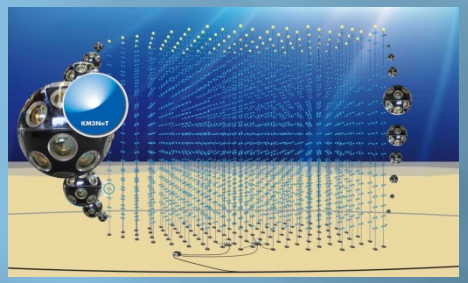
The MEUST deep sea infrastructure for the Toulon site

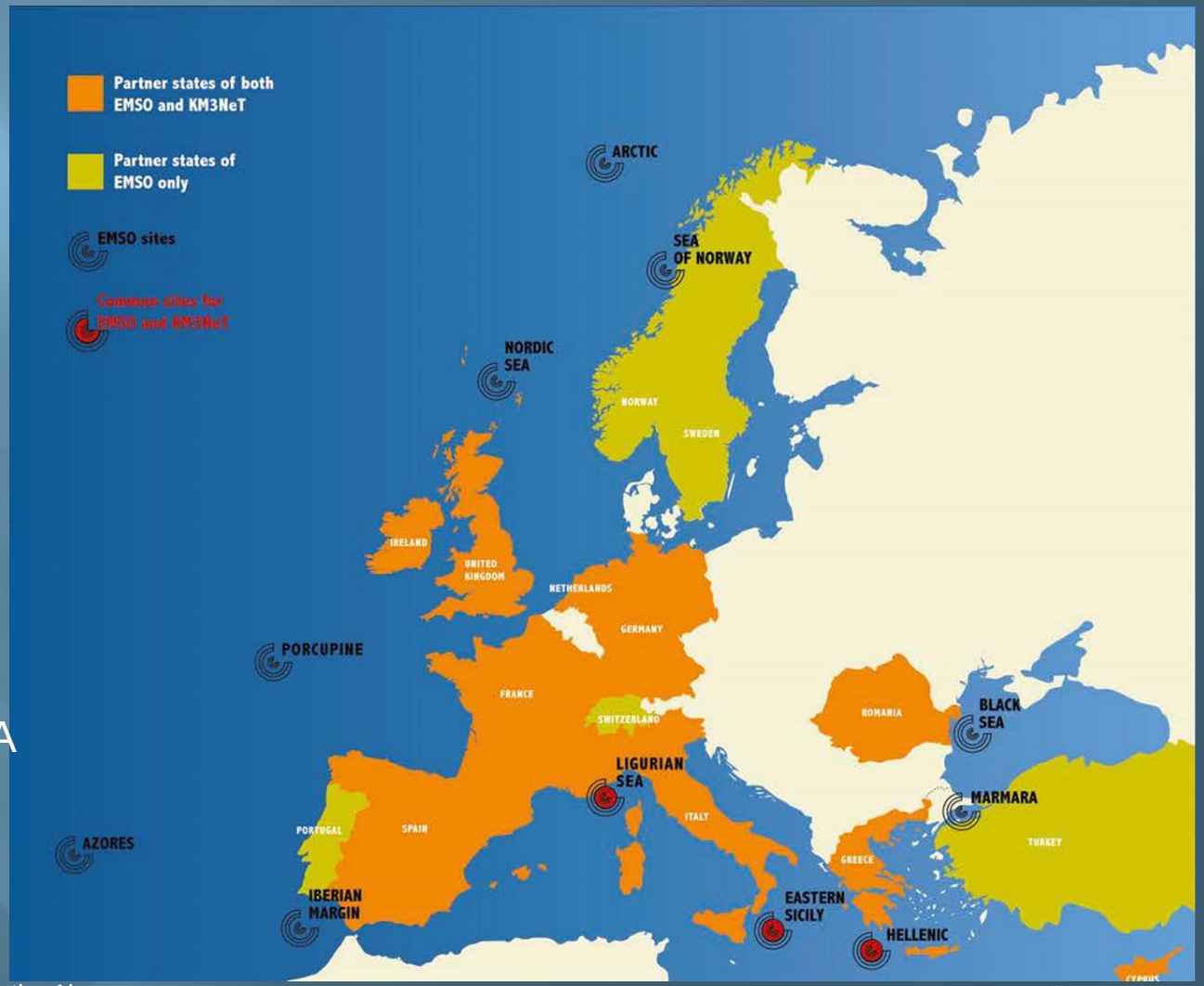
P. Lamare
on the behalf of the MEUST group

MEUST a permanent deep sea cabled observatory 40 km of Toulon for Neutrino Physics (KM3NeT) and Earth & Sea Sciences (EMSO)

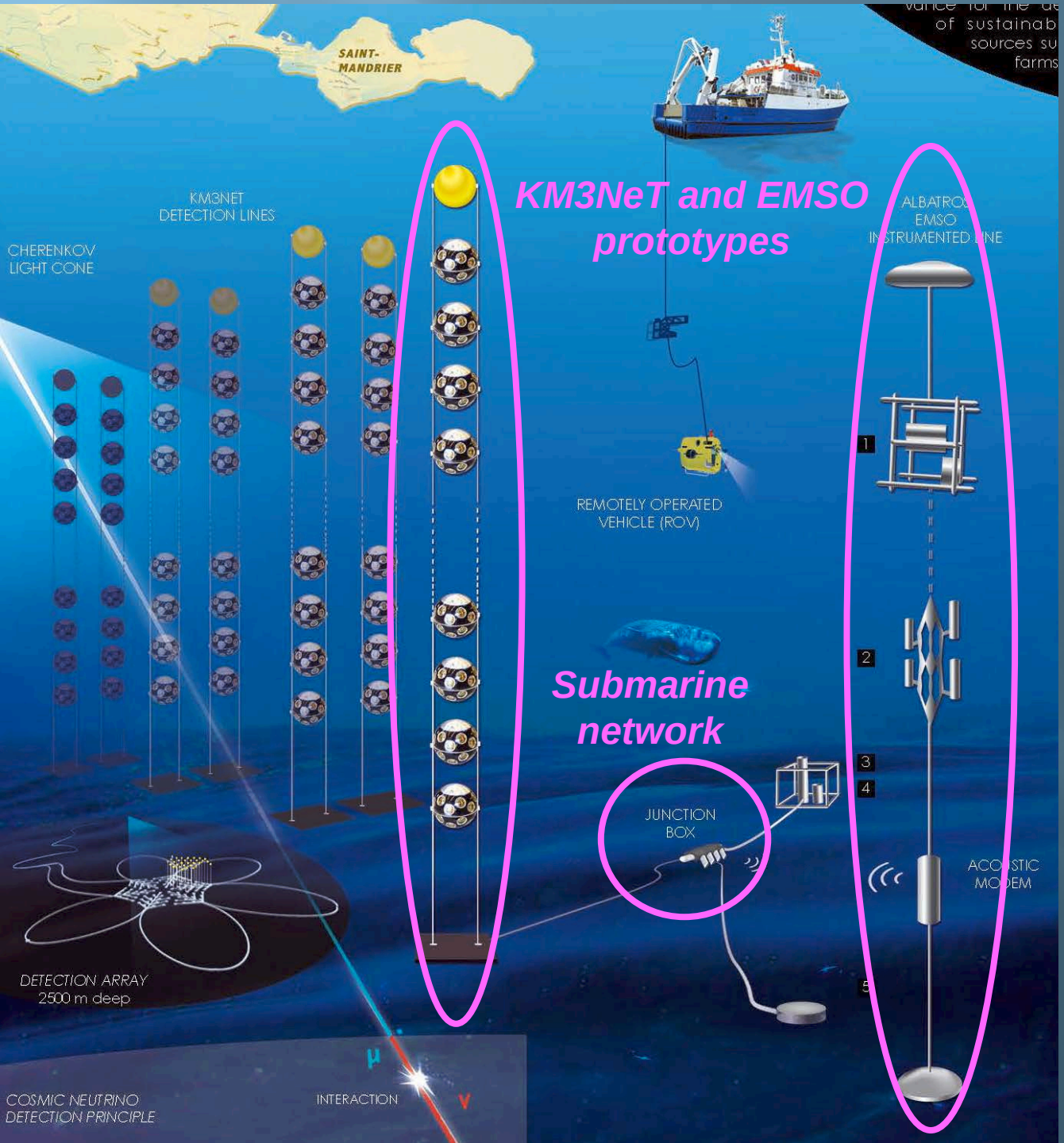
KM3NeT:



