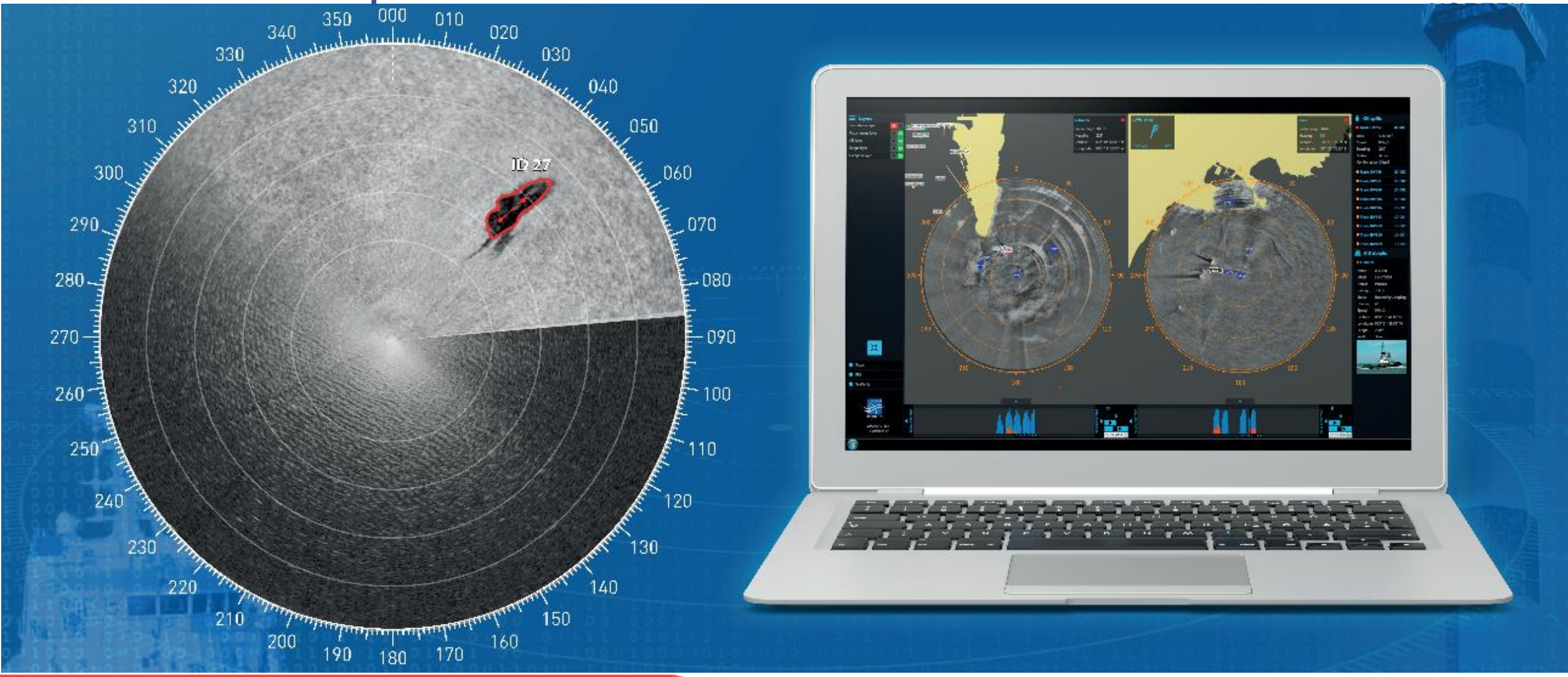
Radar Oil Spill Detection



Introduction

NORTEK B.V.

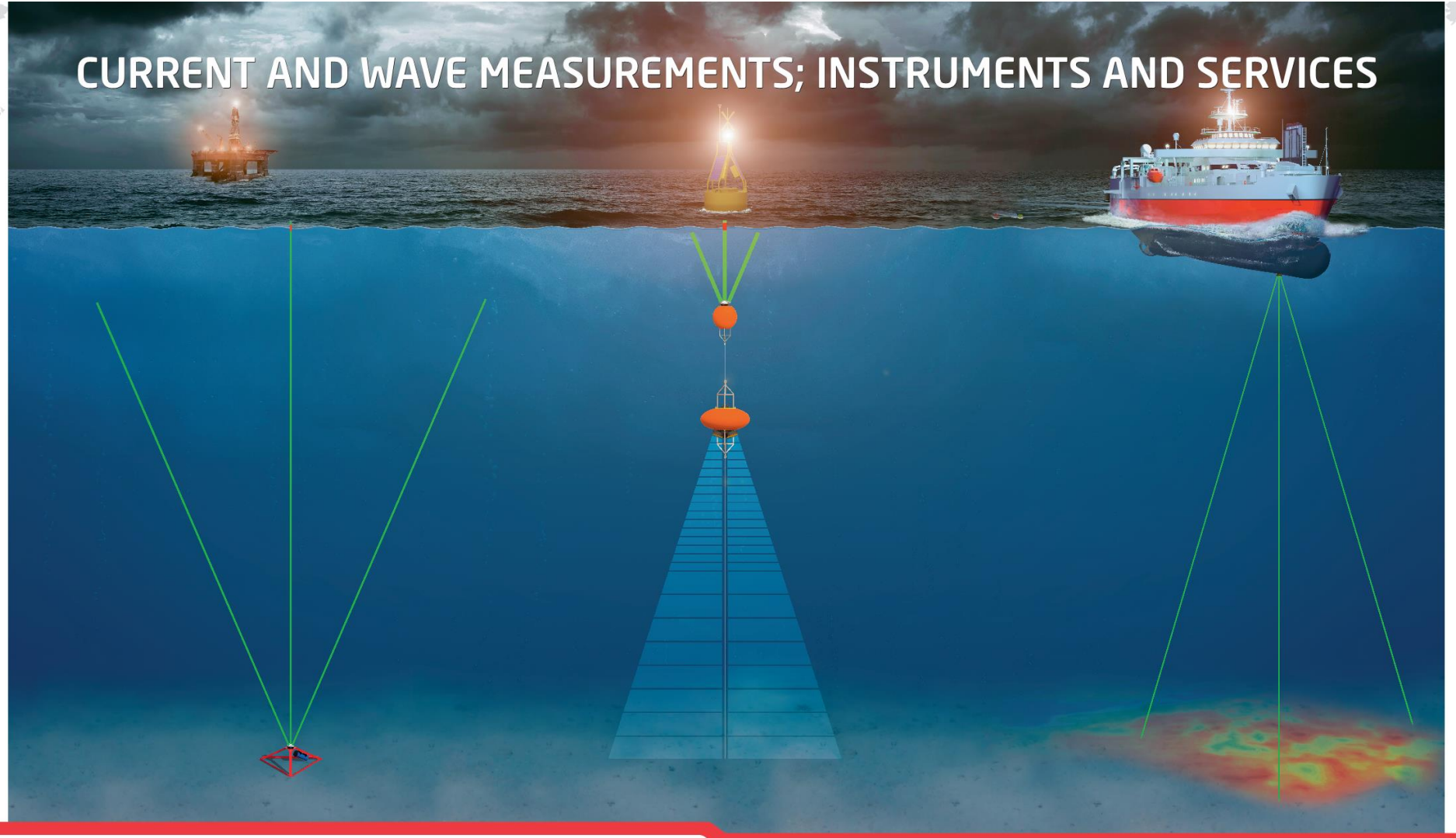
What is Nortek ?

