KM3NeT DETECTION UNIT LINE FIT RECONSTRUCTION USING POSITIONING SENSORS DATA

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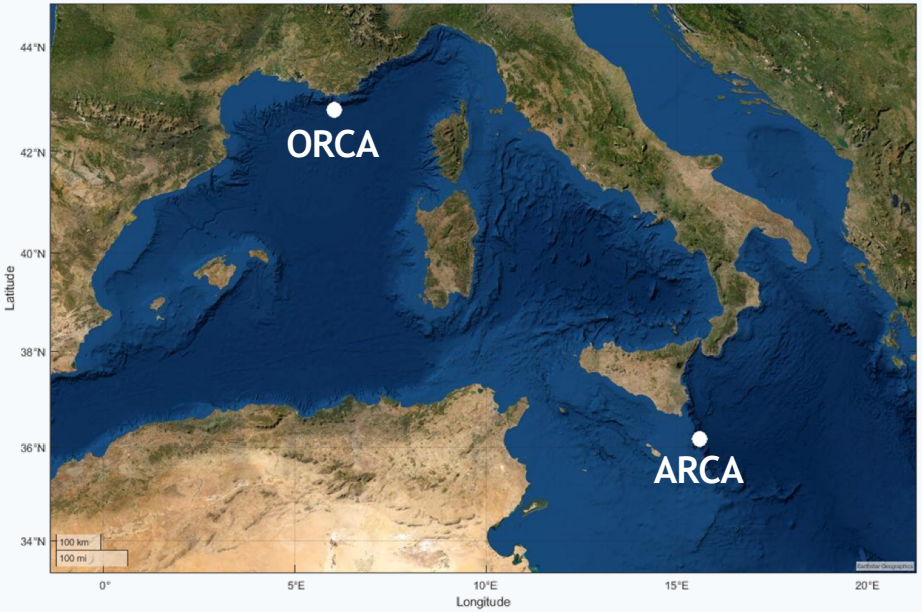
The detector framework

- Two sites:

  ARCA (Capo Passero, Italy) → **A**stroparticle **R**esearch with **C**osmics in the **A**byss

  ORCA (Toulon, France) → **O**scillations **R**esearch with **C**osmics in the **A**byss

- Three nodes with 115 DUs each one: 2 in ARCA + 1 in ORCA



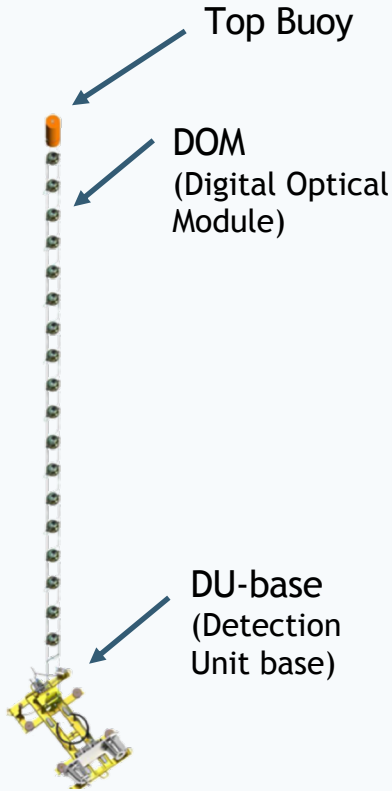
ARCA

- 18 DOMs / DU
- Depth sea bed: 3400 m
- DUs height: 700 m
- DOMs distancing: 36 m
- Volume: 1 km^3

ORCA

- 18 DOMs / DU
- Depth sea bed: 2500 m
- DUs height: 200 m
- DOMs distancing: 9 m
- Volume: 0.018 km^3

Detection Unit (DU)

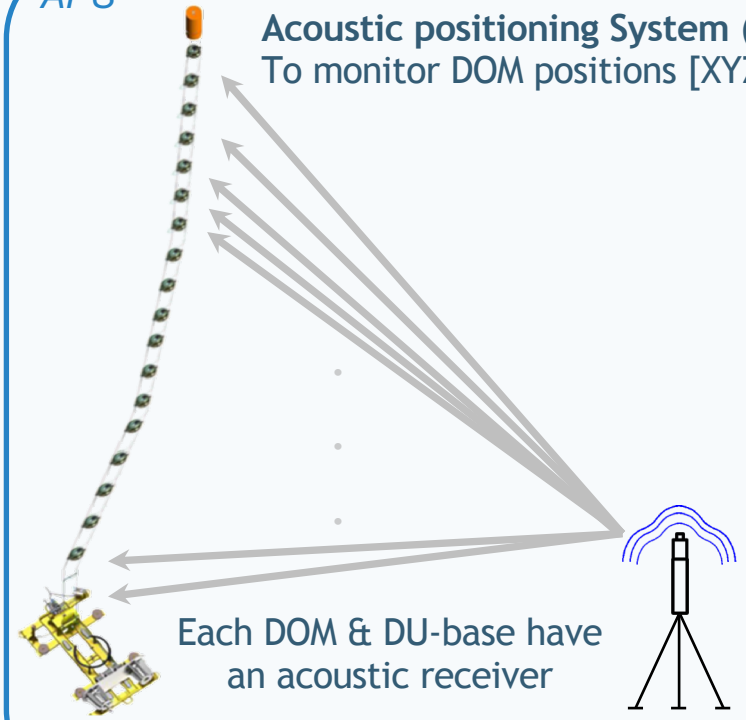


POSITIONING SYSTEM

Parts for DU Line Fit

APS

Acoustic positioning System (APS):
To monitor DOM positions [XYZ]

