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Electro-optical cable and power feeding system for the NEMO Phase-2 project

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Abstract

The "NEMO Phase-2" project consists of a new facility placed on the sea floor at 3500 m depth, 40 nautical miles southeast of the south coast of Sicily. Technical aspects of the facility under realization are presented with particular attention to the electro-optical cable, the on-shore and deep-sea power transmission system, the control system and the connection system.

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Keywords: Electro-optical submarine cables; Underwater power feeding systems

1. Introduction

The NEMO Phase-2 project represents a further step in the R&D activities of the NEMO collaboration towards the km^3 realization. The experience gained with the Phase-1 project [1] and the progress in underwater telecommunications and related technologies have made the realization of this new facility possible. In this paper, we will outline the present technical status of the project with particular attention to

- the backbone cable,
- the on-shore and deep-sea power transmission system, and
- the control system.

2. Site

A site located at a 3500 m deep abyssal plateau at approximately 40 nautical miles southeast of Capo Passero (36°20′N, 16°05′E) has been proposed by the NEMO collaboration for the installation of the km^3 detector. The optimal features of the site have been measured with more than 25 sea campaigns over 7 years [2].

The Phase-2 project will be realized on this site and will allow to install prototypes of the km^3 detector components at 3500 m, also providing an on-line continuous monitoring of the water properties.

This new facility may also be very attractive for the installation of interdisciplinary submarine observatories.

3. The NEMO Phase-2 project

The infrastructure presently under construction is composed of

- a shore station in Portopalo di Capo Passero, to host the power feeding and the data acquisition systems;
- a 100-km long backbone cable, connecting the 3500 m deep-sea site with the shore;
- the shore power system;
- the submarine power system;
- the monitoring and control systems.

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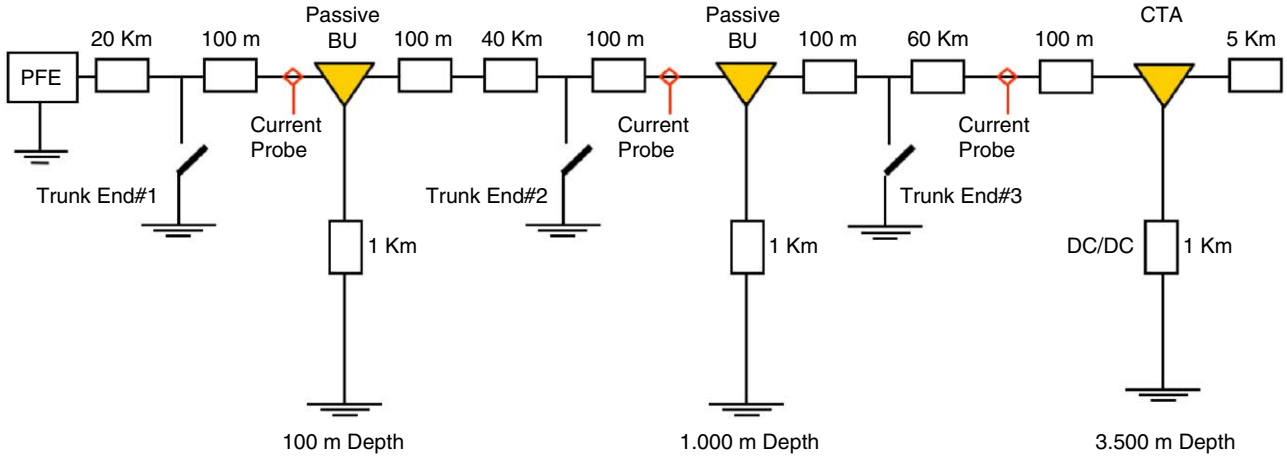

Fig. 1. The Backbone Cable configuration.