Environmental monitoring with radar.

Examples

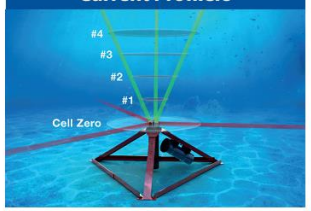
NORTEK

CURRENT AND WAVE MEASUREMENTS; INSTRUMENTS AND SERVICES

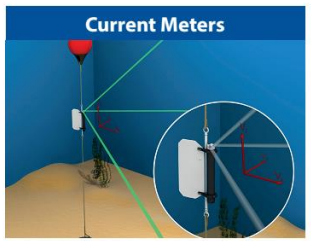


NORTEK

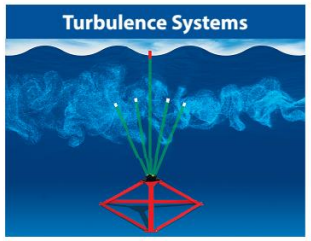
Current Profilers



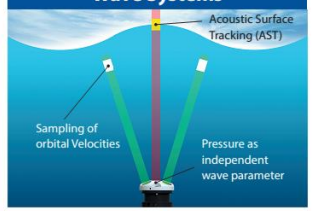
Current Meters



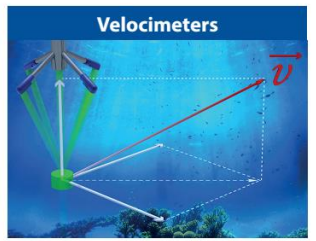
Turbulence Systems



Wave Systems



Velocimeters



Online Systems

www.nortek-as.com

True Innovation Makes a Difference

CURRENT AND WAVE MEASUREMENTS
IN THE OCEAN, LAKE AND LABORATORY

Norway United Kingdom USA France China Brazil Netherlands

SeaDarQ Environmental Radar Monitoring Solutions

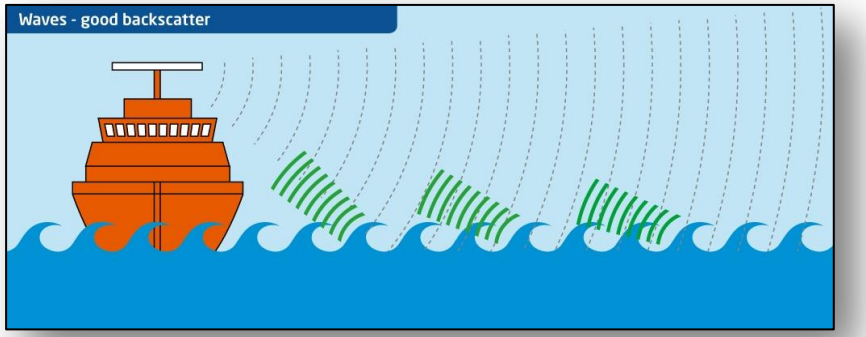
Benefits of Nortek sensors

- Data acquisition
- Data processing
- Simple to use
- Innovative

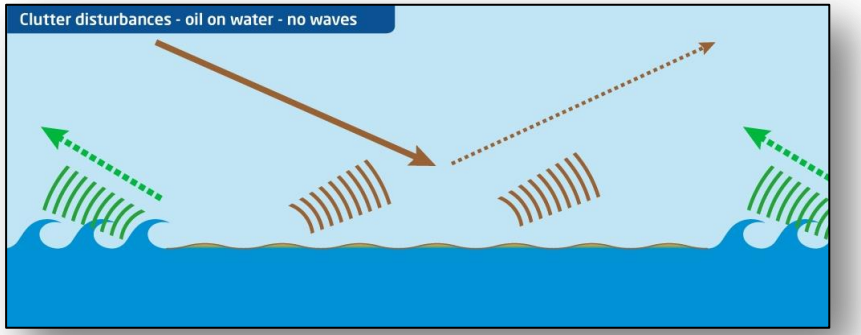
Trends :

- Operator is on shore
- Increasing data rates
- Systems approach

Radar Oil Spill Detection

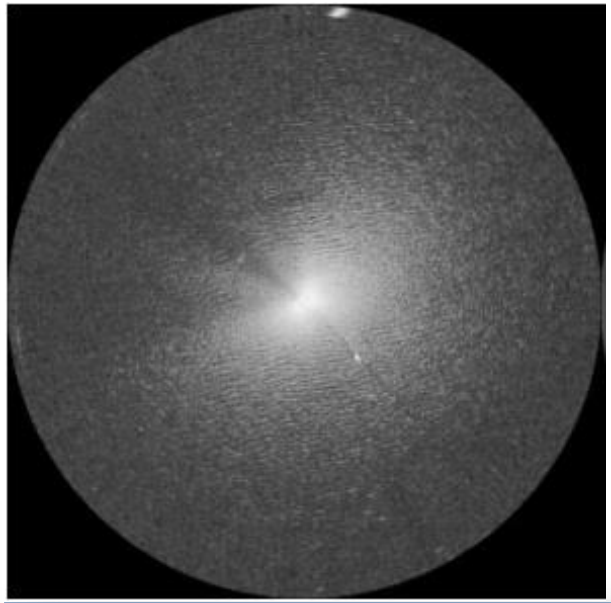


Waves – good backscatter



Clutter disturbances – Oil on water – no waves

TNO



Prestige 2002 – RWS ARCA

SeaDarQ B.V.