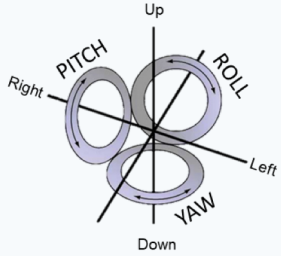


Each DOM & DU-base have an acoustic receiver

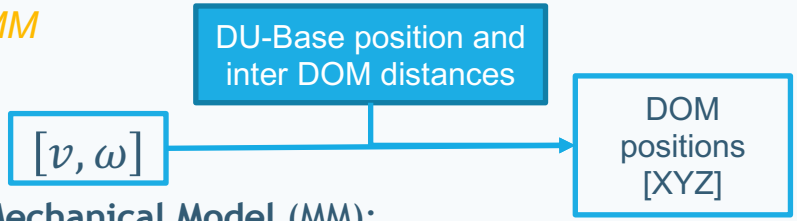
AB (Acoustic Beacon)

AHRS

Attitude Heading Reference System (AHRS):
To monitor DOM orientation [YPR]

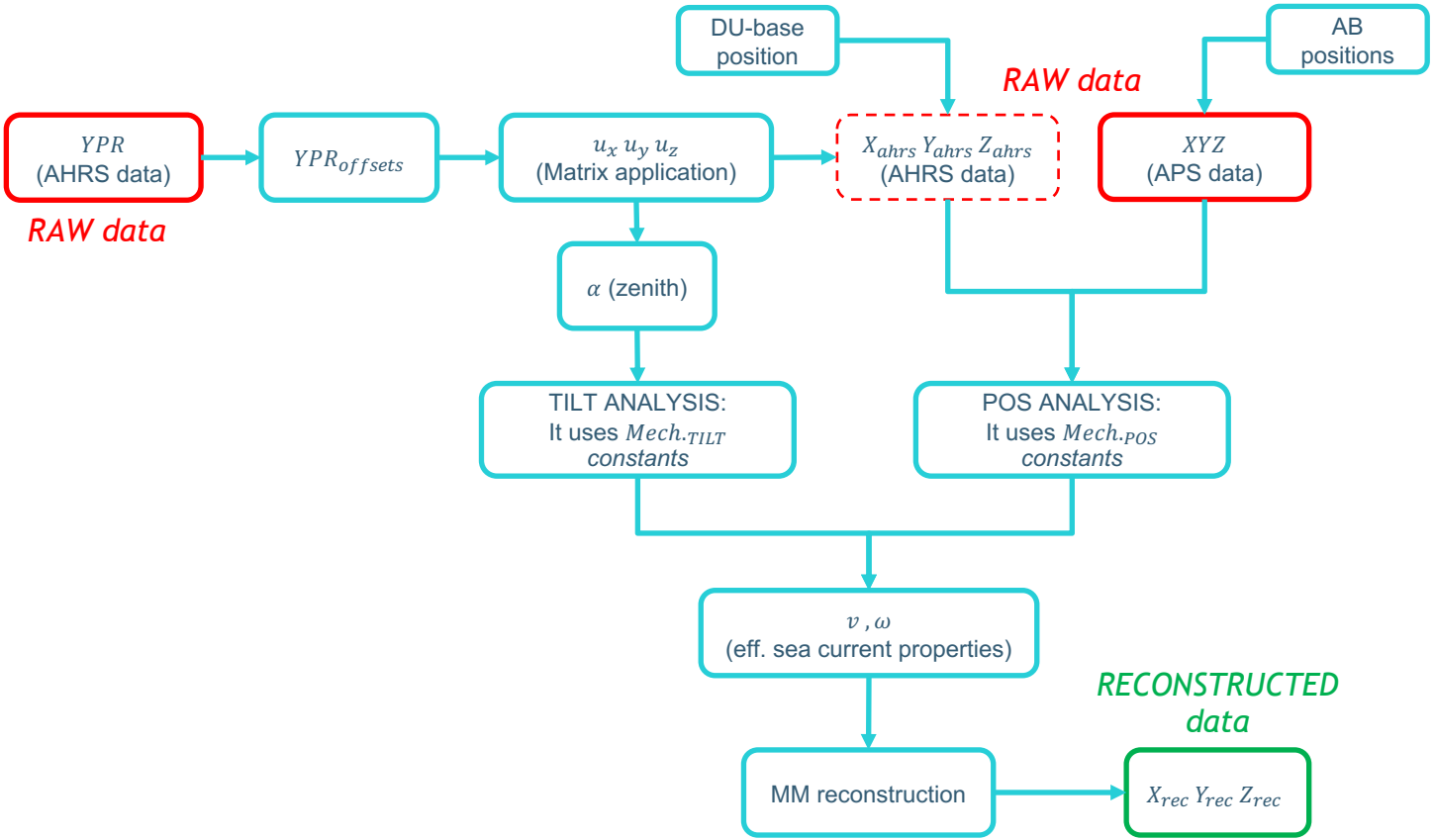


MM



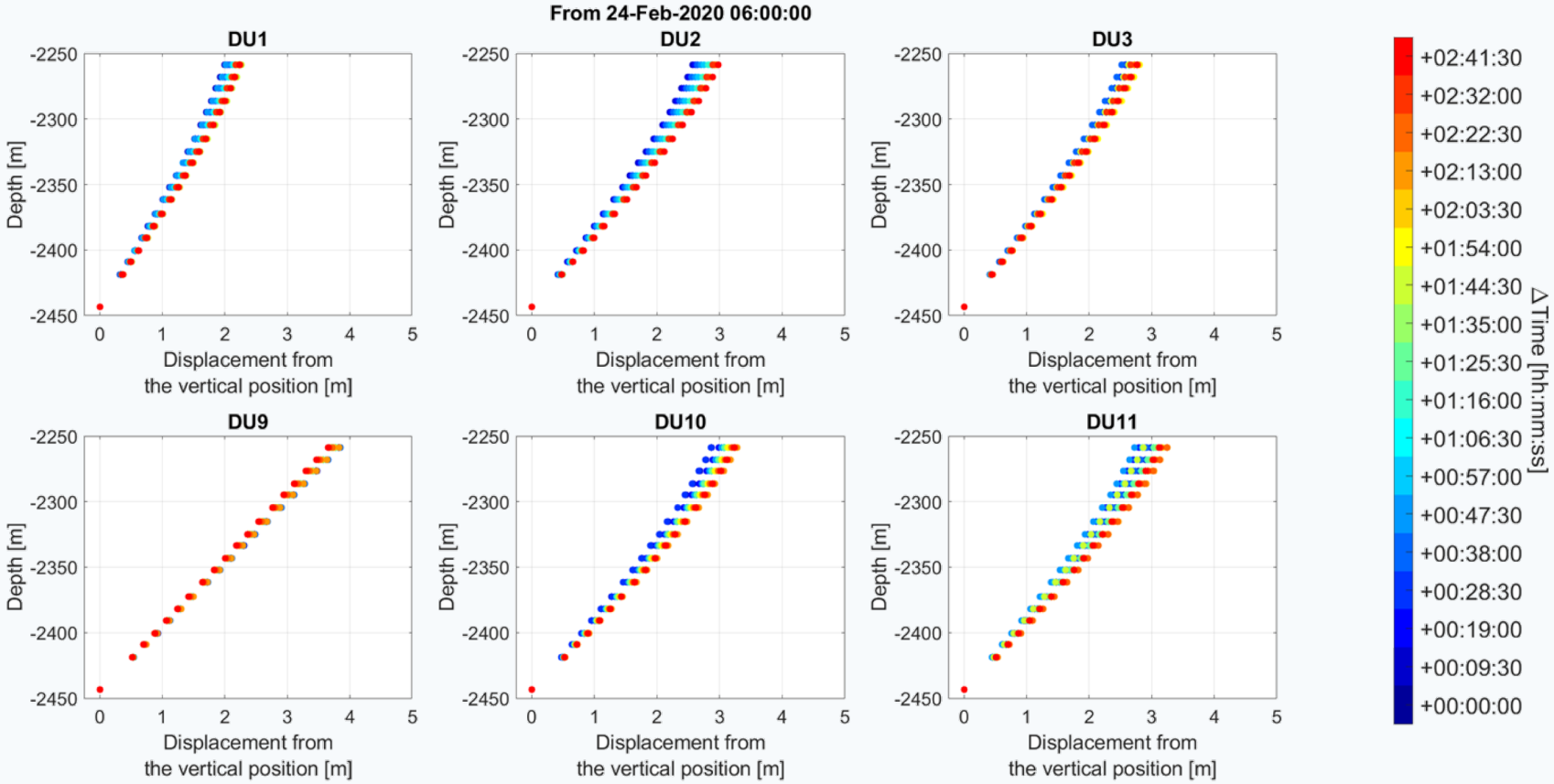
Mechanical Model (MM):
Used to reconstruct the DOM positions from input data and effective sea current(velocity v, and direction ω) as fit parameter

DU LINE FIT PROCESS



RESULTS

24/02/20 6:00 → 9:00 – High sea current (>10 cm/s)



CONCLUSIONS

- The different steps of DU Line Fit have been presented:

  1) Organization of input data from sensors to DU Line Fit analysis

  2) DU Line Fit application for a selected time period

  3) Study, represent, and organize the output (position and orientation of DOMs)

- The reconstruction method can be used when acoustic positioning data are not accessible for any reason and only AHRS data are available.

- The DU Line Fit has been tested on a sample of ORCA detector data (good results for high sea current periods). The particular case of a DU without a Top Buoy was also studied

- This work provides an overall validation of the positioning calibration and allows to infer the DOM positions even when either the XYZ or the YPR data are not available.