INSTRUMENTATION NEEDS FOR THE CALIBRATION UNIT

…AS A WORK DOCUMENT

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Plan :

- Resume on DOM instrumentation
- Possible instruments for Calibration Units ?
- Some open questions

Status on DOM instrumentation (for info)

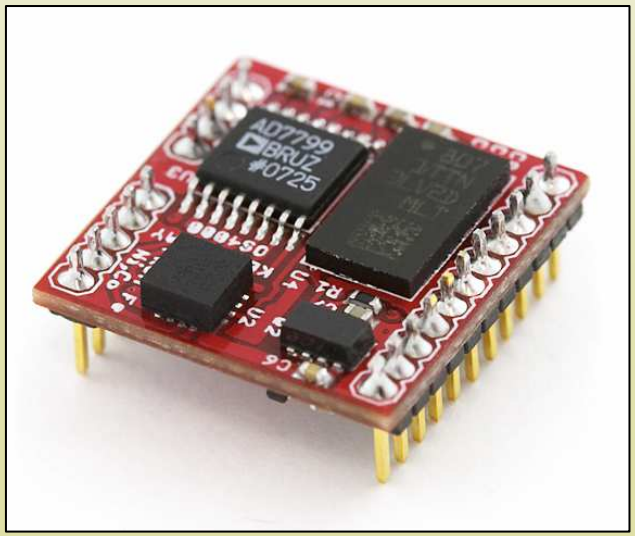
➢ Orientation : Tiltmeter and compass (from Tassos)

tiltmeter

Measurement Technology, NS-25/DQL2-IXA

- tilts accuracy : ±0.1° resolution 0.02°
- dimensions : w x d x h 25 x 25 x 16 mm
- 5 VDC, I = 10 mA
- I2C serial link

- 1 in PPM-DOM
- 1 per DOM (or perhaps the one of the Ocean Server compas will be accurate enough)



heading

OceanServer Technology, OS4000-T

- heading accuracy : 0.5 degrees, 0.1 resolution
- Roll & Pitch full rotation (<1 °)
- dimensions : 15 x 15 x 3 mm
- 3.3V-5V, I < 30 mA
- TTL serial communication

- 1 in PPM-DOM
- 1 per DOM

Status on DOM instrumentation (for info)

➢ Orientation : Compass and tilmeter

• 1 tiltmeter and 1 compass in the PPM-DOM
• need to have one tilt and heading measurement in each DOM for PMTs positioning in association with acoustic triangulation

Antares experience :

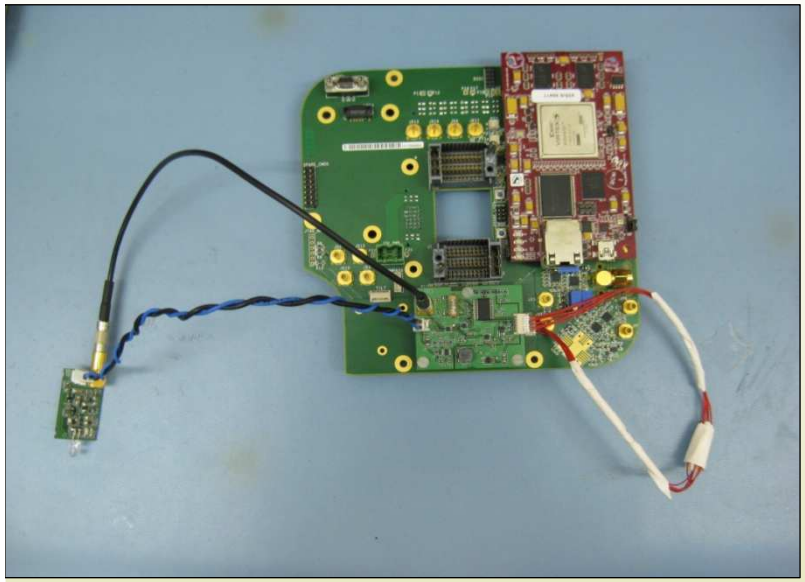
➔ compass has to be calibrated in situ using soft/hard iron internal algorithms

