KM3NeT

*Opens a new window on our universe*

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# Deployment at large depths: Technology and precise underwater positioning

INNOVATIVE TECHNOLOGICAL SOLUTIONS FROM KM3NeT

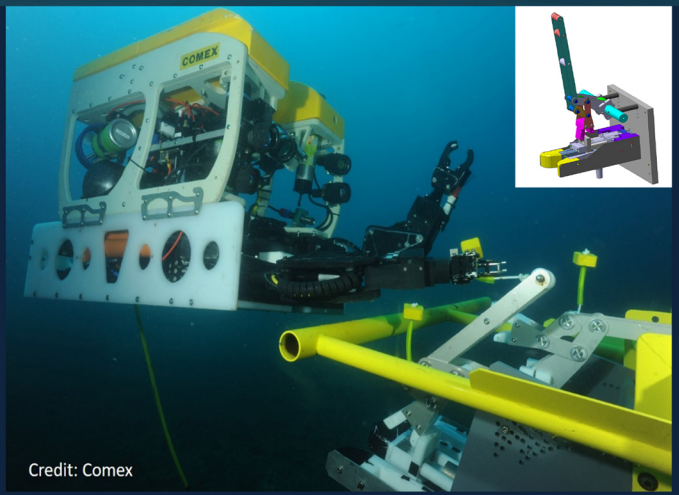
KM3NeT is a research infrastructure housing the next generation neutrino detectors, located at some of the greatest depths of the Mediterranean sea. Each detector comprises a network of vertical detection units connected to a network of electro-optical cables on the seabed. Its construction and operation required developing new technologies for accurately positioning the detector elements deployed at large depths.

Credit: Italiana d-Arte

## Tool for (dis)connecting wet-mateable connectors with lightweight ROVs

The detection units are connected to the seabed network via electro-optical wet-mateable connectors. These typically require at least 60kg of force for (dis)connection, which can only be applied by a heavy duty ROV.

KM3NeT sea operations in France use a lightweight ROV, which is less expensive and has better availability. For this purpose CPPM (Centre de Physique des Particules de Marseille) developed a tool to connect wet-mateable connectors using a lightweight ROV. This tool decreases the maximum force necessary for the ROV to deliver to less than 30 kg.




Credit: Comex

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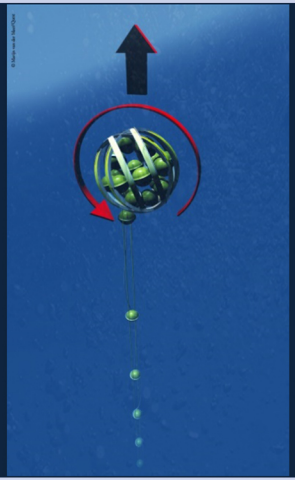
## The LOM

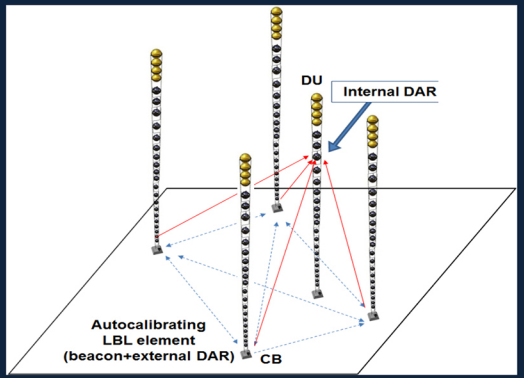
For a fast and safe deployment, NIOZ developed a spherical launching frame, the LOM. Each KM3NeT detection element is coiled like a string around the LOM in which the optical modules slot into dedicated cavities.

After deploying the LOM and connecting to the seabed network, the unfurling of the string is triggered. The LOM then starts to rise to the surface; while slowly rotating it releases the optical modules and finally the empty LOM floats to the surface and is recovered.

The LOM has been developed for KM3NeT by NIOZ (Royal Netherlands Institute for Sea Research).



## Precision in-water positioning




During the deployment phase, the absolute positioning of the mechanical structures on the seafloor is provided by commercial instrumentation that allows a precision of about 2m.

For the needs of the experiment, INFN (Laboratori Nazionali del Sud) developed the RAPS precise positioning system of the floating optical modules along the detection units. This is achieved with a relative acoustic positioning system (RAPS), formed by a Long Baseline (LBL) of acoustic transmitters (beacons) and receivers (hydrophones) placed on the seafloor in fixed positions and acoustic sensors mounted along the DU to measure the displacement of the DUs under the effect of sea-currents. RAPS position accuracy of 10 cm is achieved with this method.