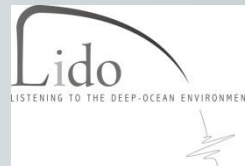


Acoustics at LIDO D.M. East-Sicily stations



Salvatore Viola
INFN-LNS

LIDO Demo Mission Meeting, January 13-14, Catania (Italy)



Acoustics at LIDO East-Sicily Site

LNS-INFN Catania



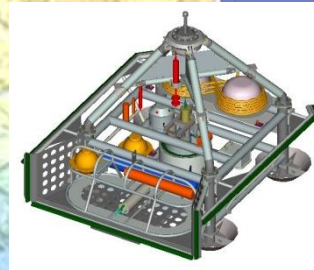
Internet Radio Link



LNS Test Site Laboratory at the port of Catania

Installation at 2000 m depth

Test Site North



5 km

5 km

20 km



NEMO JB

Test Site South

LIDO TS South



Acoustics at LIDO East-Sicily TSN

4 hydrophones (10 Hz-70 kHz bandwidth) **synchronized**.

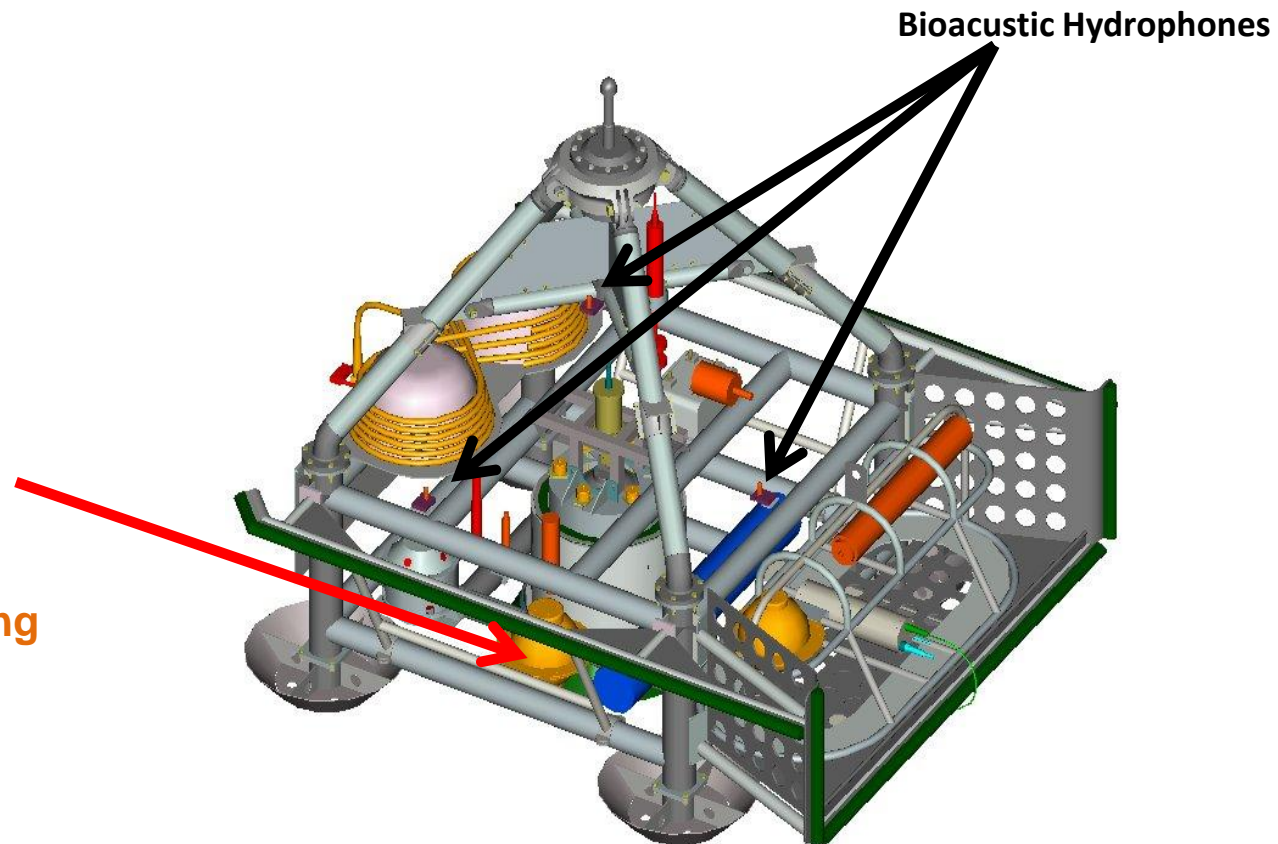
Acoustic signal digitization (24bit@96 kHz, 120 dB effective dynamic range) at **2000m depth**.

Data transmission on optical fibers **over 28 km**.

On-line monitoring and data recording on shore.



**13" INFN Glass Housing
for DAQ and DAT**



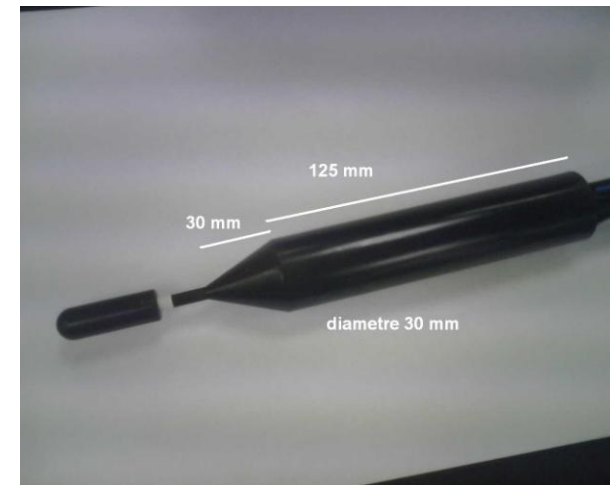
Bioacoustic Hydrophones

Acoustics at LIDO East-Sicily: hydrophones

NEMO Collaboration and an Italian company (SMID) have developed low cost hydrophones for 4000 m depth, with no change of sensitivity as a function of depth.

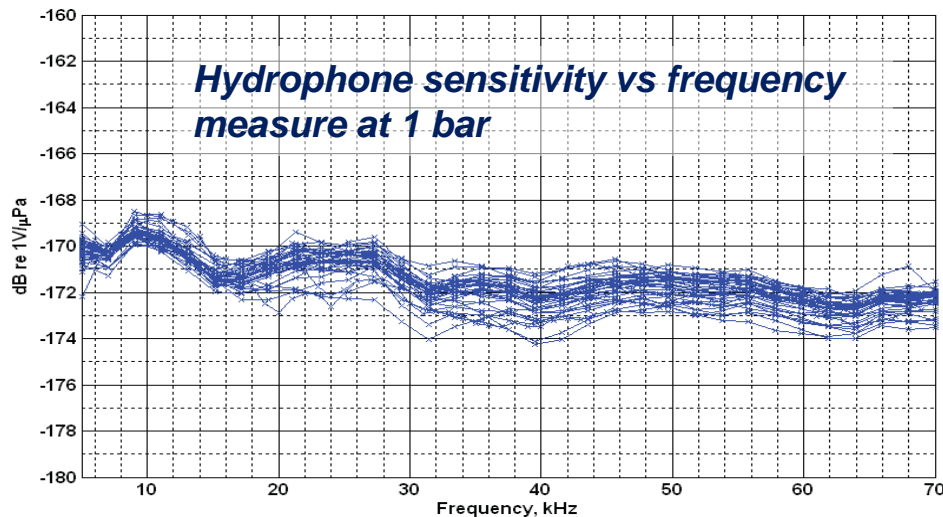
NATO has developed for/with NEMO a standard procedure for calibration under pressure.

Moulded and cabled by Seacon



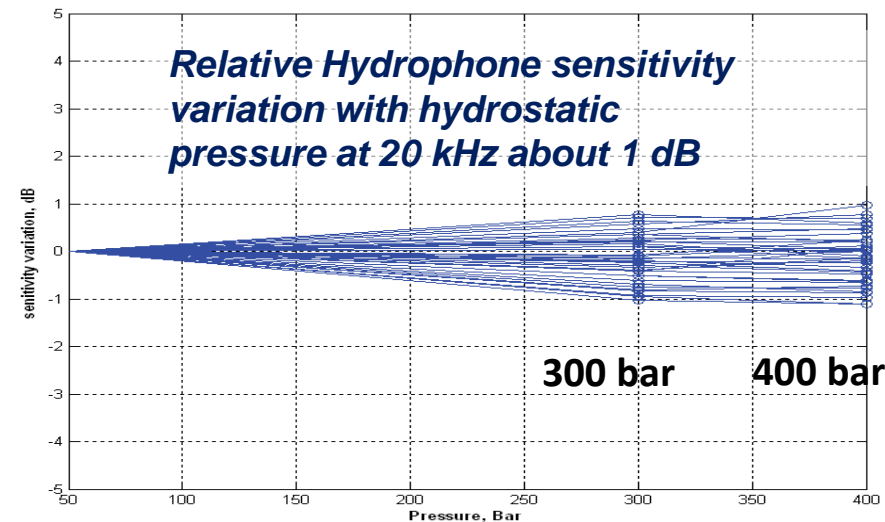
All hydrophones have been tested and calibrated at the NATO Undersea Research Center (NURC) in La Spezia