French site dedicated to neutrino physics ORCA
Italian site dedicated to neutrino astronomy ARCA



ORCA: Oscillations Research with Cosmics in the Abyss
ARCA: Astroparticle Research with Cosmics in the Abyss

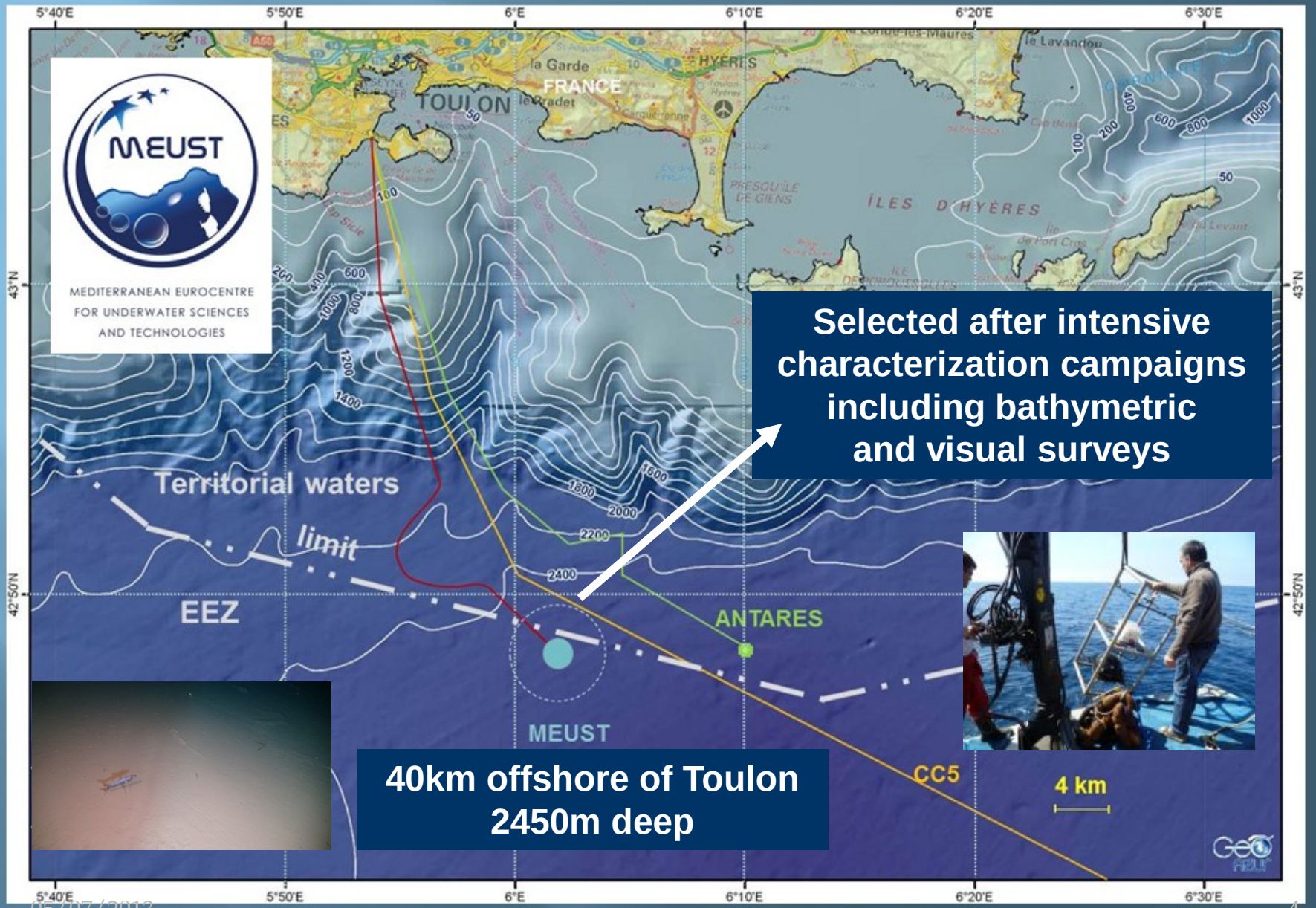


MEUST Phase – I 7M€

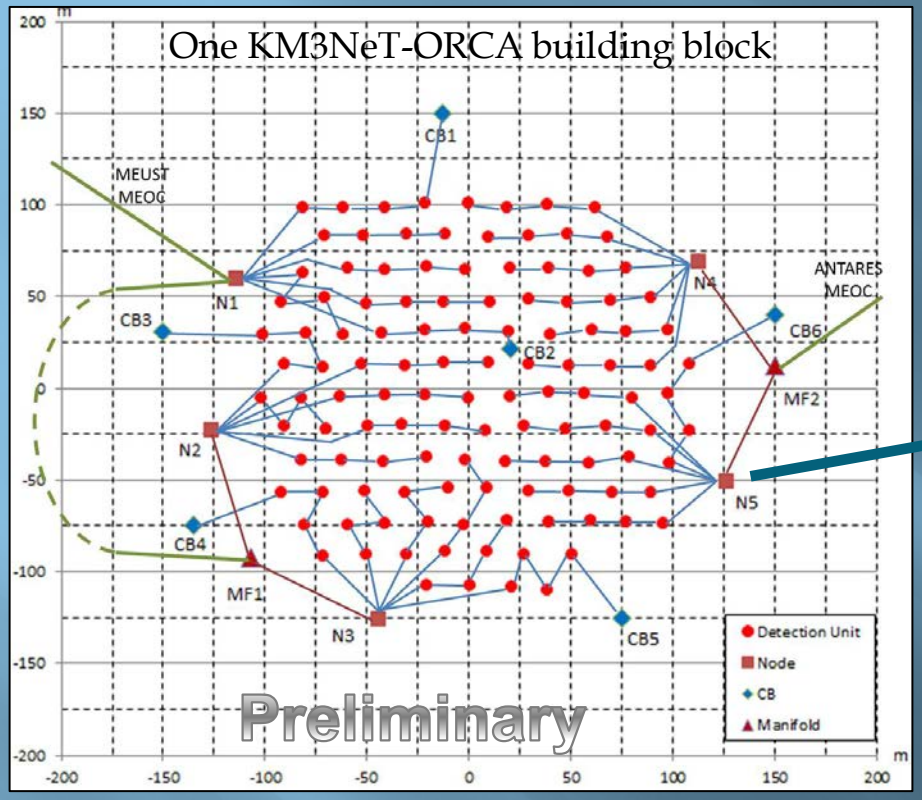
CNRS-ERDF agreement 2011-2015

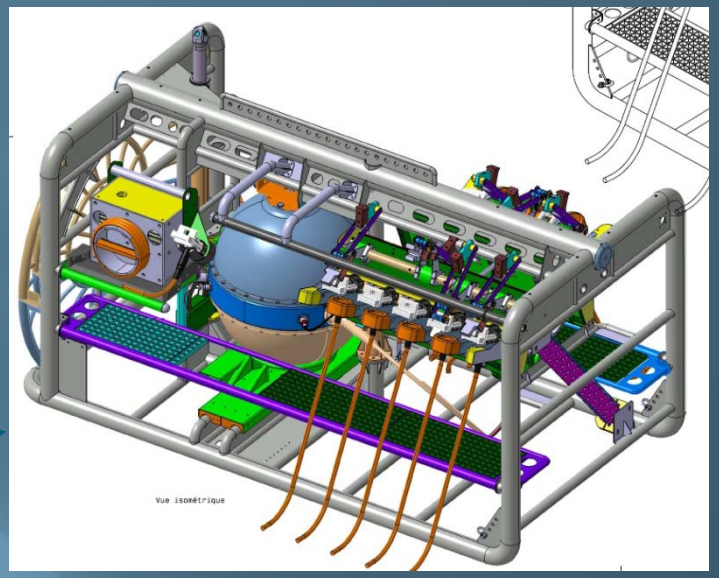