➔calibration done in situ for the LCM compasses

➔ but not possible for the SCM because the it is attached to the BSS

Status on DOM instrumentation (for info)

➢ Optical calibration : nanoBeacon (see Diego's talk)



nanoBeacon

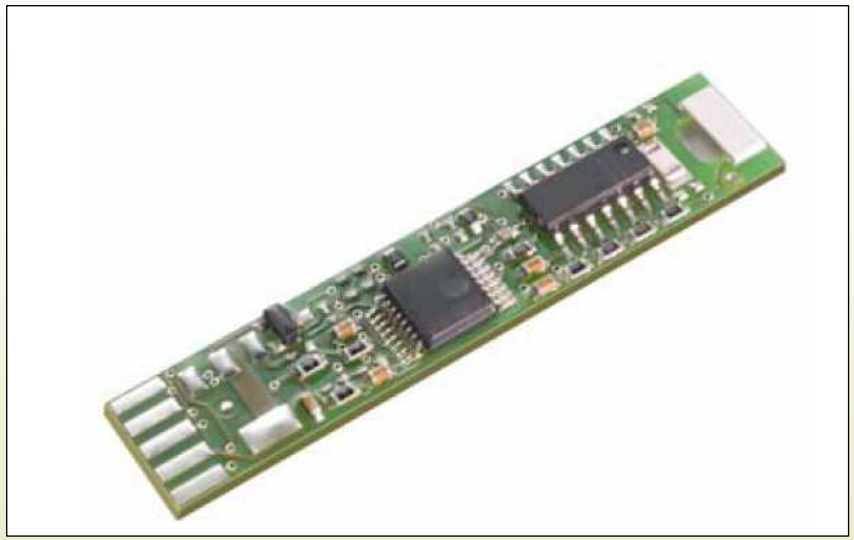
- 1 pulser : 17 x 28 mm +
- 1 control board : 45 x 75 x 10 mm
- 3.3 or 5 VDC, power < 160 mW
- pulse length : 2.5 ns, wavelenght : 470 nm
- internal or external LVDS trigger
- I2C control command

- 1 in PPM-DOM
- 8 in NEMO phase II tower
- 1 or 2 per DOM
- Intra DU optical calibration

➔ no need in Calibration Units

Status on DOM instrumentation (for info)

➢ Relative Humidity and temperature sensors (from Diego)



RH and temperature board

IST DigiPicco Basic I2C

- accuracy : ± 3%RH ; ± 0.5 °C
- dimensions : 10x47x2,8 mm
- 5 VDC, I < 3 mA
- I2C serial link

- 1 in PPM-DOM
- needed in each DOM ?

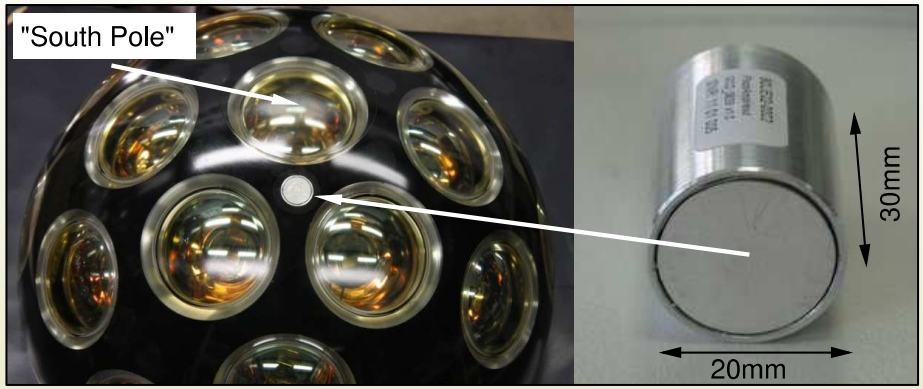
➔ needed in any container (CU) ?

Status on DOM instrumentation (for info)

➢ Acoustics positioning : receiver (from Giorgio, Miquel, Robert)

All data to shore : on shore acoustics detection algorithm, multidisciplinary sea science, neutrino detection ?