Hydrophone sensitivity vs frequency measure at 1 bar



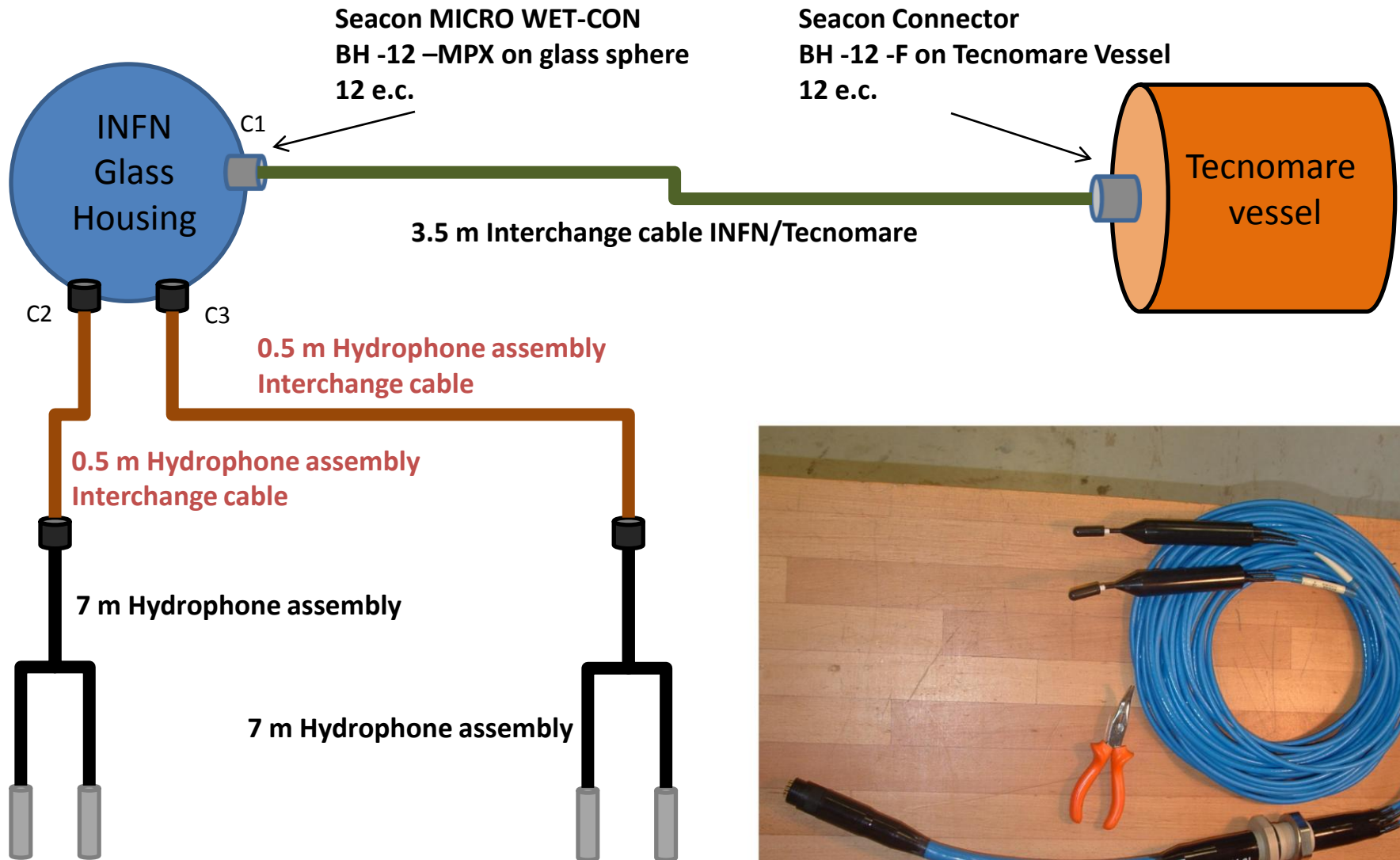
Sensitivity: -171 ± 3 dB re 1 V/ μ Pa

Relative Hydrophone sensitivity variation with hydrostatic pressure at 20 kHz about 1 dB