Design, prototyping and deployment of the main components of the final infrastructure

Submarine site



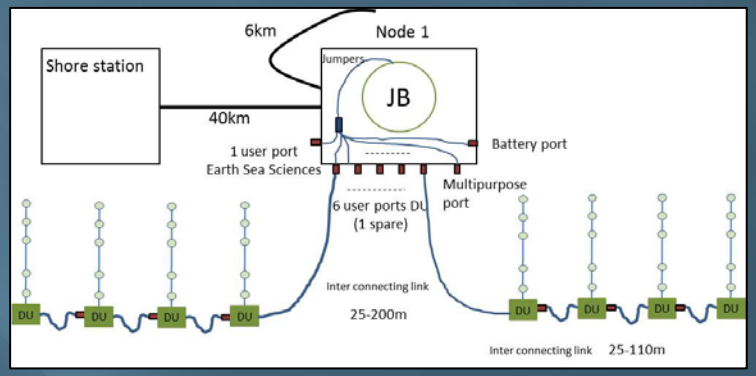
Infrastructure layout





Network nodes equipped with specific tools for connections by light ROV

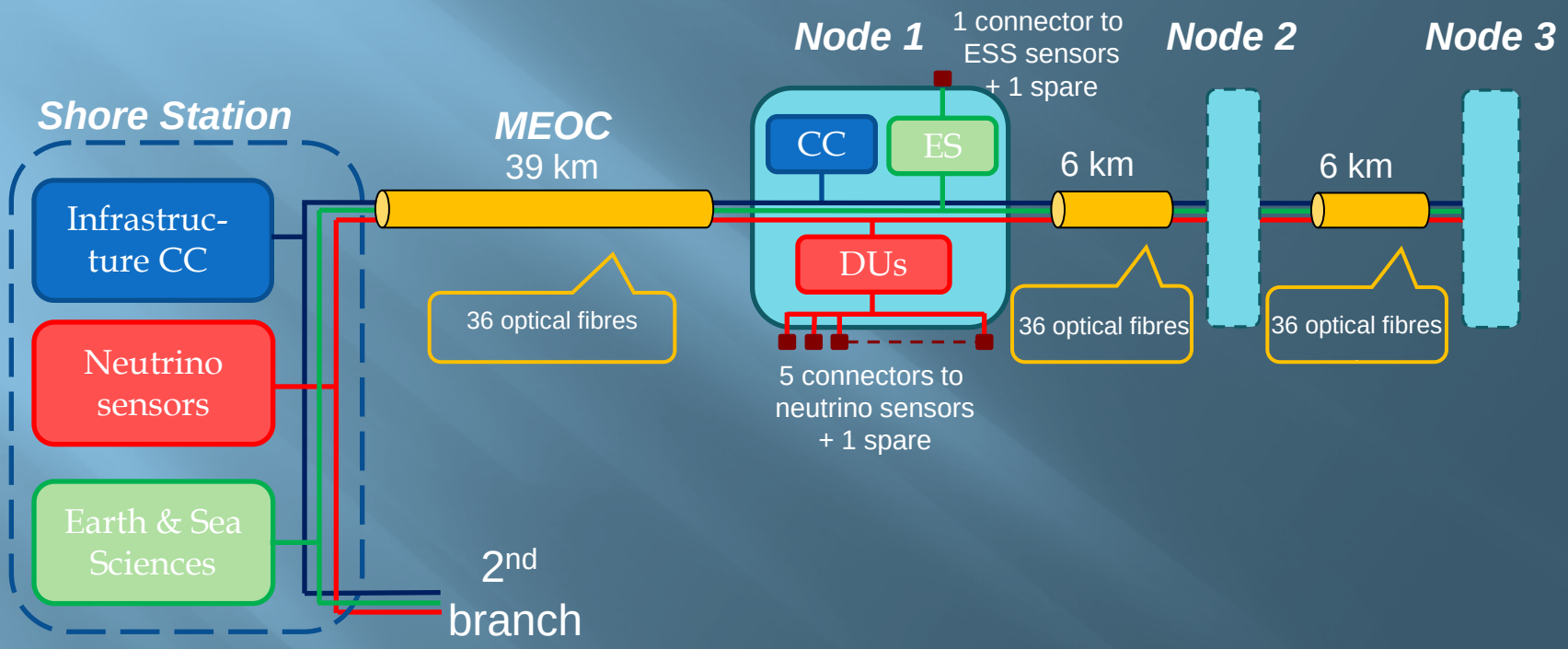
Modular, extendable, designed for up to 120 neutrino DUs, layout under optimization for ORCA