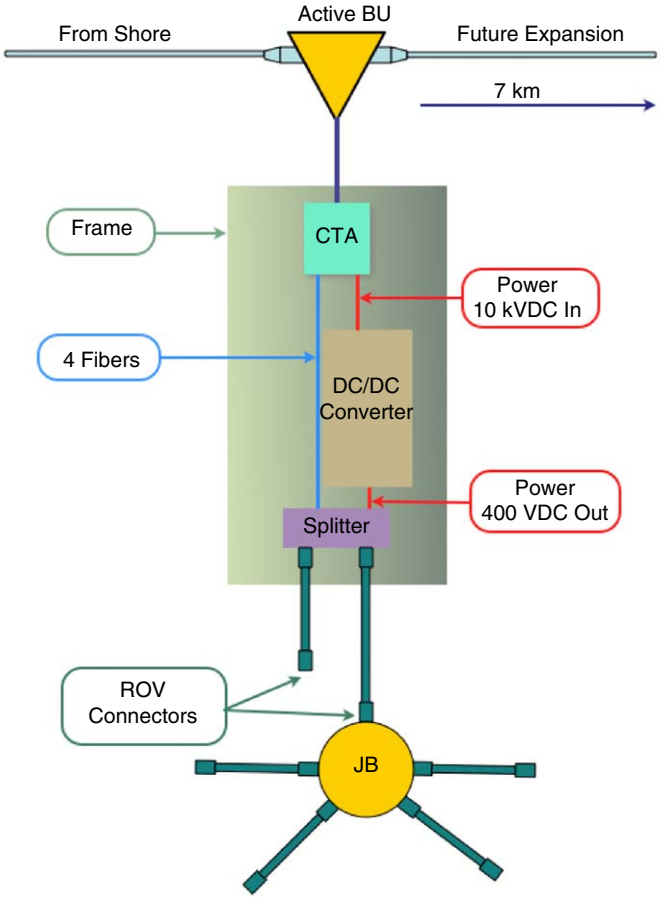

Fig. 2. Scheme of the underwater infrastructure.

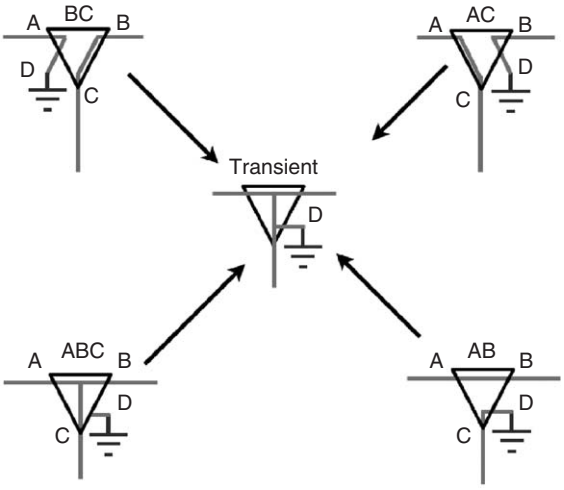

Fig. 3. BU State diagram.

4. The backbone cable

Due to the longer cable length with respect to the Phase-1 project [2], a different solution for the electro-optical cable was chosen. The backbone cable will be a DC cable, manufactured by Alcatel. It will carry a single electrical conductor, that can be operated at 10 kV DC, allowing a power transport of more than 50 kW and 20 single-mode ITU-T G655 optical fibres for data transmission. The cable total length is about 100 km.

The layout of the configuration is shown in Fig. 1. Two passive Branching Units (BU), which may be installed along the cable at 100 and 1000 m depth, are also shown.

5. Power feeding equipment (PFE)

PFE is composed of a DC converter and a controller. PFE provides 50 kW at 10 kV DC with sea current return.

A Supervisory Unit, based on a Dark Fiber Monitoring Equipment (DFME) [3], provides the interface between the management system and the submerged plant. This unit, in conjunction with a line supervisory gain cell, provides full supervisory functionality for the submerged BU, allowing switch commands to be sent from the station. The supervisory messages sent from the DFME are transmitted