Nortek B.V. - 2011

Environmental monitoring with radar

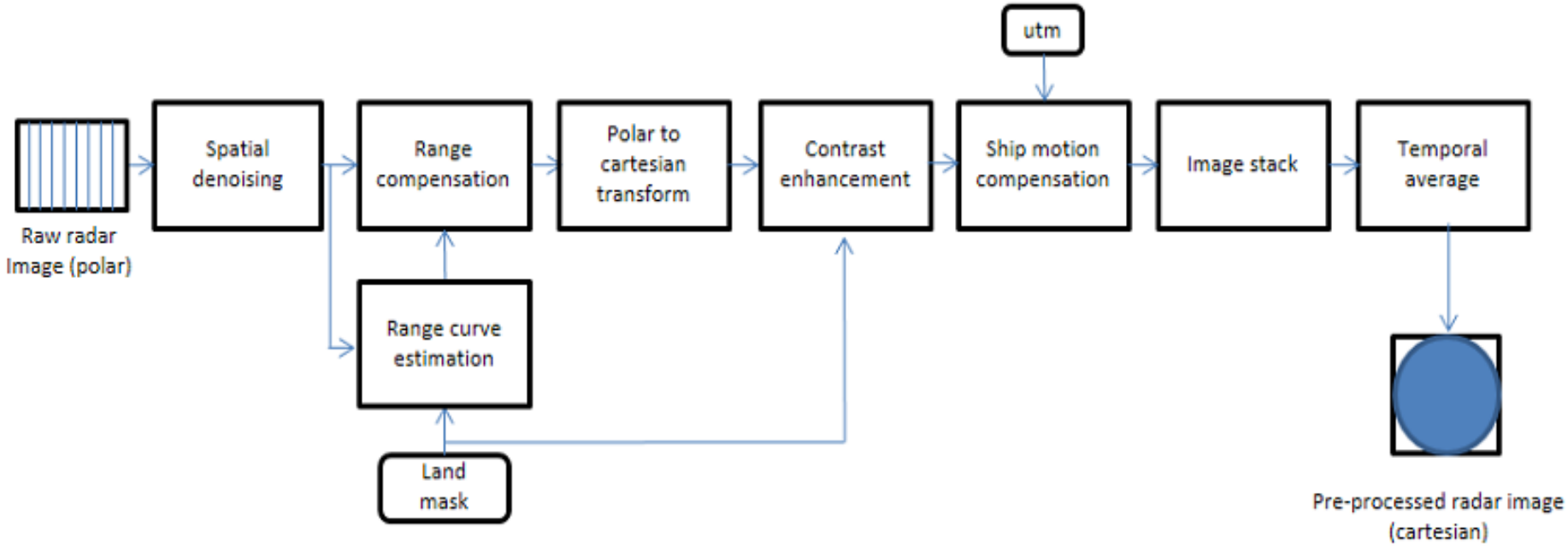
System setup for good performance:

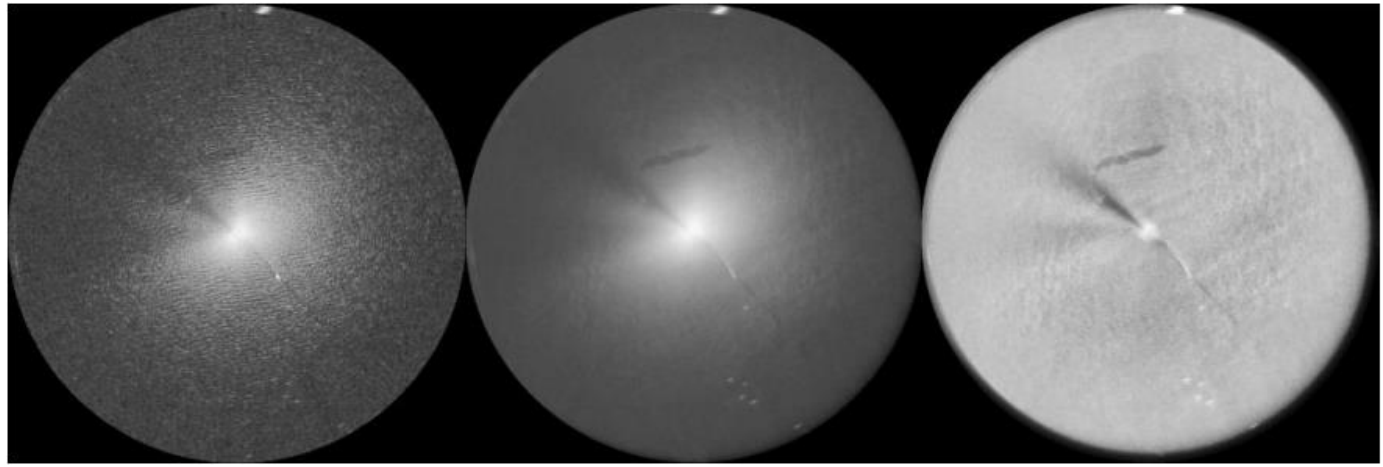
- Radar which meets the requirements for OSD
  - Dynamic range
  - VV polarized antenna
- Data acquisition is important
  - Timing of all channels
  - Details – sea clutter
- Processing
  - model based instead of threshold detector

Subjects:

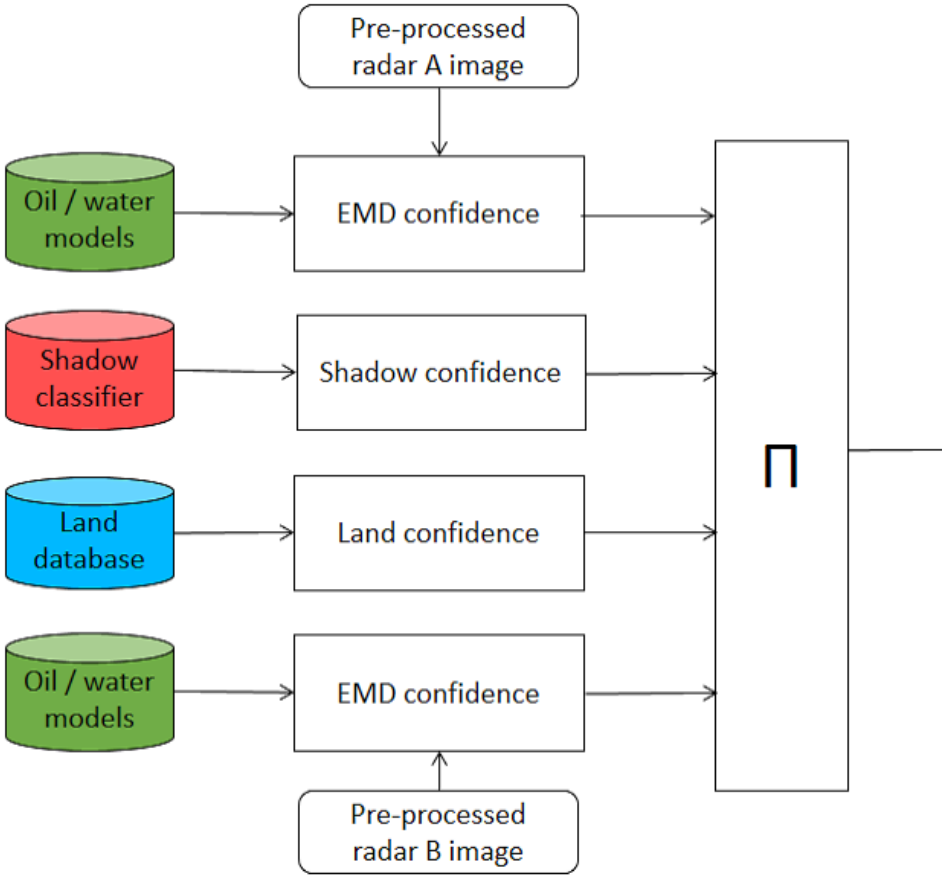
- Oil Spill Detection
- Hydrographic Information
- Online data