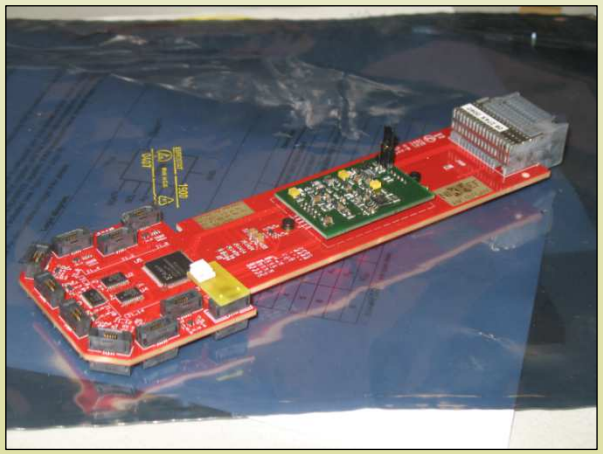
A – internal hydrophone : piezo sensor (ECAP proposal) (see Salvo's talk)



Piezosensor in DOM

- dimensions : Ø 25,4 mm height 10 mm
- 3,3 VDC, I = 20 mA

- need of preamplification board
- digitalization made by AcouPlug (INFN)



Preamplifier board on octopus

- no need for external DOM connector
- uncertainty on noise robustness

- 1 in PPM-DOM
- 2 in NEMO phase II in a single PM OM
- 1 per DOM

Status on DOM instrumentation (for info)

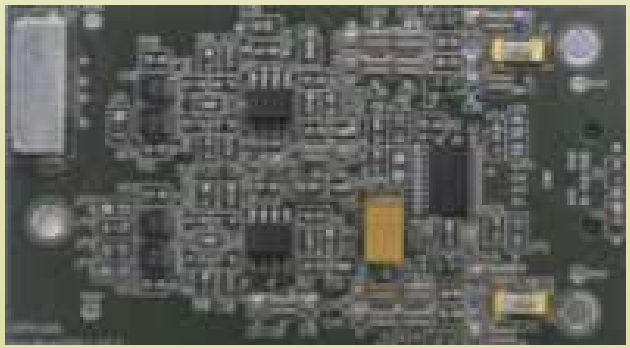
➢ Acoustics positioning : receiver part

B – external hydrophone : SMID (INFN) or FFR-SX30 (UPV)

SMID hydrophone

- dimensions : Ø 29 mm height 188 mm
- 5 VDC, I = 80 mA
- integrates a preamplifier : + 38 dB
- digitalization made by AcouPlug (INFN)

- need for external DOM connector
- 1 in PPM-DOM
- 1 in PPM-DU ?
- tested in NEMO phase II tower



acouPlug

- dimensions : Ø 29 mm height 188 mm
- 5 VDC, I = 200 mA
- 200 kHz, 24 bits
- I2S
- low noise preamplifier
- connected to CLB for clock and data transfer

- integration of acouPlug in CLB V2 under study

Instrumentation for Calibration Units (CU)

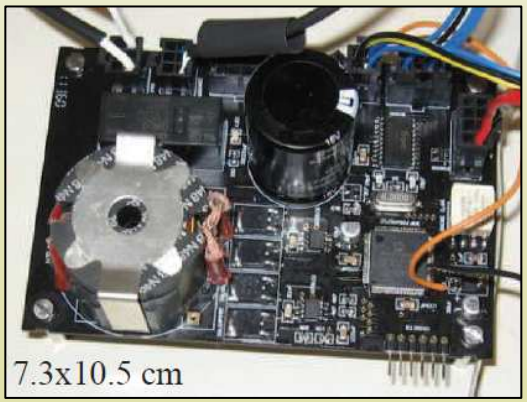
➢ Acoustic positioning : emitter part (from Miquel)