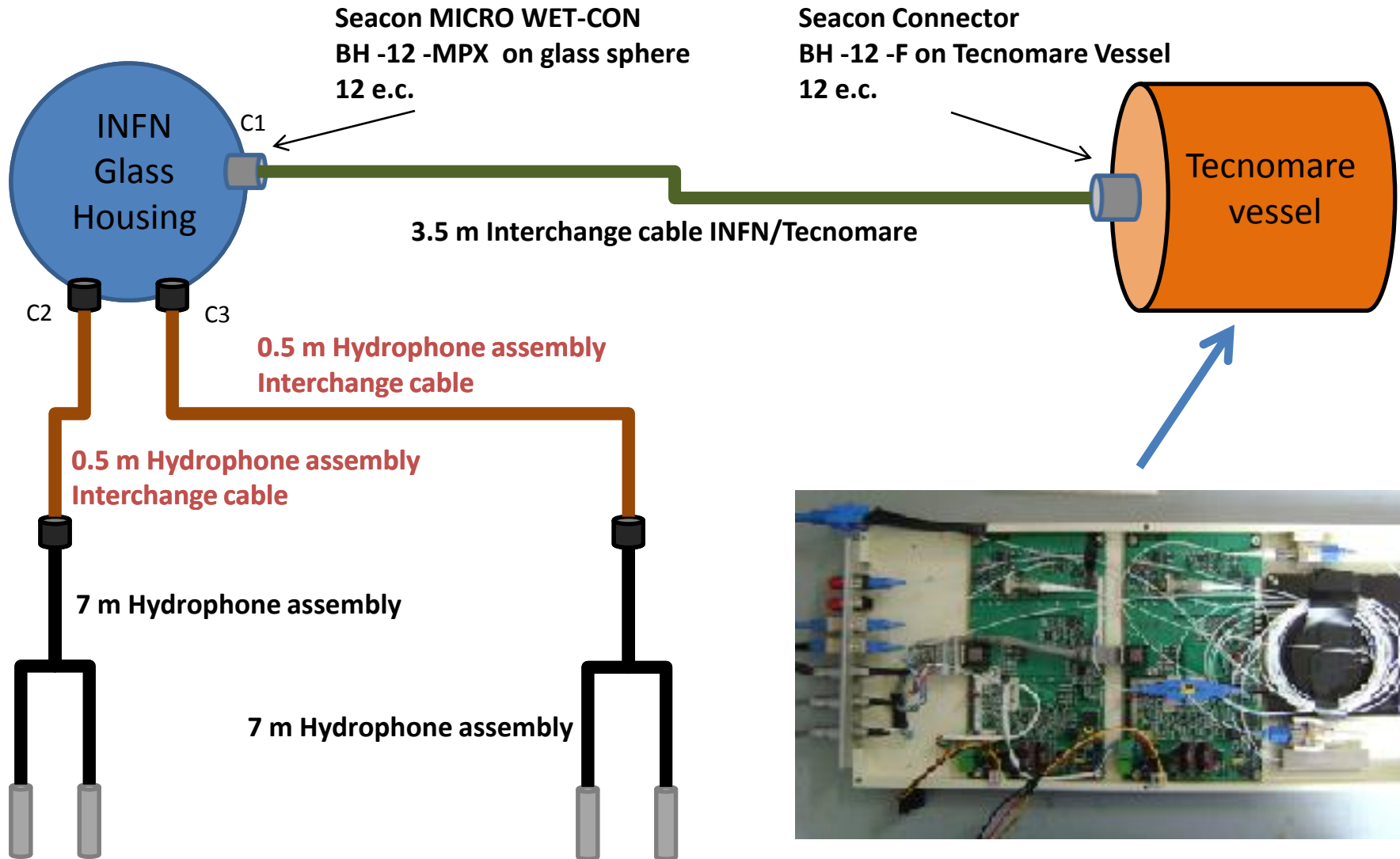
Measured variation $\leq \pm 1$ dB

Acoustics at LIDO East-Sicily TSN: connection scheme



Hydrophone assembly realised by SEACON on INFN request

Acoustics at LIDO East-Sicily TSN: connection scheme

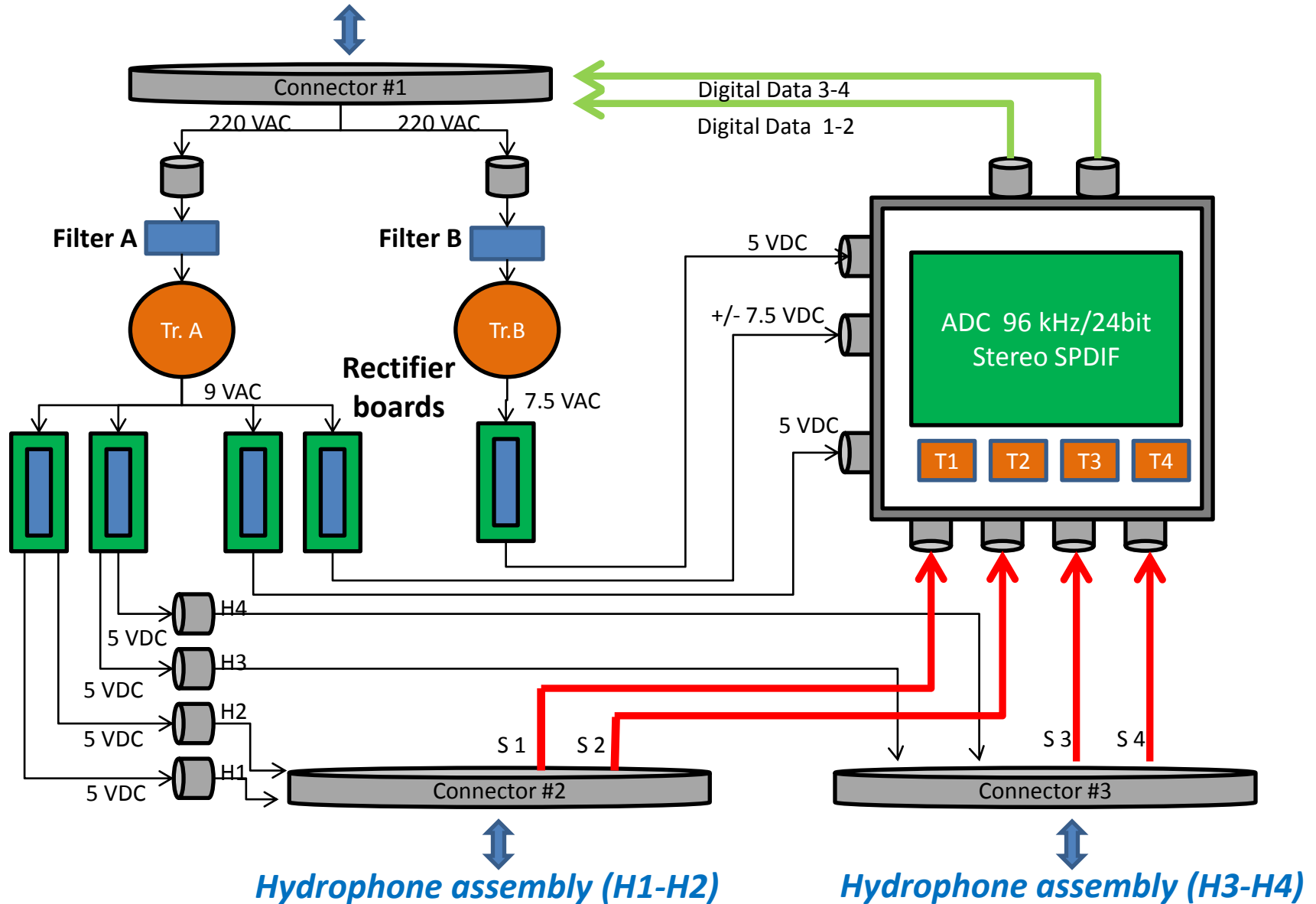


Optical box for LIDO



Acoustics at LIDO East-Sicily TSN: electronics layout

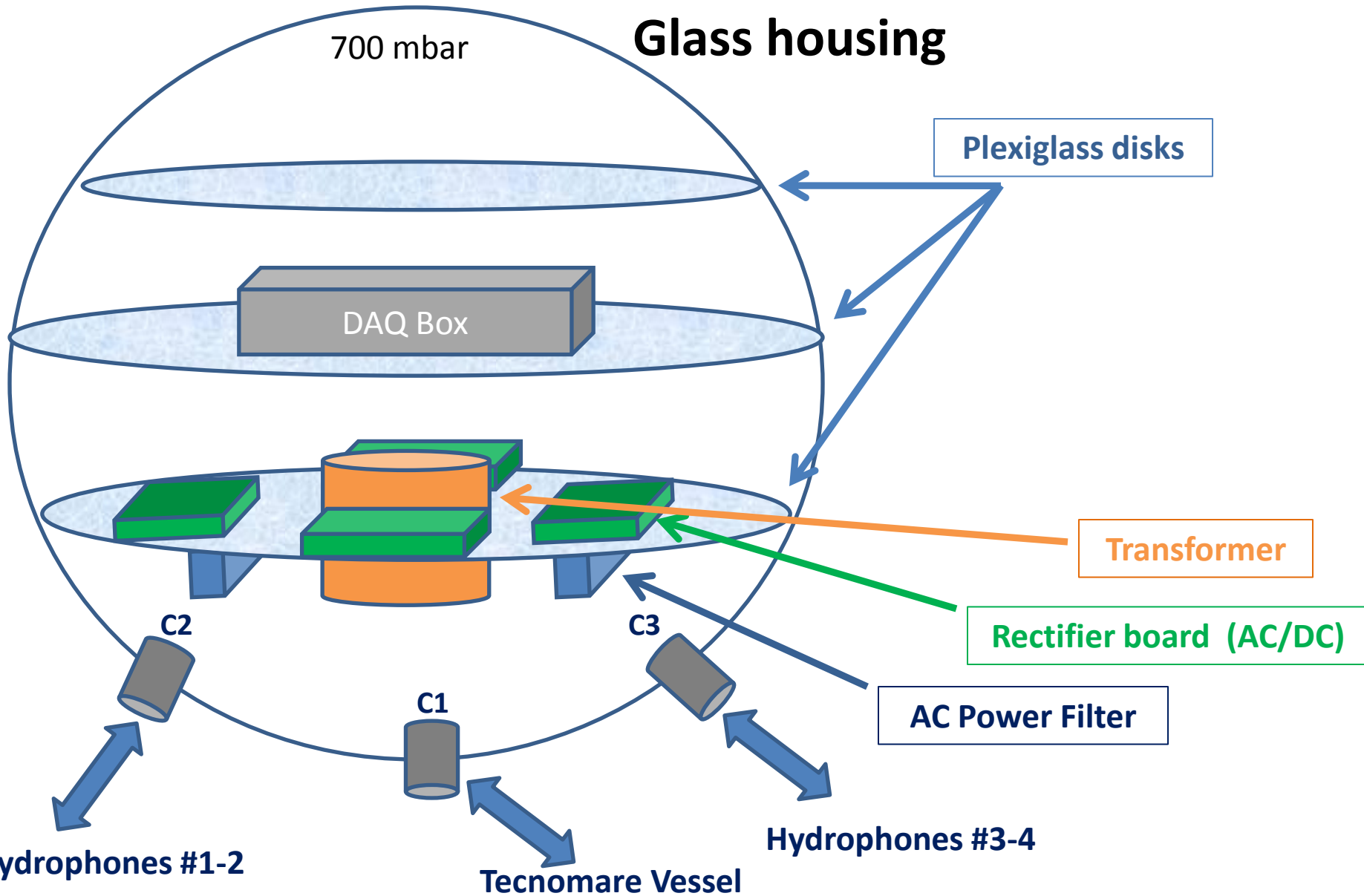
Interchange cable INFN/TECNOMARE Vessel



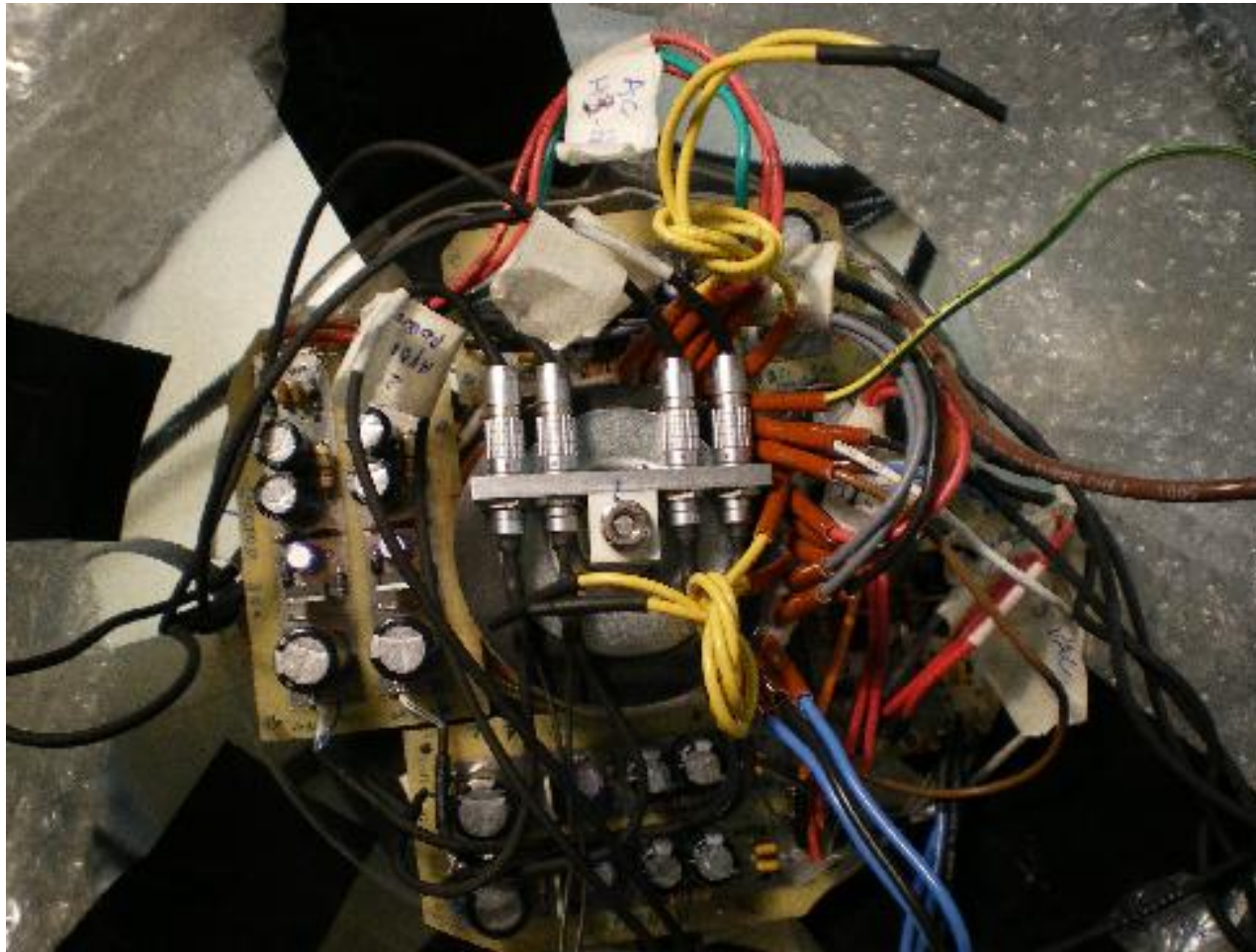
Hydrophone assembly (H1-H2)

Hydrophone assembly (H3-H4)