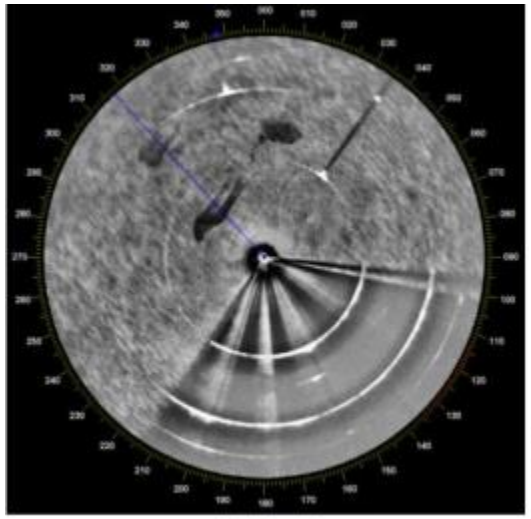
Development since 2011 : Pre-processing



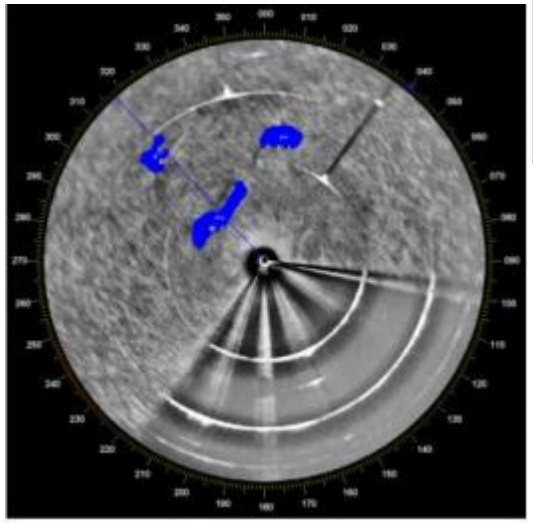


Development : Automatic Detection

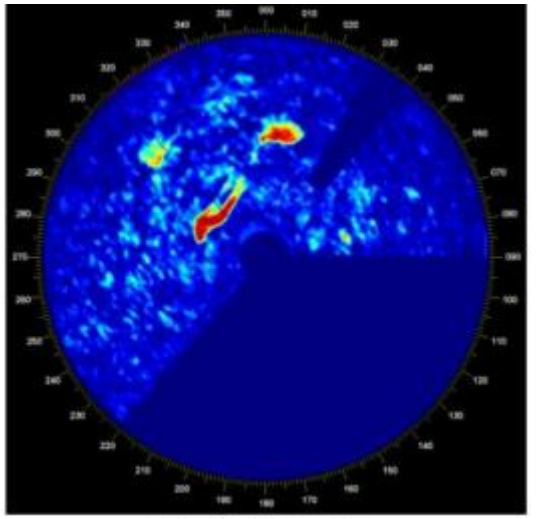




(a) Input



(c) Segmentation



(b) Confidence Map

Evaluation on 21 spills

Paper available

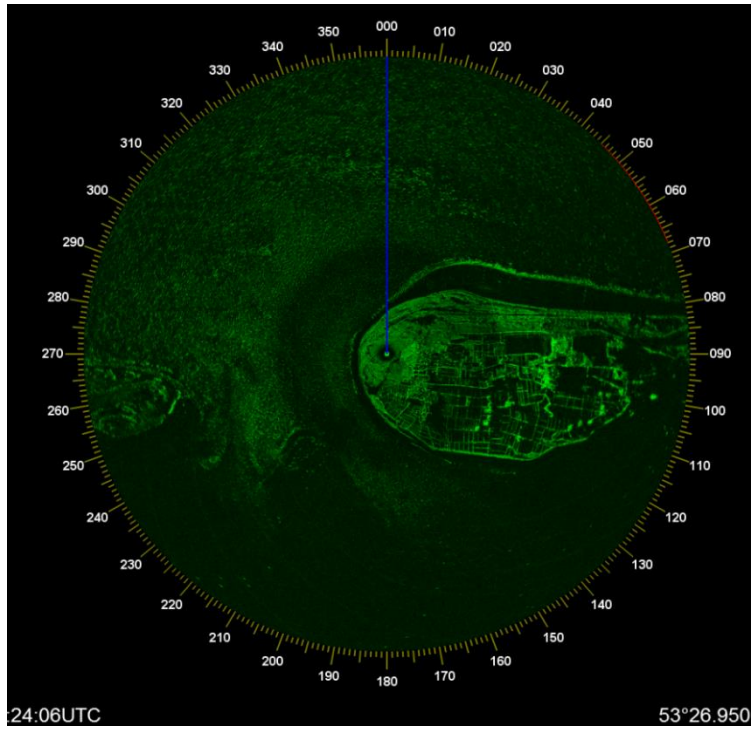
Detection rate – False alarm rate

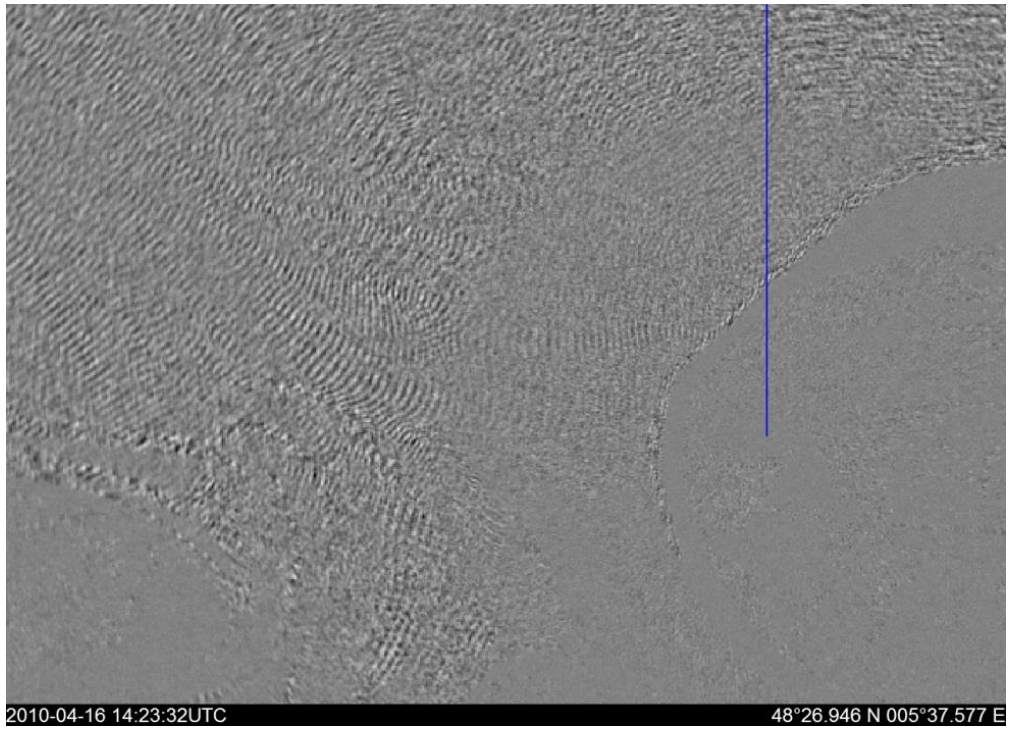
NORTEK

