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The KM3NeT Deep-Sea Research Infrastructure

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KM3NeT is a future deep-sea research infrastructure in the Mediterranean Sea that will hold a multi-cubic-kilometer neutrino telescope. Located in the Northern Hemisphere, KM3NeT will be able to observe point-like sources of cosmic neutrinos in a region of the sky that includes the Galactic Center.

KM3NeT will employ a number of innovative technologies that are the main subject of the presentation. It is currently planned to install optical modules of 17 inch diameter that will contain 31 photomultiplier tubes each. Triggered data will be digitized off-shore. These “digital optical modules” will be installed on horizontal bar structures of several meters of length. Several of these structures will be stacked to form a vertical tower, interconnected by tethers at distances of several tens of meters.

To reconstruct the Cherenkov cones of charged particles produced in neutrino interactions, a time synchronization on a sub-nanosecond level is required. To calibrate the complete timing in situ, LED beacons, integrated into the optical modules, will be used. The devices are currently tested within the ANTARES neutrino telescope. To calibrate the position of the optical modules on the towers, which are free to sway with the sea currents, a system of acoustic transceivers at fixed positions on the sea floor and receivers along the towers will be used. The data will be sent continuously to shore, where the algorithms for position calibration will be applied. Sending all data to shore will allow both for flexibility in applying the position calibration algorithms and for using the data for further analyses, such as for marine science investigations or acoustic neutrino detection.

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