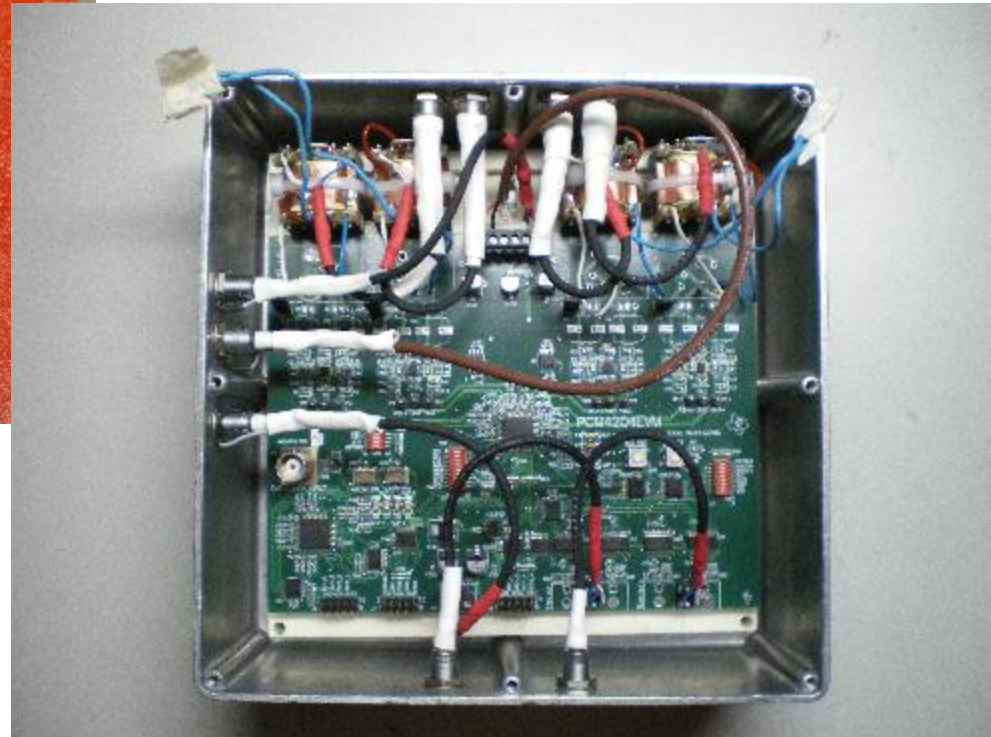
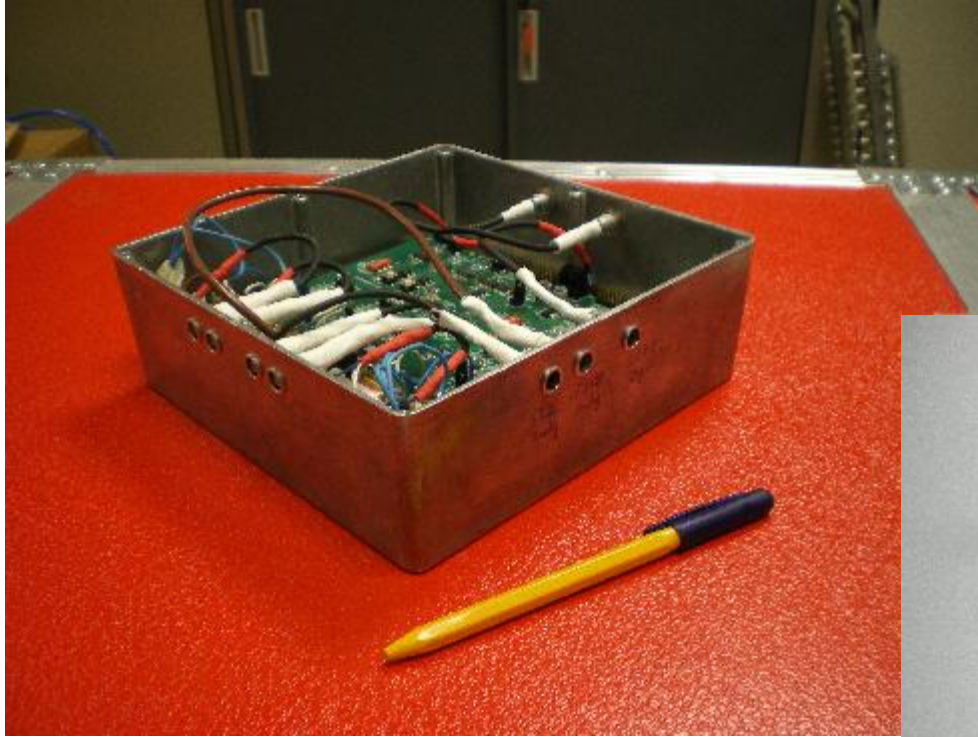
Acoustics at LIDO East-Sicily TSN: the glass housing



Power distribution system

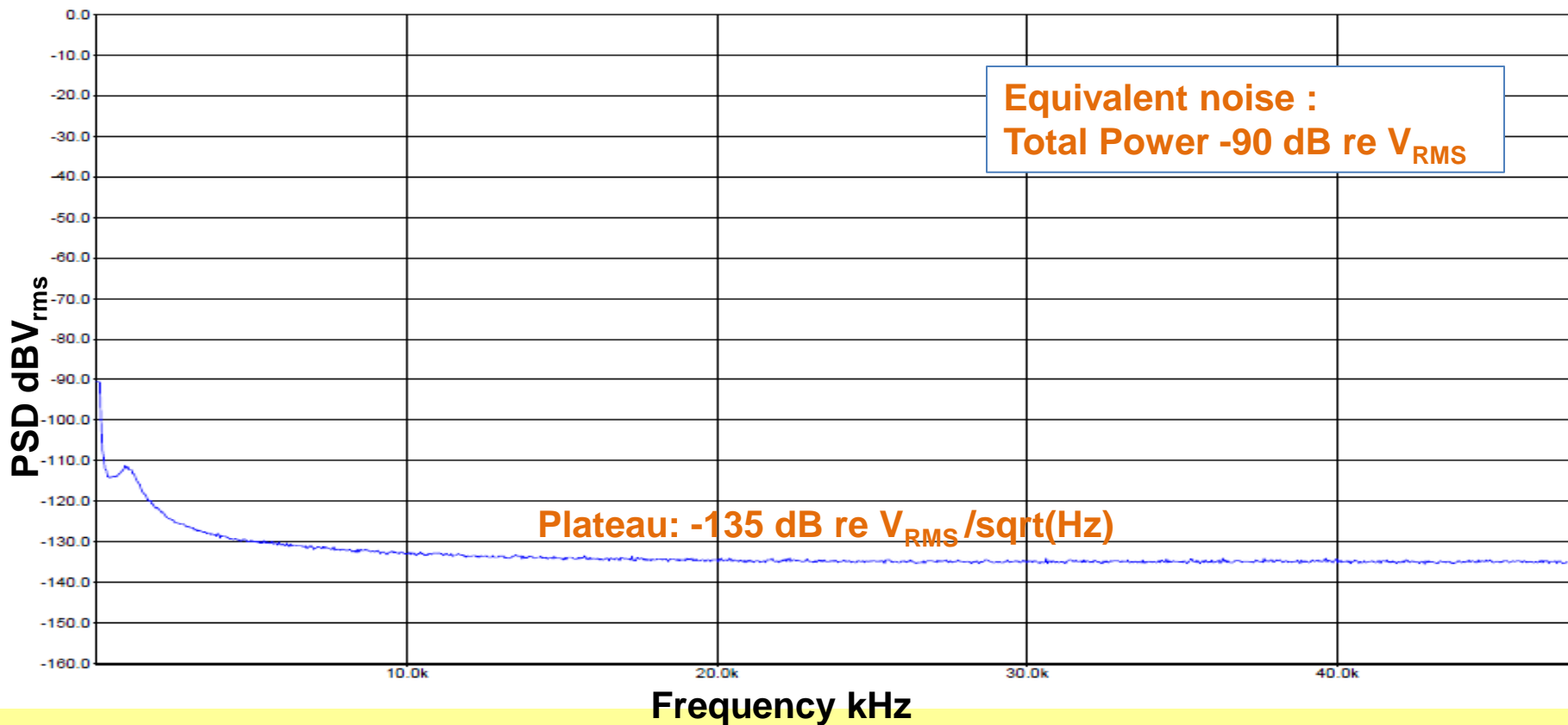


DAQ box



Acoustics at LIDO East-Sicily TSN: test and calibration

Measured:
Equivalent noise of the whole system
Front-end electronics calibration



Acoustics at LIDO East-Sicily TSS

JUNCTION BOX:

Two output e.o. ROV mateable connectors available

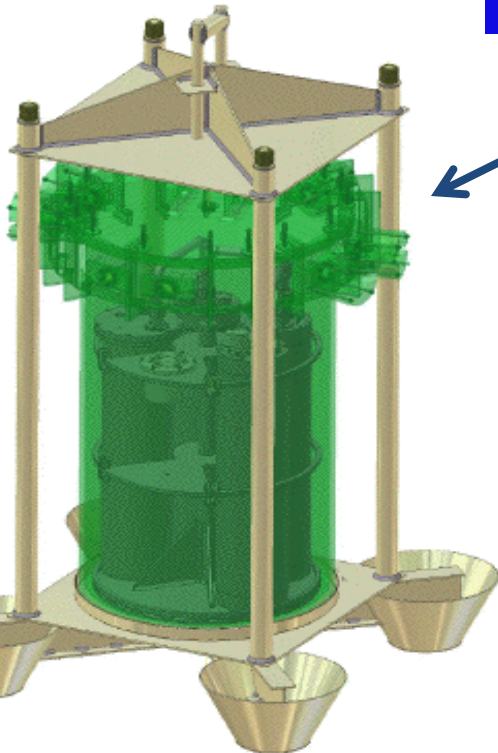
Power load per output connector:

1.5 kVA - 380 VAC (3-phase)

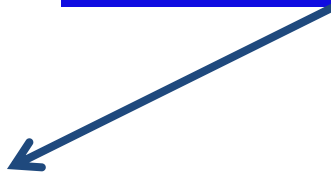
Optical fibre link:

DWDM (optional CWDM)