Hydrographic Information

Example of a radar image

- SeaDarQ analyses wave crest propagation
- clutter for navigation purpose = information for SeaDarQ





Results and validation – Sand Motor

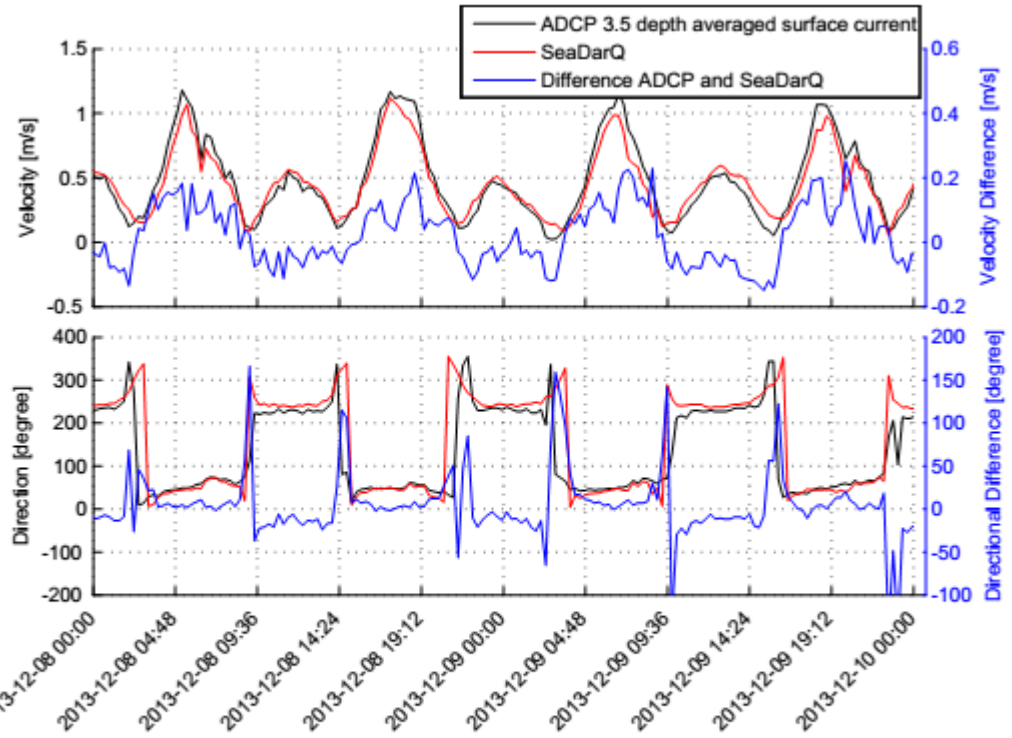


Figure 5-9: The SeaDarQ output, 3.5 meter depth averaged surface current measured with the ADCP and the difference between those two are plotted to show the comparisons between the two measurement devices.