4 DUs daisy chained by 4 on one output

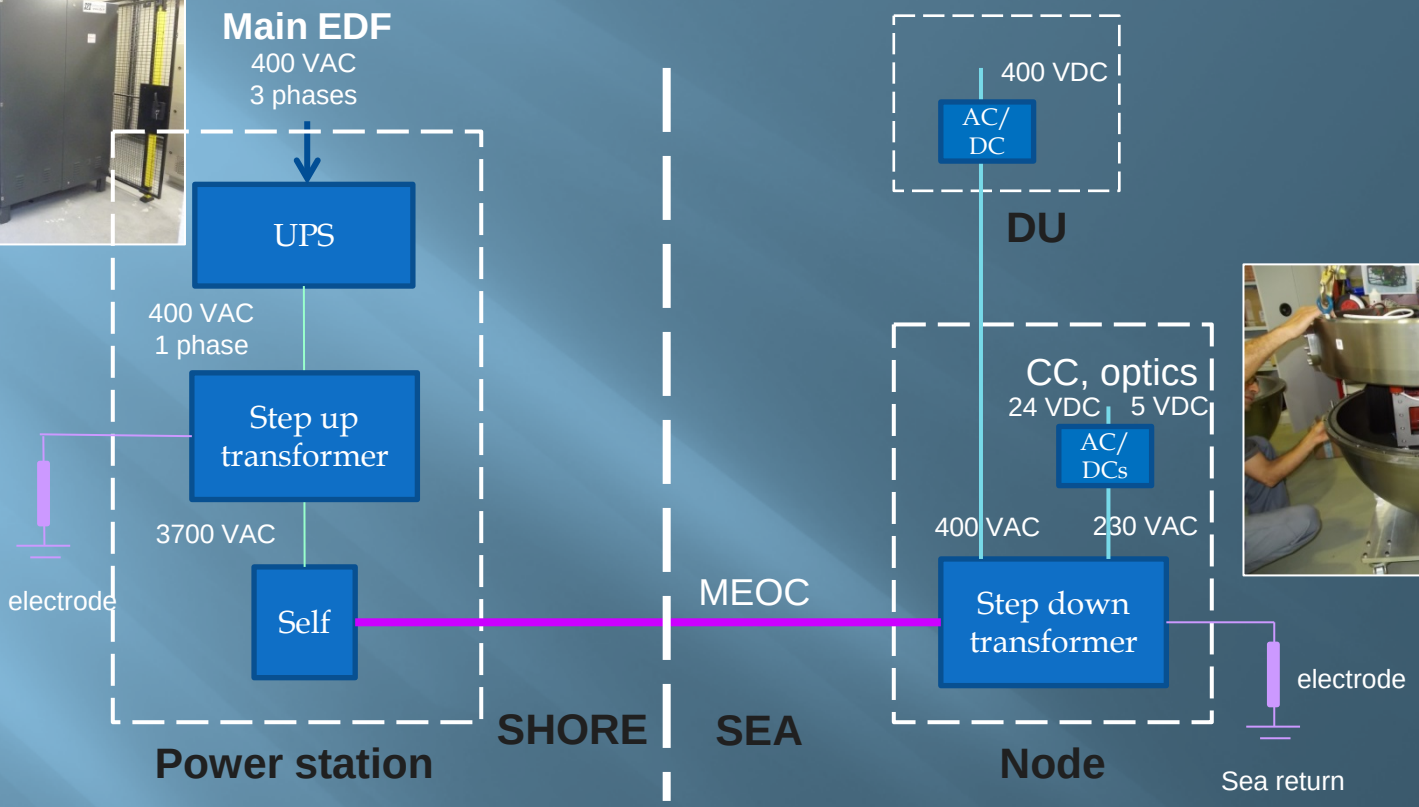
Optical network

Based on standard telecommunications techniques



3 optical networks
Control/Command infra: unidirectional
Earth & Sea Sciences: CWDM bidirectional
Neutrino sensors: DWDM 50GHz, 74 colours/fibre