Junction Box

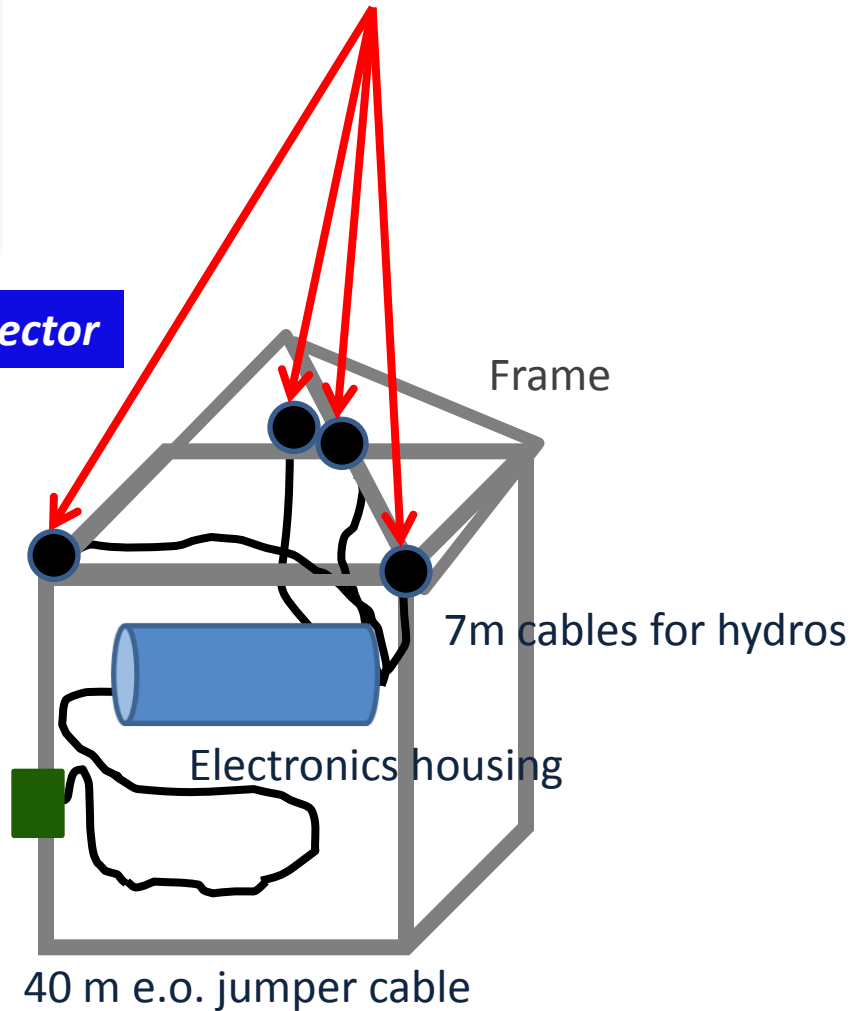


electro-optical connector



ROV mateable
ODI connector

Hydrophones



Acoustics at LIDO East-Sicily TSS

JUNCTION BOX:

Two output e.o. ROV mateable connectors available

Power load per output connector:

1.5 kVA - 380 VAC (3-phase)

Optical fibre link:

DWDM (optional CWDM)

Junction Box

electro-optical connector

ROV mateable
ODI connector

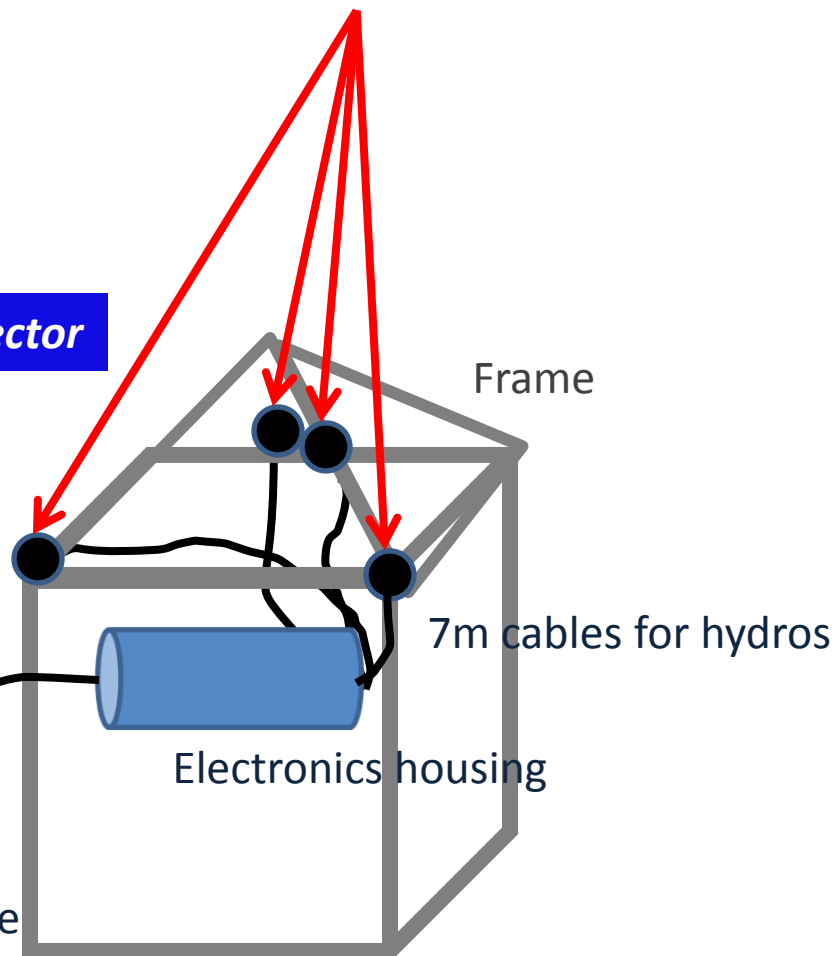
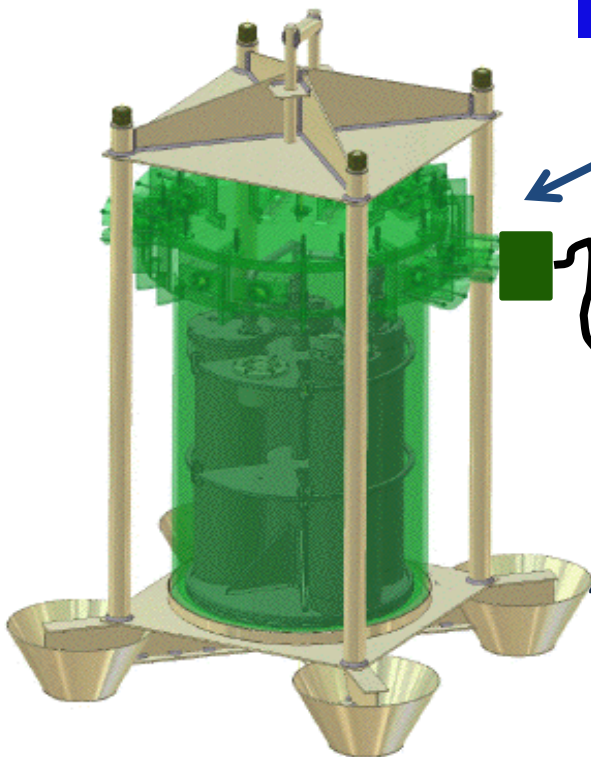
40 m e.o. jumper cable

Hydrophones

Frame

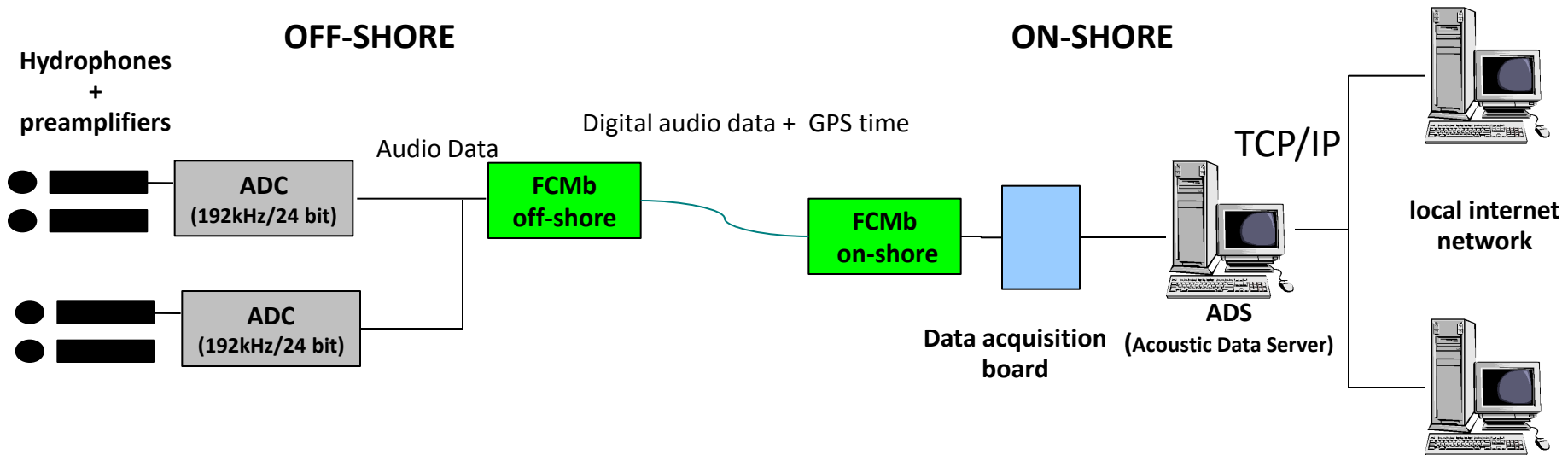
7m cables for hydros

Electronics housing

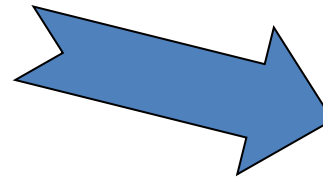


Acoustics at LIDO East-Sicily TSS

The LIDO East Sicily TSS acoustic system is based on the acoustic positioning system developed by INFN for the NEMO Project.