TU Delft – Anna van Gils, Deltares, Rijkswaterstaat

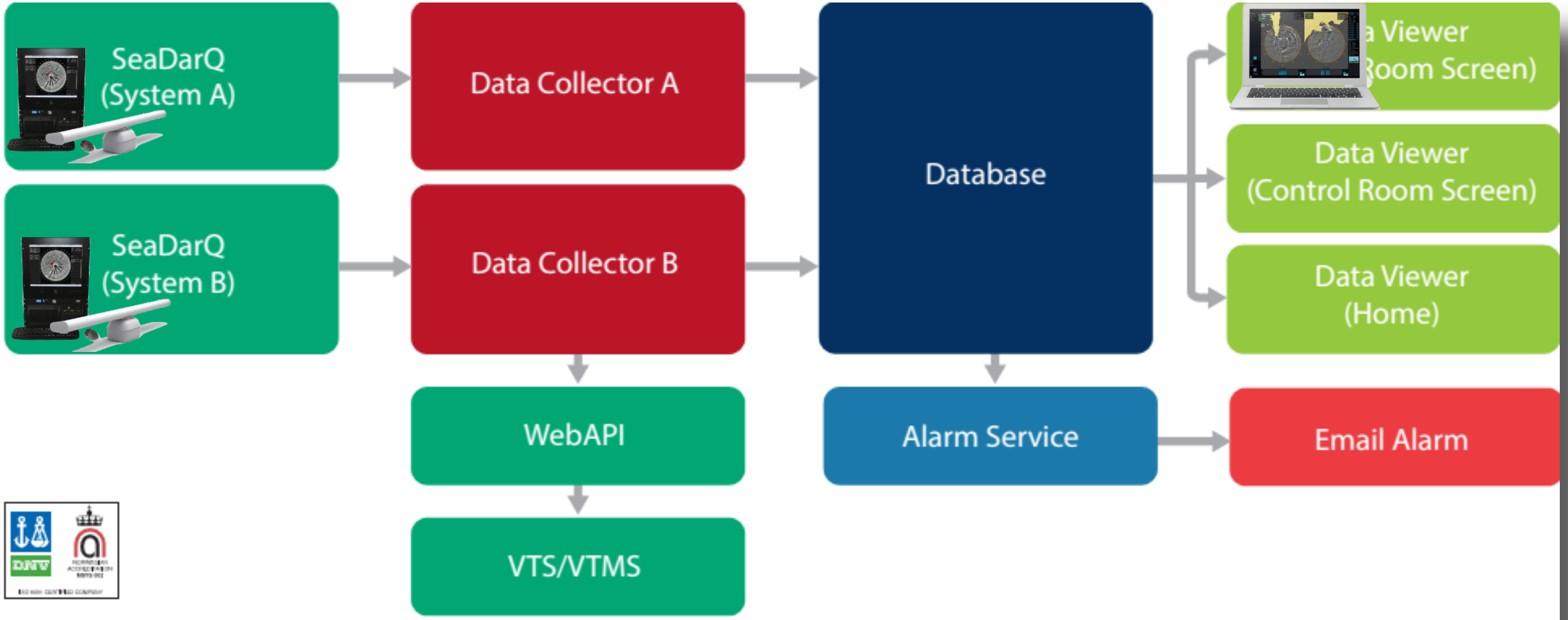
SeaDarQ Online

Online data of SeaDarQ systems

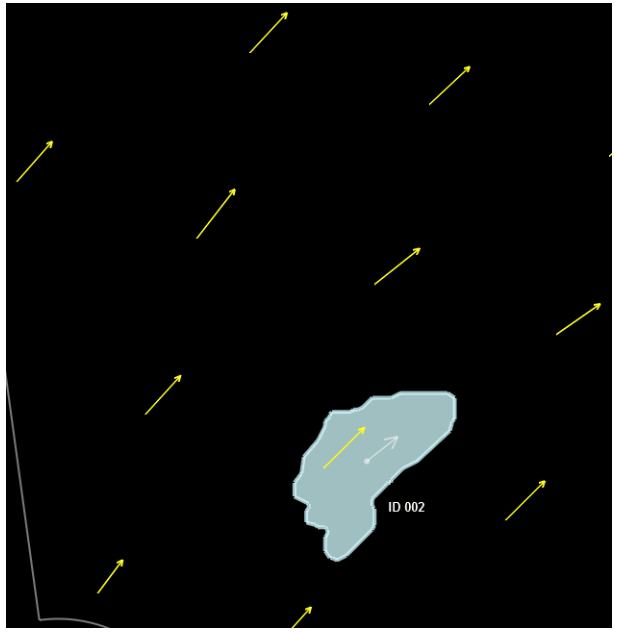
NORTEK

SeaDarQ Environmental Radar Monitoring Solutions

SeaDarQ Online Infrastructure



Three examples



EMSA Vessel

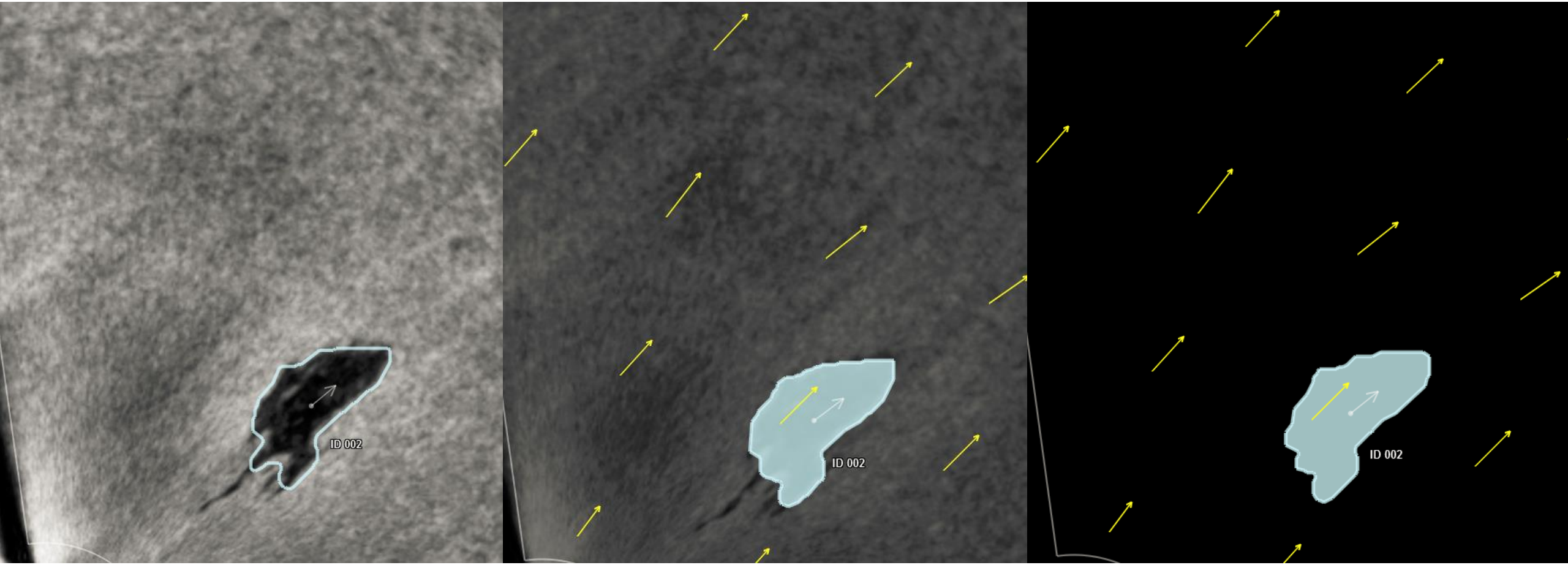
Sand Motor

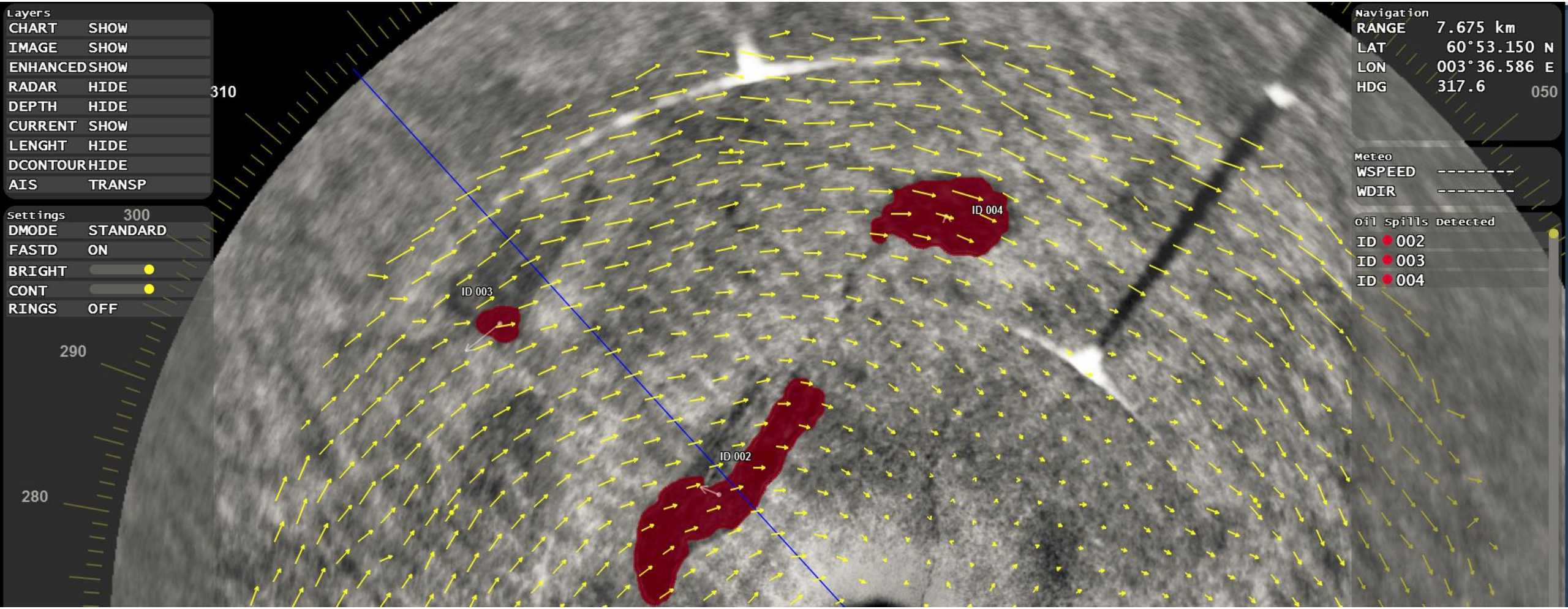
Frade Field


Small spill in North Atlantic.
