

KM3NeT is a modular research infrastructure, composed of two neutrino detectors, currently under construction in the Mediterranean Sea. The first detector, ORCA, is located near Toulon, offshore the French coast at a depth of 2.5km. It is dedicated to the study of the atmospheric neutrino oscillations at energies of a few GeV with the main goal of determining the neutrino mass hierarchy. The second detector, ARCA, is placed offshore Portopalo di Capo Passero in Italy at a depth of 3.5km. It is optimized to measure the TeV-PeV cosmic neutrinos, originating from various astrophysical sources, like blazars, supernovae or gamma ray bursts.

Both detectors operate by measuring the Cherenkov light emitted by energetic particles passing through the sea water. Photomultiplier tubes (PMTs), that are mounted with other electronic instruments inside digital optical modules (DOMs) are used to detect this light. Each DOM contains 31 3-inch PMTs and is attached onto a vertical line, called detection unit (DU). Every DU carries 18 DOMs. ARCA and ORCA are taking data since 2017. Both detectors are currently operating in configurations with 6 DUs installed. The full detector configurations will be two blocks with 115 DUs for ARCA and one block with 115 DUs for ORCA.

Atmospheric muons are simulated in KM3NeT using one of the two Monte Carlo (MC) codes: MUPAGE or CORSIKA. The first is a fast parametric routine, based on HEMAS model of the atmospheric muon flux and tuned on results of underground measurements of muon fluxes from the MACRO experiment. CORSIKA is a software, which simulates event-by-event the extensive air showers (EAS) caused by the interactions of primary CR particles with air molecules in the upper atmosphere. The outputs of both codes are further processed by a set of software developed within KM3NeT to produce a simulation resembling the experimental data as closely as possible.

The results of a comparison between the experimental data from ARCA2 and ORCA4 (ARCA with 2 DUs and ORCA with 4 DUs) and the respective MUPAGE and CORSIKA simulations are presented in the poster. The MC reproduces the shape of the data, but there are some discrepancies that require further attention. All the results are shown at the reconstruction level without any quality cuts that could in future improve the agreement. In the zenith plots there is a false contribution to the upgoing muons, which is due to the badly reconstructed (flipped) direction. There are ongoing efforts to improve the agreement, e.g. by optimizing the simulation of muon propagation through water or refining the energy reconstruction algorithm.

The atmospheric muon flux observed by the KM3NeT detectors is predicted to have two distinct components: conventional and prompt. Conventional muons have been experimentally measured and are typically created in decays of charged pions and kaons, whereas prompt muons originate from fast decays of heavy hadrons. The existence of the prompt muon flux component has not been experimentally confirmed so far. According to the first results from simulations for the full ARCA detector (ARCA115), an excess of prompt over the conventional muons is expected for muon bundle energy (total energy of all muons in the bundle) above 1 PeV. In fact, a similar excess is also predicted for ORCA115. Both results have yet to be verified at the reconstruction level.