The acoustic signals are sampled by ADCs and "labeled" with GPS time by FCMb off shore



Acoustic array synchronous and phased with absolute GPS time

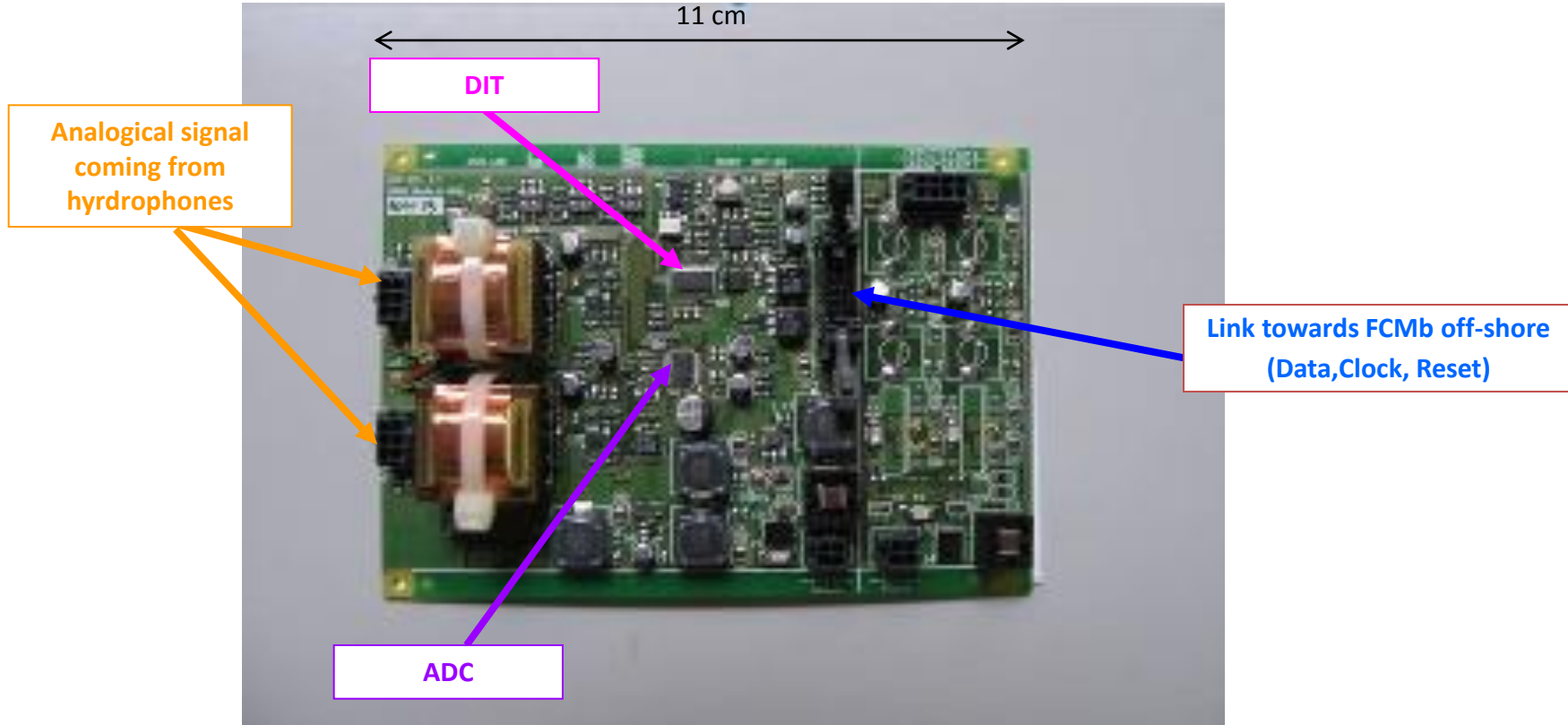
Data stream 32 bits @ 192 kHz → 6.2 Mbps (1 hydrophone)

Acoustics at LIDO East- Sicily TSS: AcouBoard

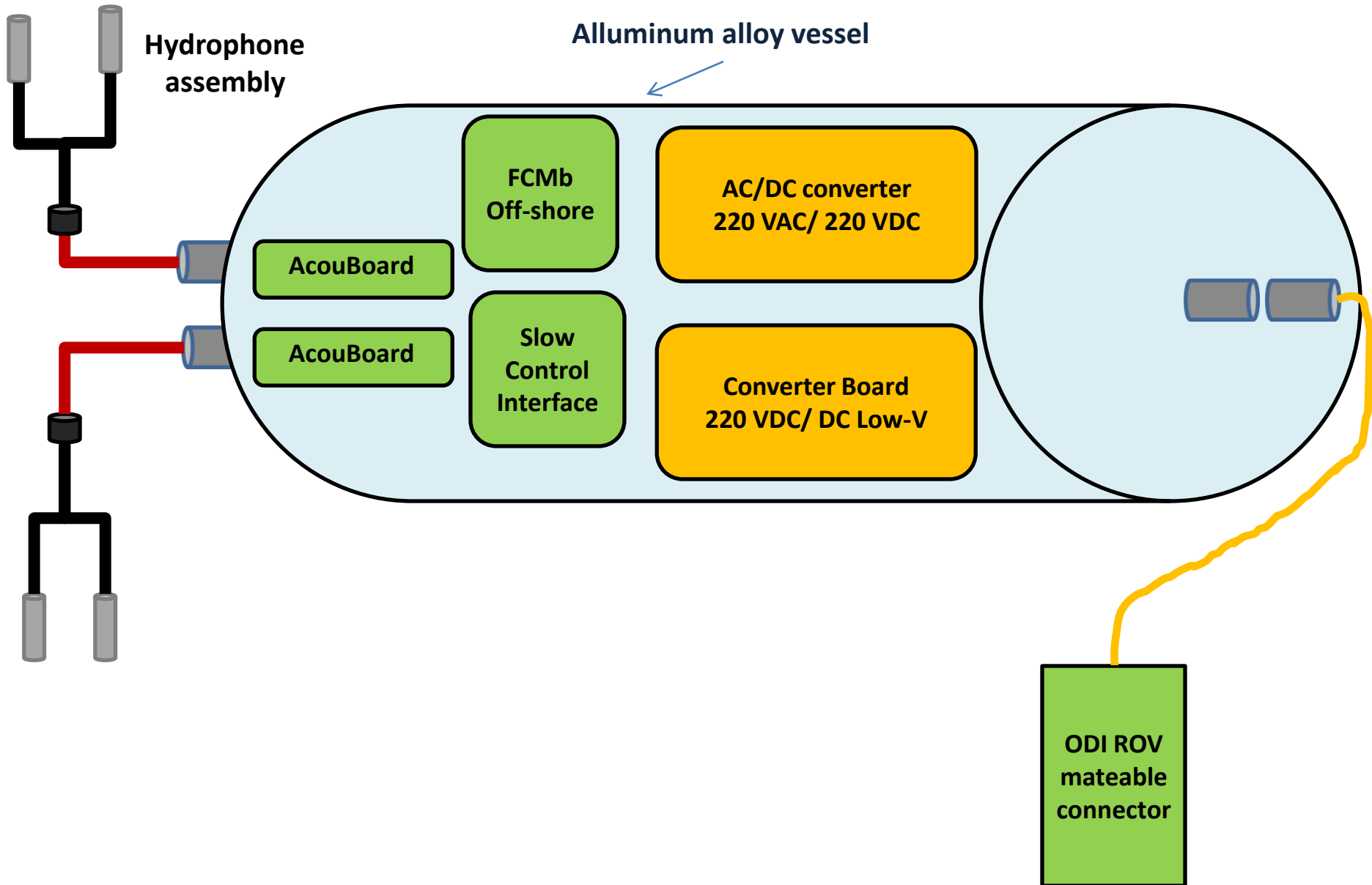
The AcouBoard has been designed and realised by NEMO in collaboration with AGE Scientific (Lucca, Italy), by using professional audio technology components:

- ADC Stereo Crystal CS-5381 (24 bit/192kHz, Max input $2 V_{RMS}$)
- DIT Crystal CS-8406 (standard EBU/AES-3 stereo)

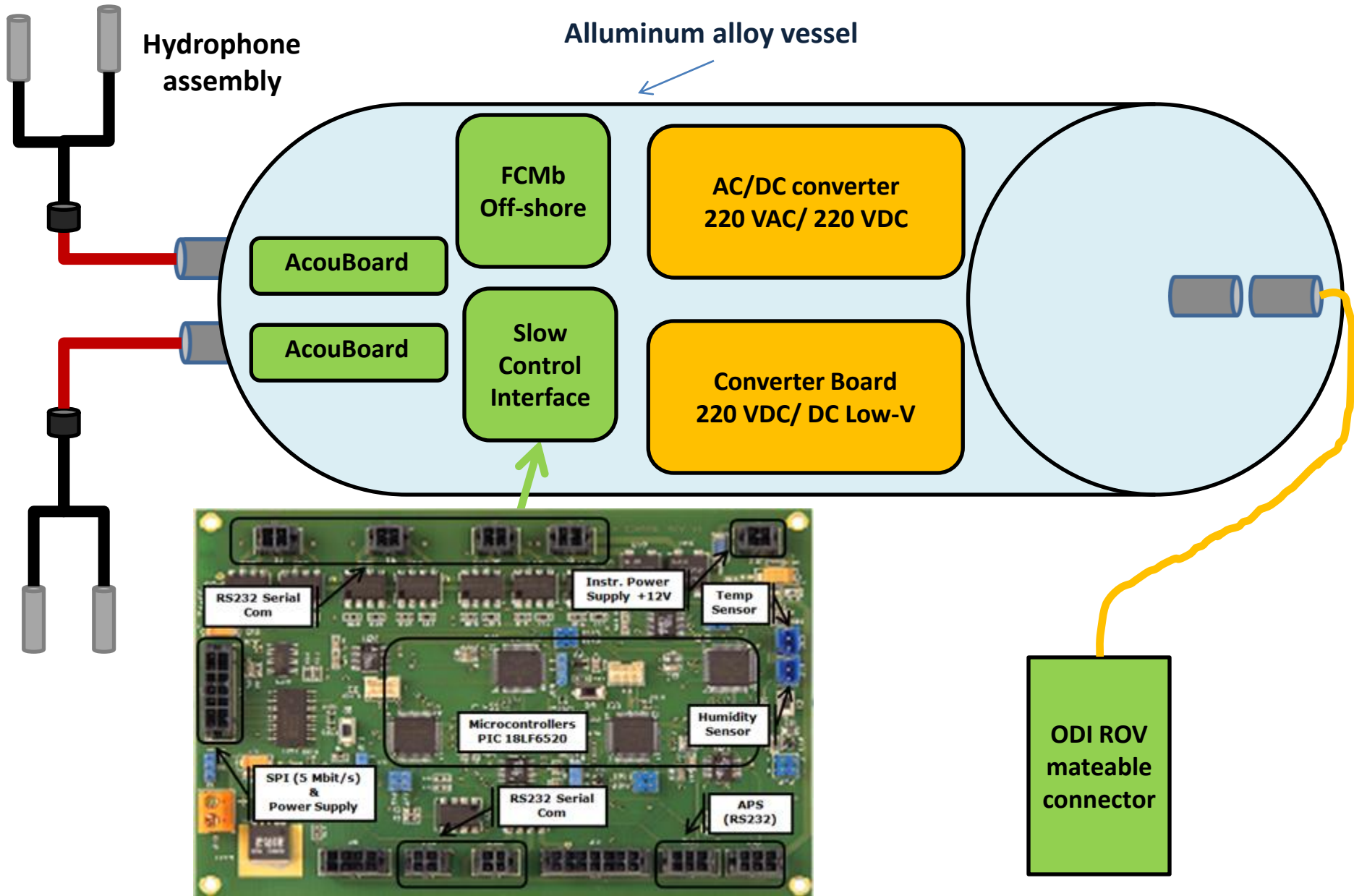
ADC and DIT are driven by a clock signal (24.576 MHz) , given by FCMb off-shore.