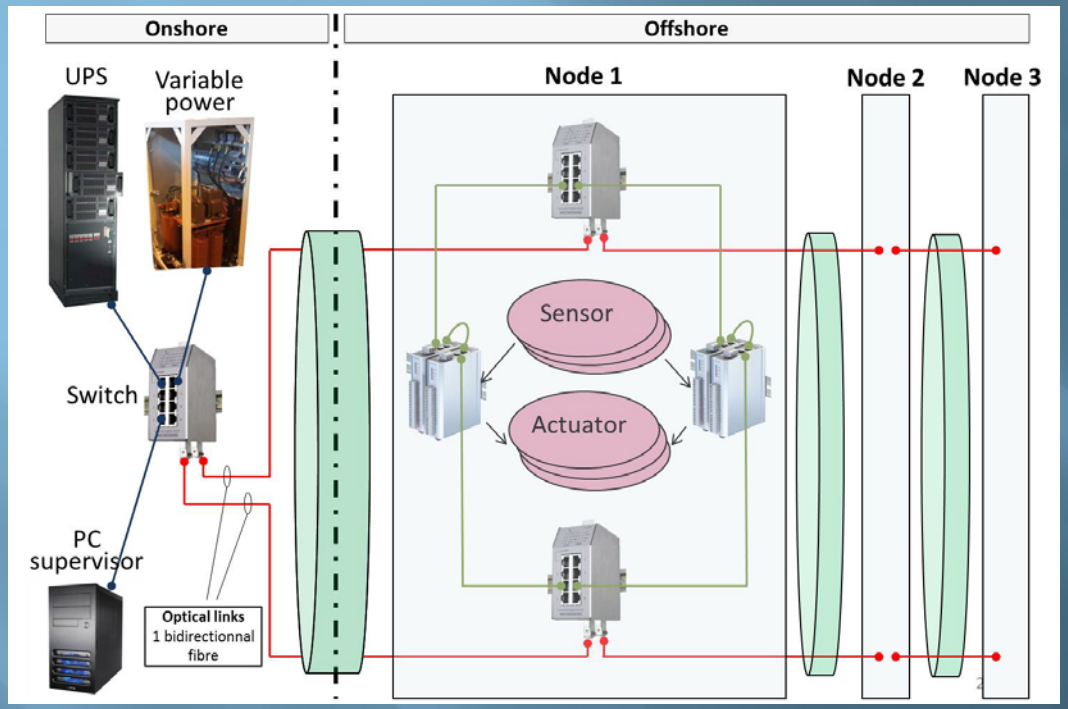
Power system

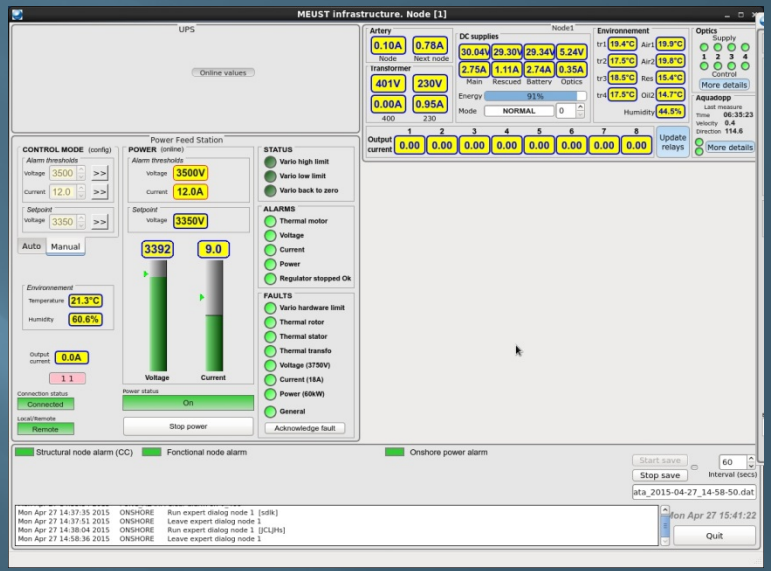


AC voltage distribution with sea return
10KVa per node
400VAC to feed DUs & ESS

Control/command

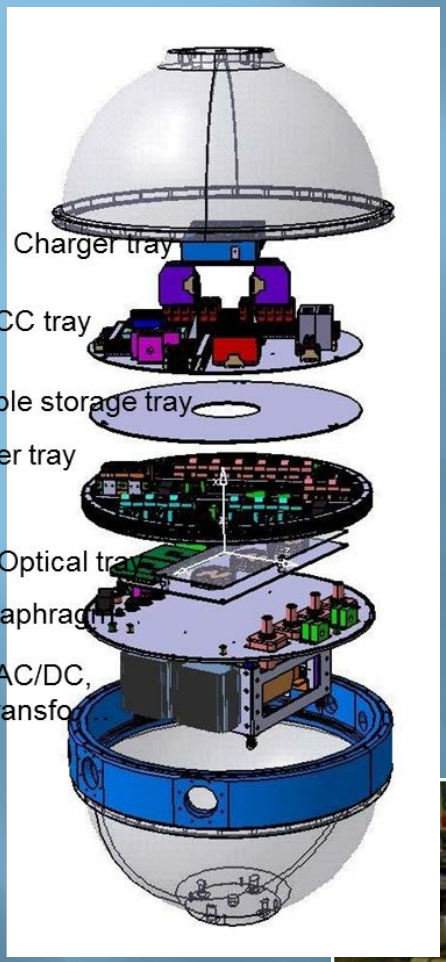
Dedicated to the infrastructure (power and optical systems)

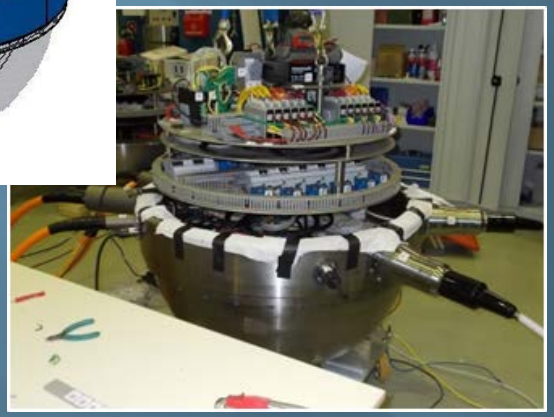




Redundant Ethernet network
Industrial components with high MTBF
Home made software

Node

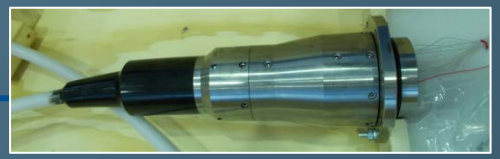




Titanium frame hosting:
Junction Box
Sea return electrode
8 wet mate user ports
Sea current meter

Main cable

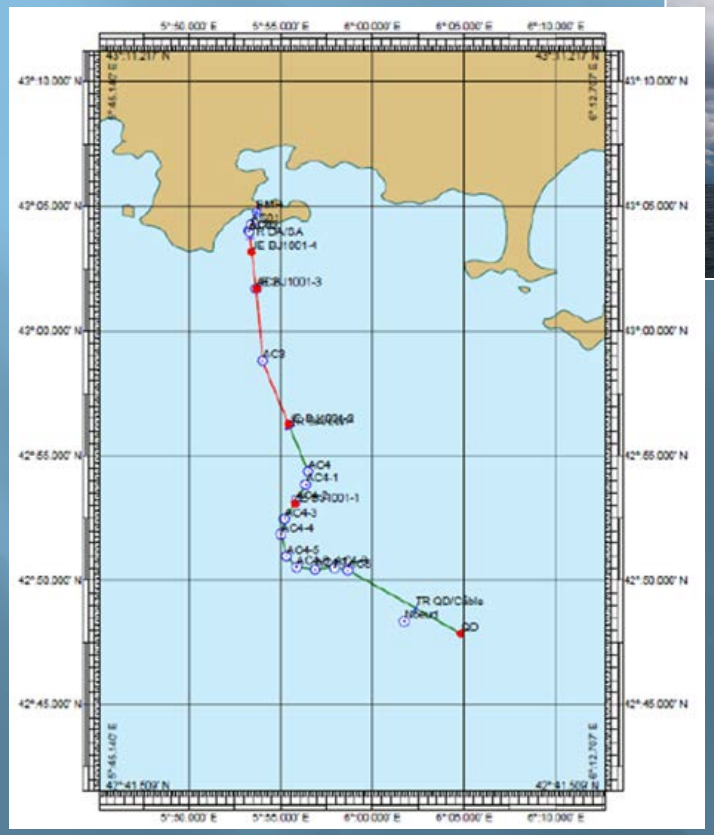
Alcatel cable OALC7 with 36 optical fibres terminated with a Seacon penetrator