1 (or 2) external transducers (E/R) + one electronic board

FFR-SX30

Sensor Technology FFR-SX30

- dimension : Ø 44 mm; height 25 mm
- frequency range : 20-40 kHz [30 kHz]
- 133 dB ref 1 µPa/V @1 m
- will be tested in IL12
- mandatory on the fixed anchor of the CU
- could also be used as receiver hydrophone (/SMID)



SEB

Sound Emission Board SEB (UPV)

- dimension : 105 x 73 mm
- 12 VDC I=1 mA + 5VDC I=100 mA
- max signal 400 pp ?
- RS232 serial link (or other possibility)
- external LVDS trigger signal
- on demand sinusoïdal, arbitrary, MLS signals

➔ will be tested in IL12 + NEMO phase II

➢ Sound velocity (SV) evaluation (from Vincent)

A- direct measurement : sound velocimeter

- Antares experience : unexpected behavior, data not used
- market study on SV performed in 2010 (P.Keller)

B- Indirect measurement : CTD probes (conductivity, temperature, depth)

- computed from Chen and Millero formula
- Antares experience : all CTD probes data are in agreement
- Sound velocity used for alignement : one initial SV L1 measurement corrected by column of water height

Hand made measurement between 2 short distances transducer ?

➔SV evaluation is needed
How many ?
SV reliability ? CTD ?

Instrumentation for Calibration Units (CU)

➢ Compass/tilt (from Vincent)

➔need to know the precise position of the acoustic emitter : need for heading and tilt of the fixed part of the CU

Antares experience :

➔ problem due to the metallic mass of the BSS, the heading given by the Compass board inside SCM is false

➔ orientation has been measured by an external gyrocompass of the ROV

for Calibration Unit :

➔ local Compas/tilt measurement possible ? or external measurement (ROV) ?

➢ Pressure sensor (from Vincent)

➔needed to have a precise measurement of each acoustic emitter depth (<10 cm) in alignment reconstruction

- **Antares experience** : BSS pressure sensors have a drift behavior.
- possibility to make measurement with an external accurate scientific sensor on ROV (Paroscientific type)

Instrumentation for Calibration Units (CU)

➢ Inter DU optical calibration : laser Beacon (see Diego's talk)

Laser beacon

➔ Needed for the optical calibration

- dimension : Ø 142 mm; height 542 mm
- proposal : **48 V,** power < 100 W
- wavelength : 532 nm
- serial link proposal : **I2C**
- pulses < 1 ns
- no synchronization needed

- will be tested in Antares IL12 and NEMO phase II
- up to 25 µJ expected for next version

- 1 every 6 DU ?

Instrumentation for Calibration Units (CU)

➢ Seacurrent meter (ADCP) (from Vincent)

➔needed in KM3Net, to be defined
➔ how many ?

➢ Measurement off light transmissivity (from Vincent)

➔ needed to evaluate the attenuation of Cherenkov light
• **Antares experience** : unexpected behavior of dedicated instrument (CSTAR)
• evaluation comes from LedBeacon studies

➔needed for KM3Net detector
dedicated device ? Or could it be evaluated from optical calibration devices study ?
How many ?
Another possibility : used data from turbidimeter used in seascience lines

➢ RH/temperature

➔do we need to monitor Relative Humidity and temperature in each CU container ?

Resume of instrument needs in CU

Device	Fonction needed	Device available for CU	Need continuous data	Backup solution
Acoustic E/R	yes	yes	yes	
Currentmeter	yes	yes	yes	
LaserBeacon	yes	Yes	yes	
Velocimeter	yes	?	?	Use CTD sensors or compute SV from a constant ? Travel times on a short known distance ?
Pressure sensor	yes	yes	no	Extra measurement from independant device
Light transmissivity	yes	?	?	Analyses from light Beacons or turbidimeter (oceanographic line ?)
Compass/tilt	yes	?	no	Extra measurement from independant device
RH/Temp.	?	yes	yes	

Some open questions ?

- Could the CLBV2 be used to interface the CU instruments ? Or
- Shall we need a new board to manage some interfaces from CU intruments ?
- Could we use the DOM power board or do we need a specific CU power board ?
- Definition of the container, connectics and mechanical interfaces

Thank you for your kind attention