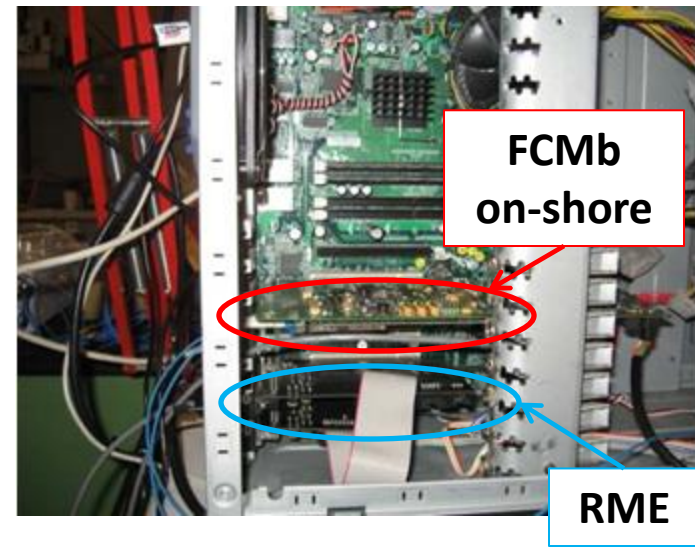
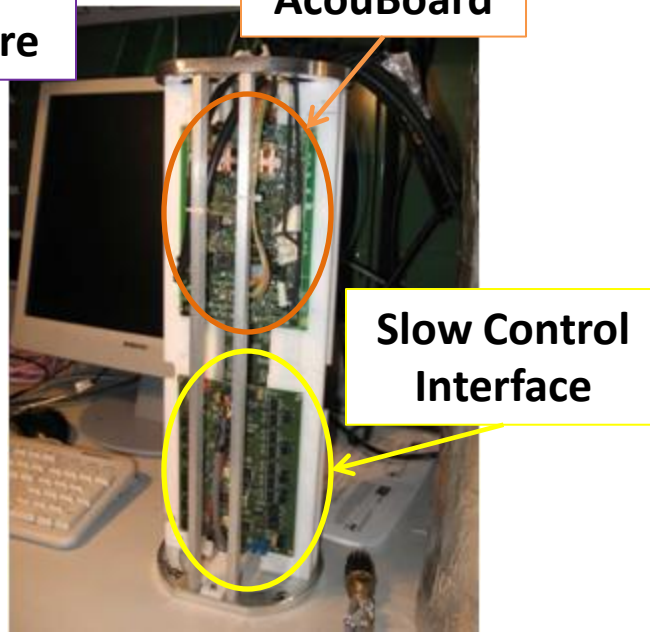
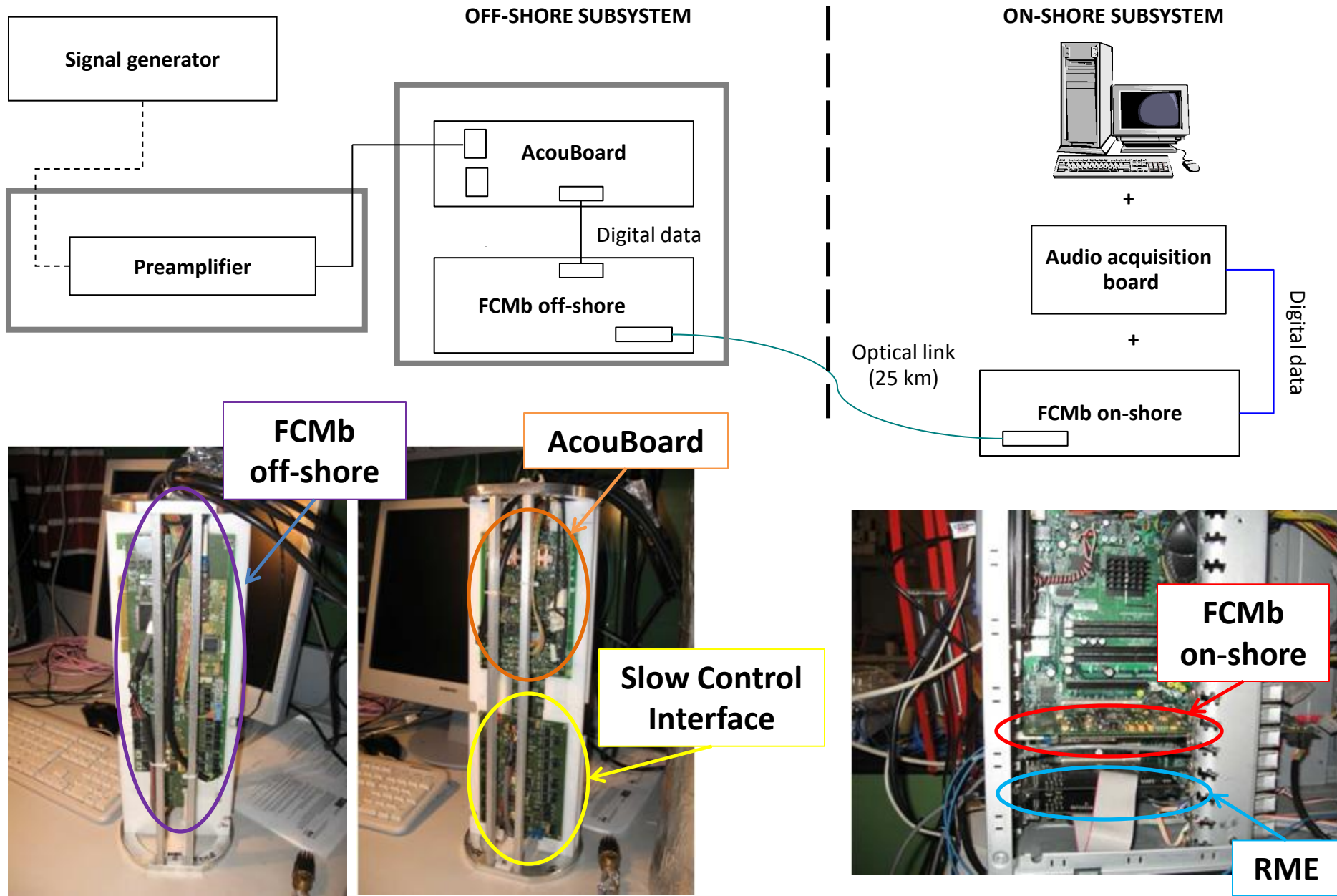
Acoustics at LIDO East-Sicily TSS: connection scheme