SeaDarQ detection from a vessel

NORTEK

Oil spill and currents

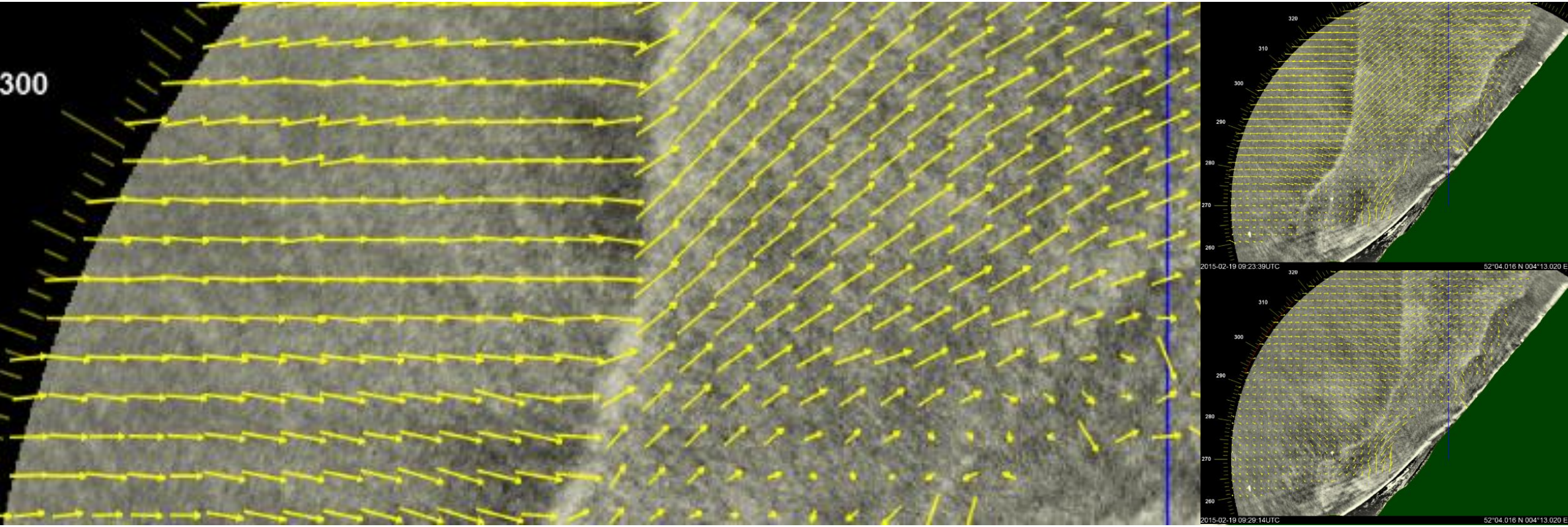



Layers
CHART SHOW
IMAGE SHOW
ENHANCED SHOW
RADAR HIDE
DEPTH HIDE
CURRENT SHOW
LENGHT HIDE
DCONTOUR HIDE
AIS TRANSP
Settings
DMODE STANDARD
FASTD ON
BRIGHT
CONT
RINGS OFF
310
300
290
280
ID 003
ID 004
ID 002
Navigation
RANGE 7.675 km
LAT 60°53.150 N
LON 003°36.586 E
HDG 317.6
050
Meteo
WSPEED --------
WDIR --------
Oil Spills Detected
ID 002
ID 003
ID 004