DA: 1.8km

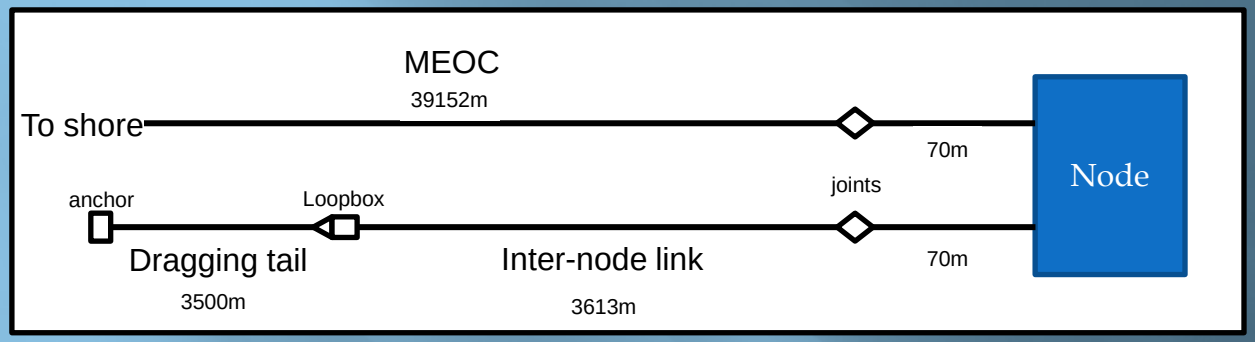
SA: 15km

LWP: 12km



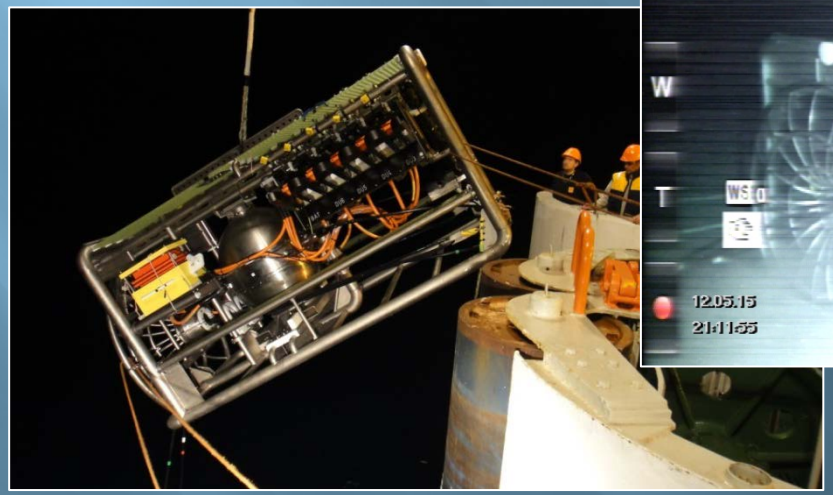
39 km long cable successfully deployed last December by Orange Marine

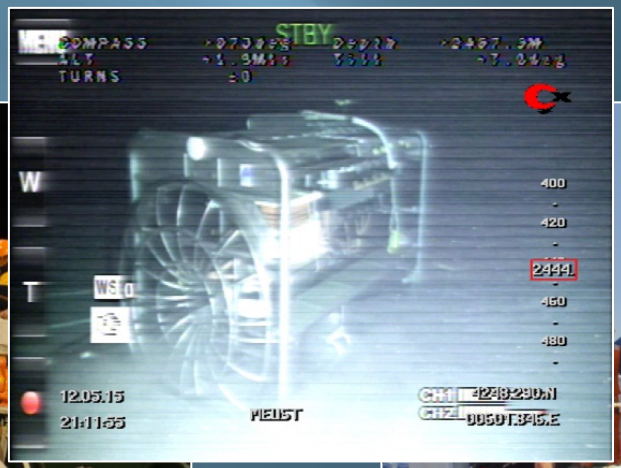
Node deployment



Configuration of the installation on the seabed

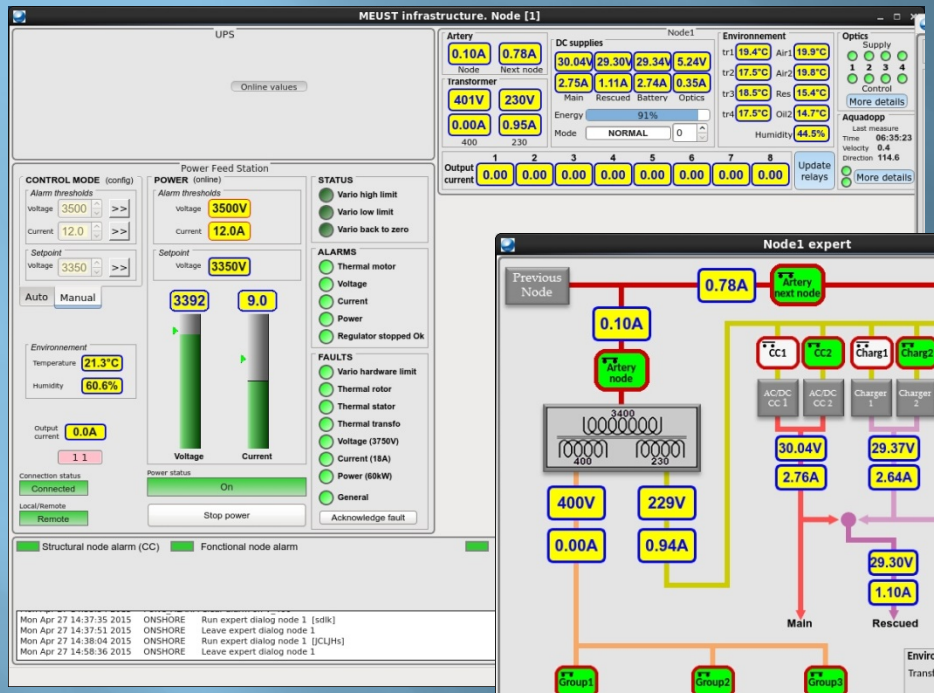
Installation by Orange marine with onboard cable jointing and deployment technique used for Branching Unit