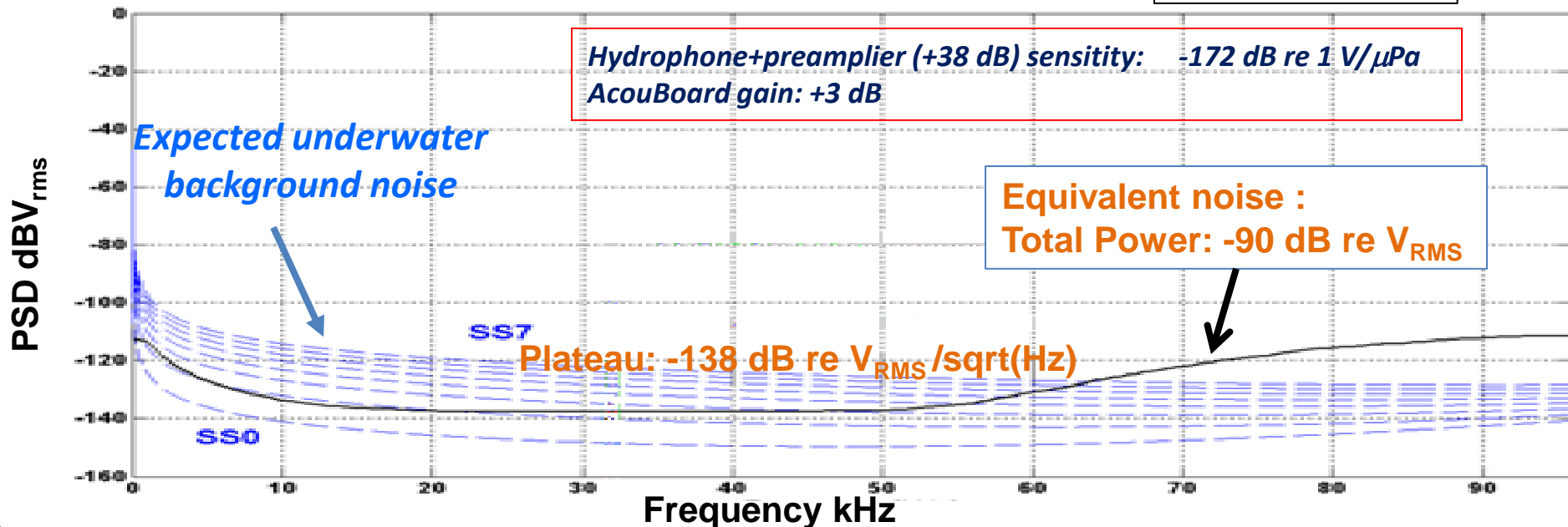
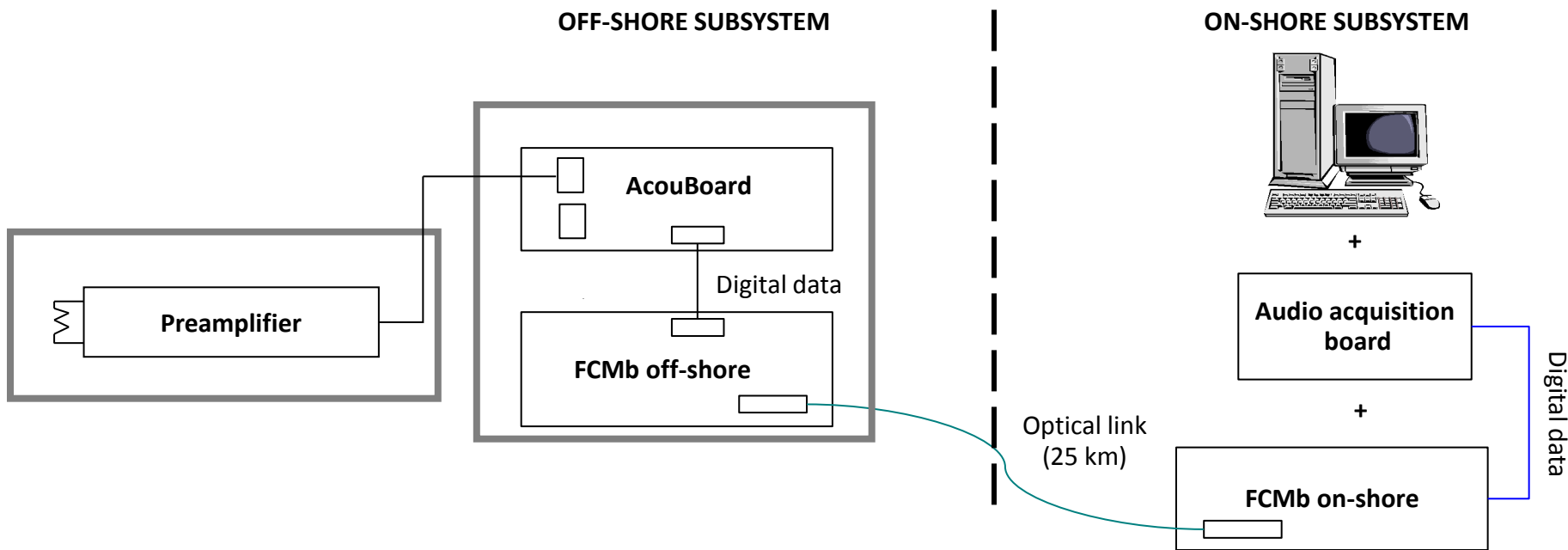
Acoustics at LIDO East-Sicily TSS: connection scheme



Acoustics at LIDO East-Sicily TSS: test and calibration

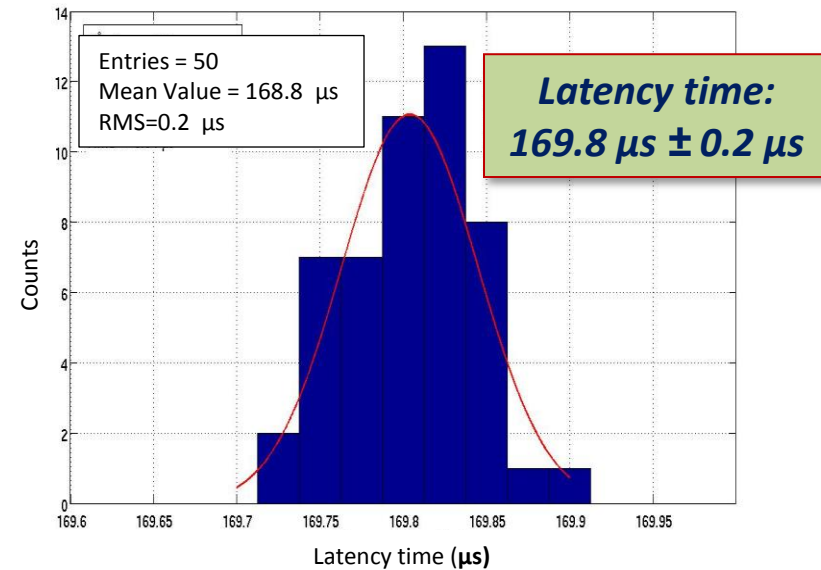
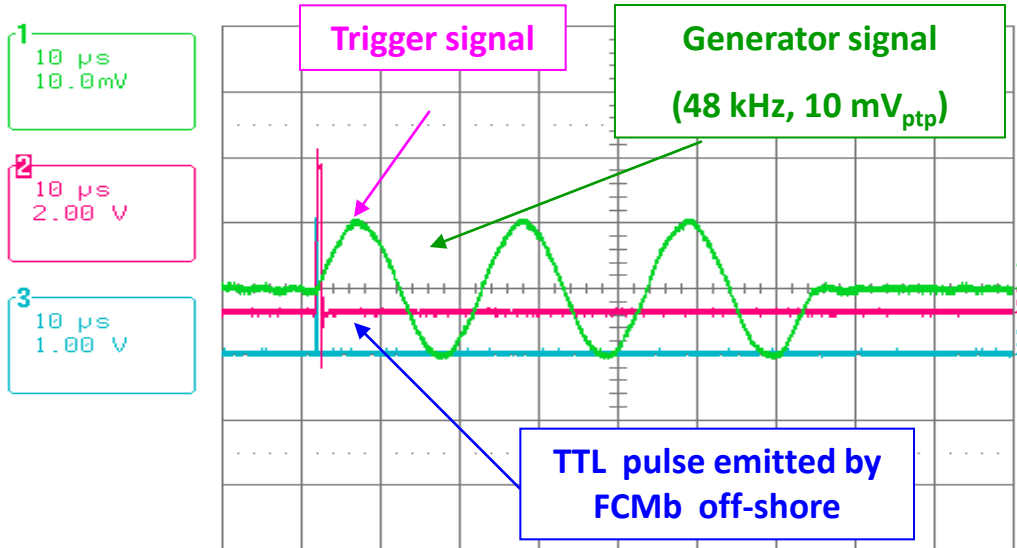
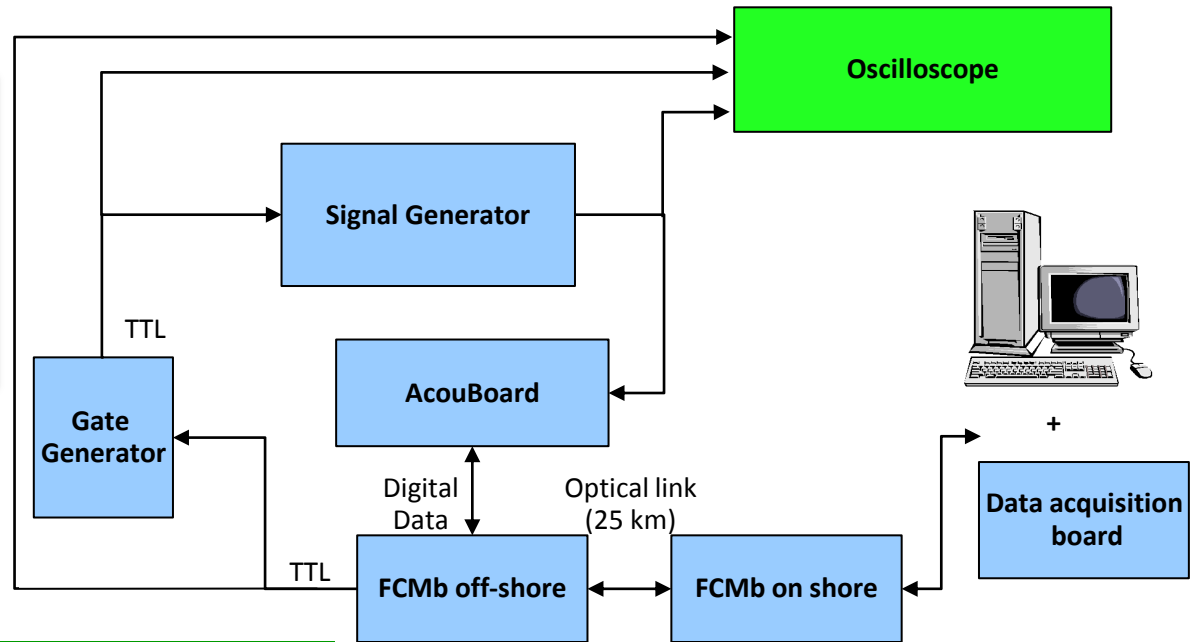


Acoustics at LIDO East-Sicily TSS: test and calibration



Acoustics at LIDO East-Sicily TSS: test and calibration

The accuracy on the measure of the arrival time of acoustic signals on the hydrophones depends on the **latency time** of the system.



Acoustics at TSN:

- *Hydrophones acquired and calibrated*
- *Data acquisition chain realised and tested*
- *Data transmission system realised and tested*
- *Power supply realised and tested*

To do:

- *Mechanical integration on LIDO TSN station*

Acoustics at TSN:

- *Hydrophones acquired and calibrated*
- *Data acquisition chain realised and tested*
- *Data trasmission system realised and tested*
- *Power supply realised and tested*

To do:

- *Mechanical integration on LIDO TSN station*

Acoustics at TSS:

- *Hydrophones acquired and calibrated*
- *Data acquisition chain realised end tested*
- *Data trasmission system realised and tested*
- *Power supply realised*
- *Mechanical frame and electronics housing under construction*

To do:

- *Power supply test*
- *Mechanical integration*