceCube) and several proposals and R&D projects for a detector in the deep water of the Mediterranean sea, namely ANTARES, NESTOR and NEMO, which in the future could lead to the construction of a $km^3$ telescope as pursued by the KM3NeT project. The energy–zenith angle event distribution in a NT, in the extreme high energy regime, provides a unique tool to determine several interesting physical observables like the neutrino-nucleon cross section at extreme kinematical regions, and the high energy neutrino flux. Recently it has been also proposed the use of atmospheric neutrinos to perform a *radiography* of the inner part of the Earth by estimating the density of crossed matter through the observed number of charged lepton events at a NT. For this purpose, we present a development of the methods already applied to study the high energy performance of under-water NTs due to the 3D surface profile nearby the experimental setup. The implemented tool is a Monte Carlo code, based on the two event simulators HERWIG and GEANT, capable to follow the generation of a neutrino-induced cascade in matter, till the NT. By using this code we analyze the sensitivity of an under-water NT to the Earth radial density profile parameterization. The tool can be also applied to a *conceptually* similar problem provided by the study of the inner structure of a volcano (Vesuvius) by means of high energy muons from cosmic rays (see the talk by P. Strolin).