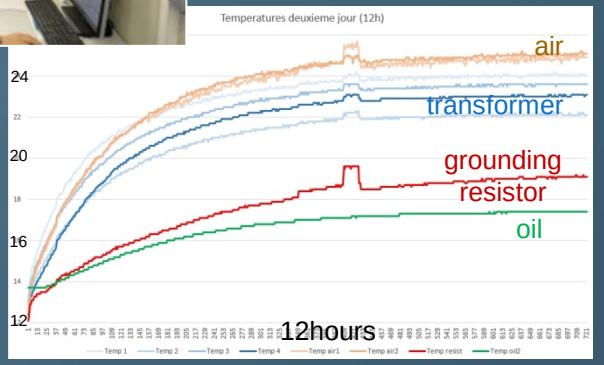
Successfully deployed on April 27th … and then recovered on June 17th for repair (cable and penetrator faults)

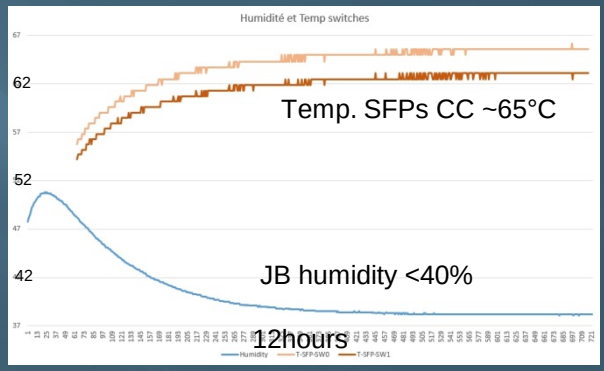
Node operation

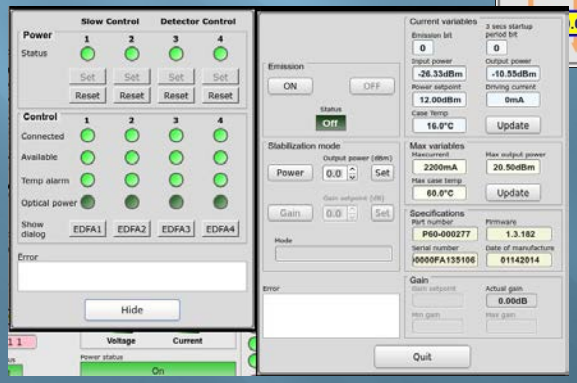


Global system

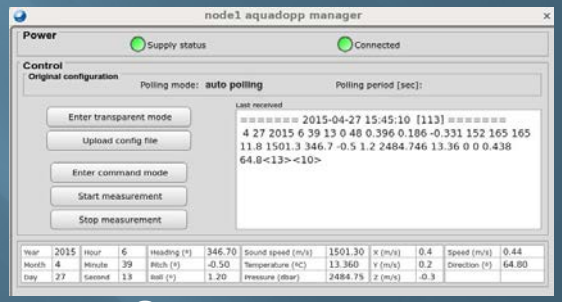
JB power







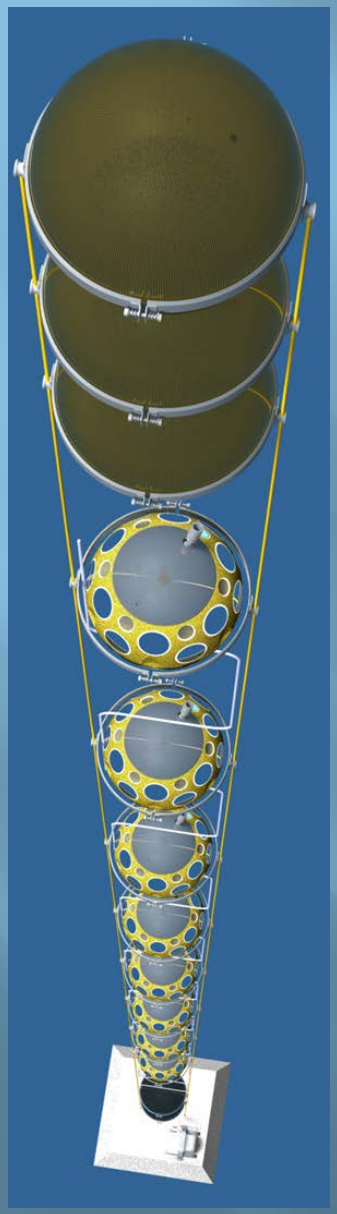
Optics (EDFAs)

