EPJ Web of Conferences **116**, 09003 (2016)
DOI: 10.1051/epjconf/201611609003

Km3Net Italy – Seafloor network

Riccardo Papaleo for the KM3NeT collaboration

INFN – Laboratori Nazionali del Sud, via Santa Sofia 62, 95123 Catania, Italy

Abstract. The KM3NeT European project aims to construct a large volume underwater neutrino telescope in the depths of the Mediterranean Sea. INFN and KM3NeT collaboration, thanks to a dedicated funding of 21.000.000 € (PON 2007–2013), are committed to build and deploy the Phase 1 of the telescope, composed of a network of detection units: 8 towers, equipped with single photomultiplier optical modules, and 24 strings, equipped with multi-photomultipliers optical modules. All the towers and strings are connected to the main electro optical cable by means of a network of junction boxes and electro optical interlink cables. Each junction box is an active node able to provide all the necessary power to the detection units and to guarantee the data transmission between the detector and the on-shore control station. The KM3NeT Italia project foresees the realization and the installation of the first part of the deep sea network, composed of three junction boxes, one for the towers and two for the strings. In July 2015, two junction boxes have been deployed and connected to the new cable termination frame installed during the same sea campaign. The third and last one will be installed in November 2015. The status of the deep sea network is presented together with technical details of the project.

1. Introduction

The Km3NeT Italy is the first block of the KM3NeT neutrino telescope [1]. Figure 1 shows its underwater layout.

It is composed of 24 strings (red circle), 8 towers (green circle) and 3 Junction Boxes (JBs): 1 is dedicated to manage the towers (green square) and 2 will serve the strings (red square).

Each Detection Unit (DU), both string-like and tower-like structures, is connected to a JB which acts as an active underwater node for the exchange of data and power from and to the shore station.

The main electro optical cable (MEOC) is a standard telecommunication cable with 20 optical fibres (G655 type) for data transfer and one electrical conductor for power transfer. The cable is able to transport up to 100 kW to the detector. At its end a Medium Voltage Converter (MVC) transforms the power supply from 10 kV to 375 V.

The MVC is hosted on a Cable Termination Frame connected to the JBs by electro optical interlink cables equipped with 4 optical fibres and 2 electrical conductors.

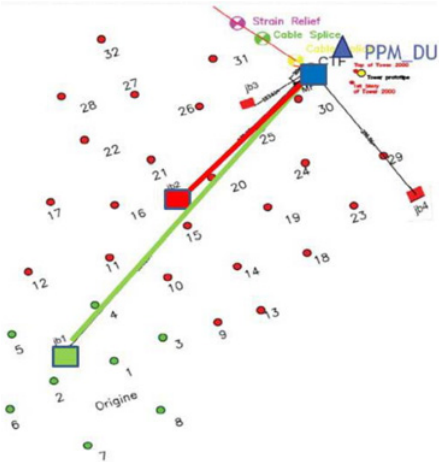

Figure 1. Underwater layout.

Figure 2. CTF during deployment operation (july 2015).

2. Cable Termination Frame (CTF)

The CTF (Fig. 2) is the termination system of the main electro optical cable. The design of the CTF includes a mechanical frame (Titanium), a Cable Termination Assembly system (for the splitting of the fibres and electrical connection), a patch panel with 5 hybrid ROV wet mateable connectors (each one able to manage 4 optical fibres) and a Medium Voltage Converter for the power supply of the underwater telescope.

The mechanical frame is realized in Titanium grade 5. The design of the CTF is optimized in order to guarantee the stability of the system during the deployment phase and after the touchdown on the seabed.

The first 3 connectors on the patch panel are used for the connection of the KM3NeT Italy JBs. The fourth connector is used for the connection of the EMSO JB (www.emso-eu.org).The fifth connector in the future could be used to connect another JB of the underwater detector.

Figure 3. The junction box.

3. Junction Box

The Junction Box (Fig. 3) is a key element of the detector and connects the MEOC to the detection units.

Each junction box is located near a group of up to 12 DU's to reduce as mch as possible the distance junction box – DU's.

Its main function are the distribution of the power to the units and the control of the data flux from/to shore.

The JB includes the following items:

- a mechanical frame to host all the PODs (Protective Ocean Devices) and the ROV wet mateable connectors. The frame has been designed in order to optimize the assembly, the maintenance and the sea operations of the JBs;
- 4 plastic panels to host the hybrid ROV wet mateable connectors: an input connector coming from the CTF and up to 12 connectors for the connection to the DUs;
- a vessel for fibre and conductor routing, named manifold, and three vessels with different functionality (Fig. 4):
  - a junction box power POD, to manage the power supply towards the DUs;
  - a junction box optical POD, to manage the optical data flux from and to the shore station;
  - a junction box electronic POD, to control and monitor the full system.

The mechanical frame is realized in Al Alloy 5083. The central part of the mechanical frame hosts the manifold and the PODs.

All the electronics devices (boards, optical amplifier, mux&demux filter, etc) have been grouped by function in order to optimize the reliability of the system and the connector and cabling system. The size and the weight of each POD is compatible with an easy handling and installation on board. This allows to replace a failed POD even on board, minimizing the costs for maintenance and the downtime of the apparatus. The material of the PODs is Al Alloy hard anodized in order to increase the protection against the corrosion.

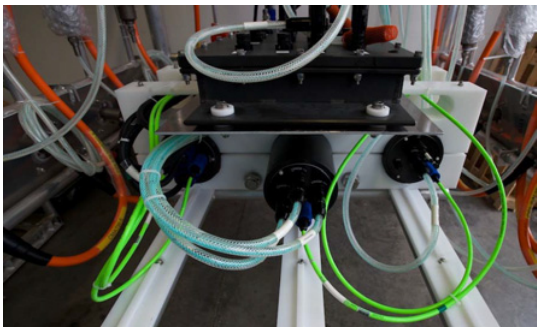

Figure 4. Detail of the manifold and the PODs installed on the mechanical frame.

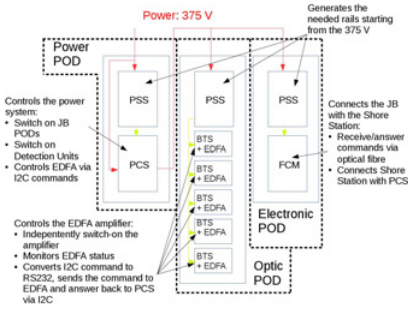

Figure 5. Scheme of the power system of the JB (string type).

From the electric point of view (Fig. 5), the JB simply acts as a switch of the main power line (375 V) provided by the DC-DC MVC in the CTF).

The power line which enters the JB, is converted by dedicated DC-DC converters and is split in 8 or 12 different lines; each of them is connected to a DU.

Those lines are controlled by switches located in the power POD of the JB. Dedicated commands from the Shore Station will power on the single DU, independently.

From the optical point of view, the JB will re-route all the optical fibres to the correspondent DU, to allow its direct communication with the shore station.

Optical amplifiers are necessary to guarantee the necessary optical budget for the communications. The amplifiers are located and managed in the optical POD of the JB.

4. Summary

The KM3NeT detector is under construction. On July 2015 a sea operation has been performed in order to install the first components of the underwater telescope: the new Cable Termination Frame and 2 Junction Boxes (1 for the tower and 1 for the string) has been installed and connected. The current plan of work foreseen the installation of the first DUs on December 2015. The KM3NeT seafloor network will be completed on spring 2016 with the installation of the last Junction Box.

Reference

[1] R. Coniglione, this conference