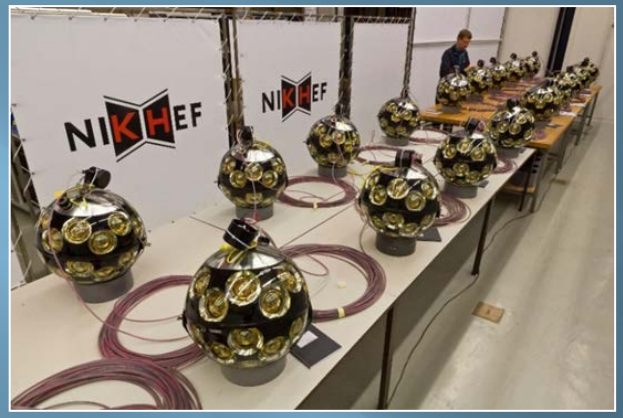


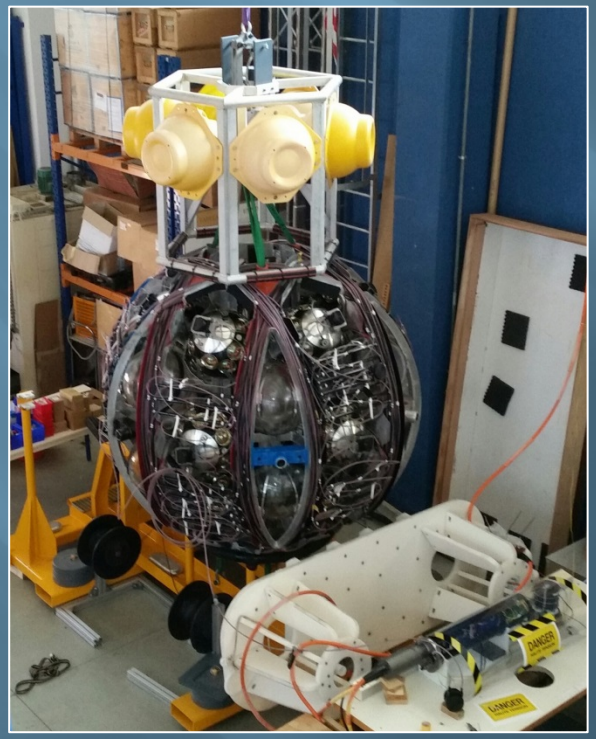
Sea current meter

Operated from shore at nominal voltage (3350V) during one month

Detection Unit





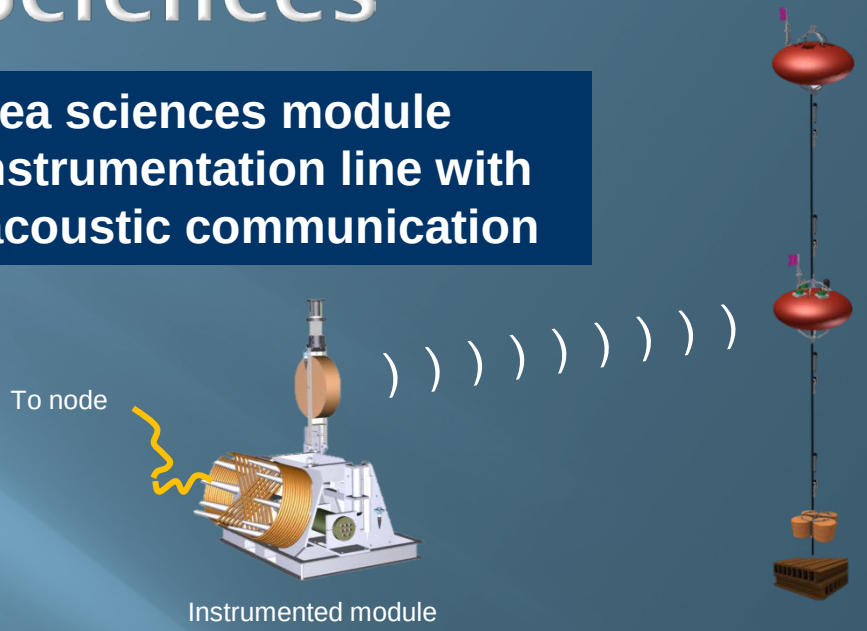


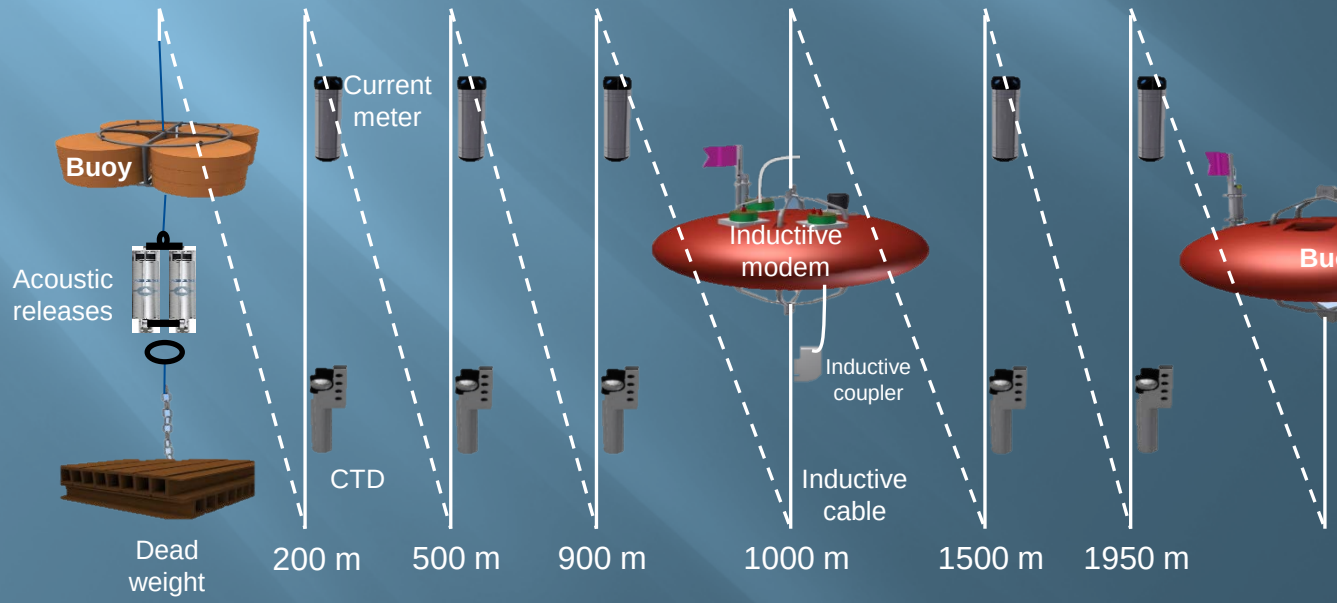
Line calibrated and assembled on the deployment tool on the anchor at CPPM

Sea Sciences

Sea sciences module MII to be connected on the node

Instrumented sea sciences module
Autonomous instrumentation line with inductive and acoustic communication





ALBATROSS line deployed in June

Status

- Infrastructure
  - Cable and node deployed and operated one month in May 2015
  - Repair operation in June for cable fault, node recovered for penetrator repair
  - New penetrators planned beginning of October
  - Node deployment expected before end of 2015
  - Autonomous beacons for the acoustic positioning system installed
  - Configuration for ORCA under study
- Neutrino line
  - 1st detection unit almost ready for deployment
  - Procedures for installation defined
- ESS
  - Instrumentation line (ALBATROSS) deployed
  - MII module ready for deployment

Feedback

- Sea operations for cable/node installation and repair successful, some improvements under study
- Operation of the infrastructure managed locally and remotely
- Control/command of the infrastructure validated, some works to do for optimization and connection to KM3NeT DB
- Power system works as expected, some minor improvements made in the power station

Next

- Completion of MEUST phase 1 before end of 2015
- Installation of 6 DUs ORCA-style in 2016-2017 (KM3NeT commitments)
- Funding requests in progress in France and KM3NeT to extend the infrastructure (2016-2020)
- New CNRS building with control room and assembly hall in La Seyne sur Mer (2017-2018)