Sand Motor

Rijkswaterstaat, Deltares, TU Delft

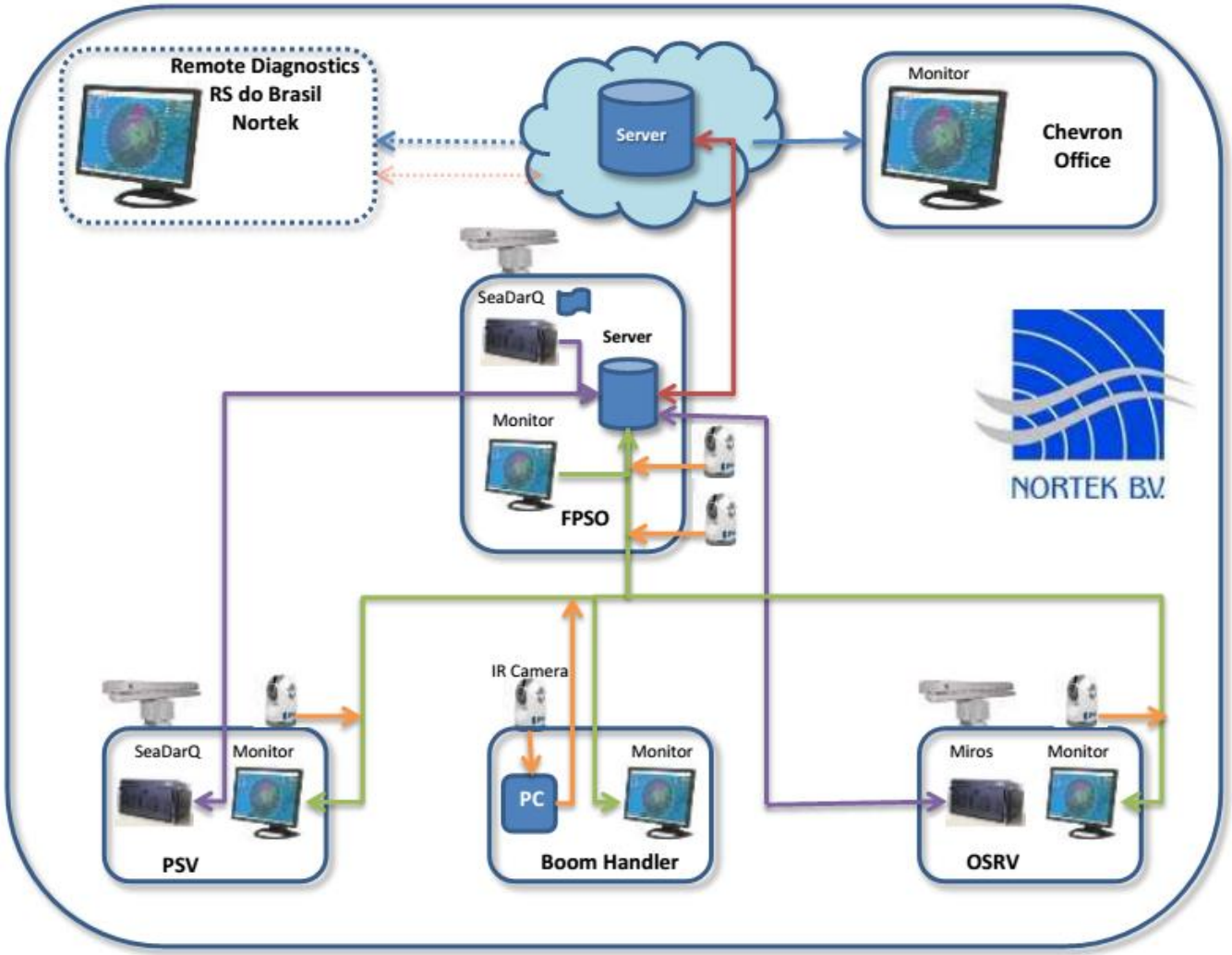
Flow patterns at Sand Motor

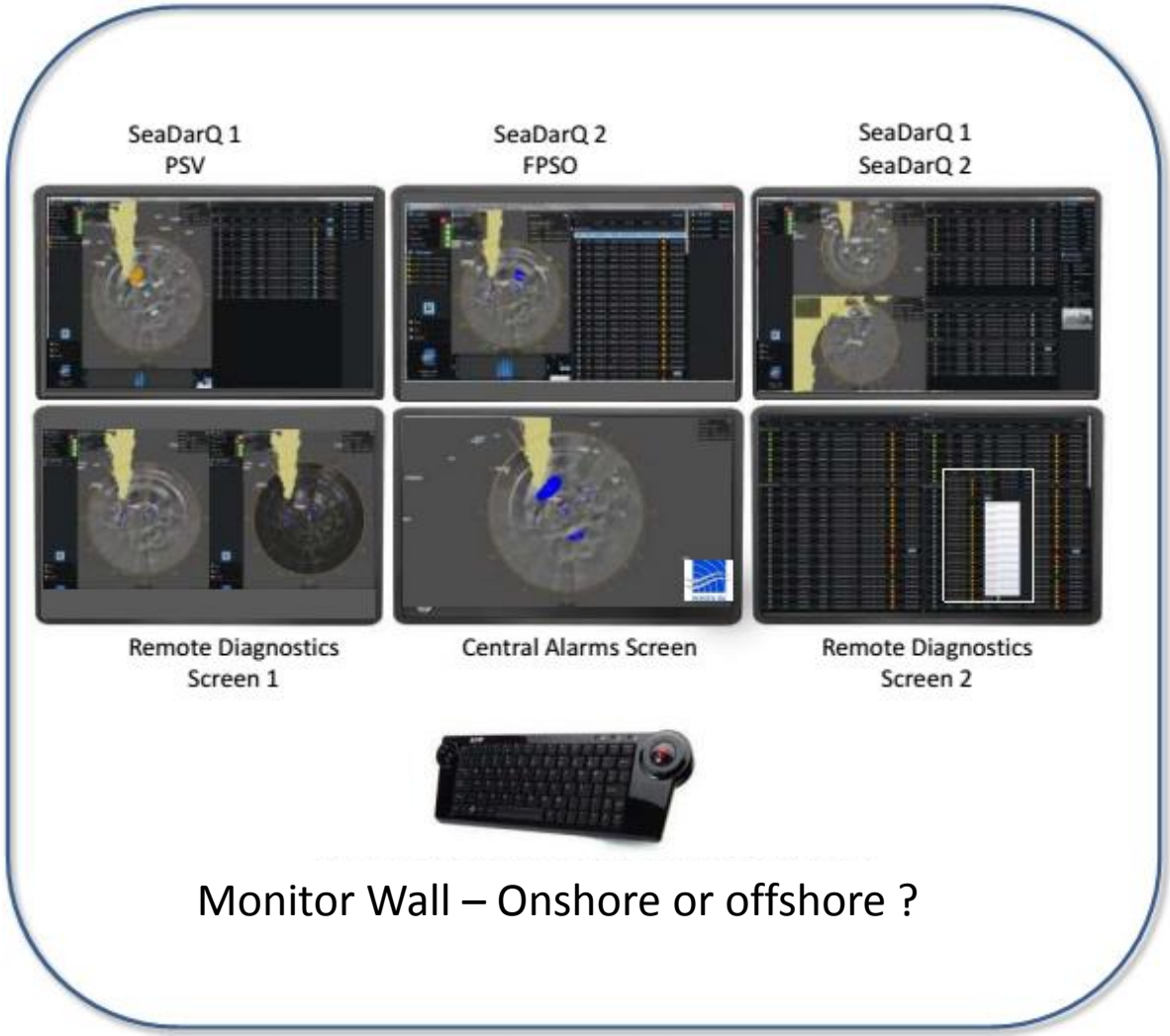


Chevron Frade field, offshore Brazil

OSD Radars on 3 vessels, additional sensors, Oil Spill Detection, Hydrografy
SeaDarQ Online with Viewers on the Vessels, the FPSO, central office, authorities
Installation in summer 2015

Frade field, infrastructure





Monitor Wall – Onshore or offshore ?

Current monitoring buoy – 1200m depth

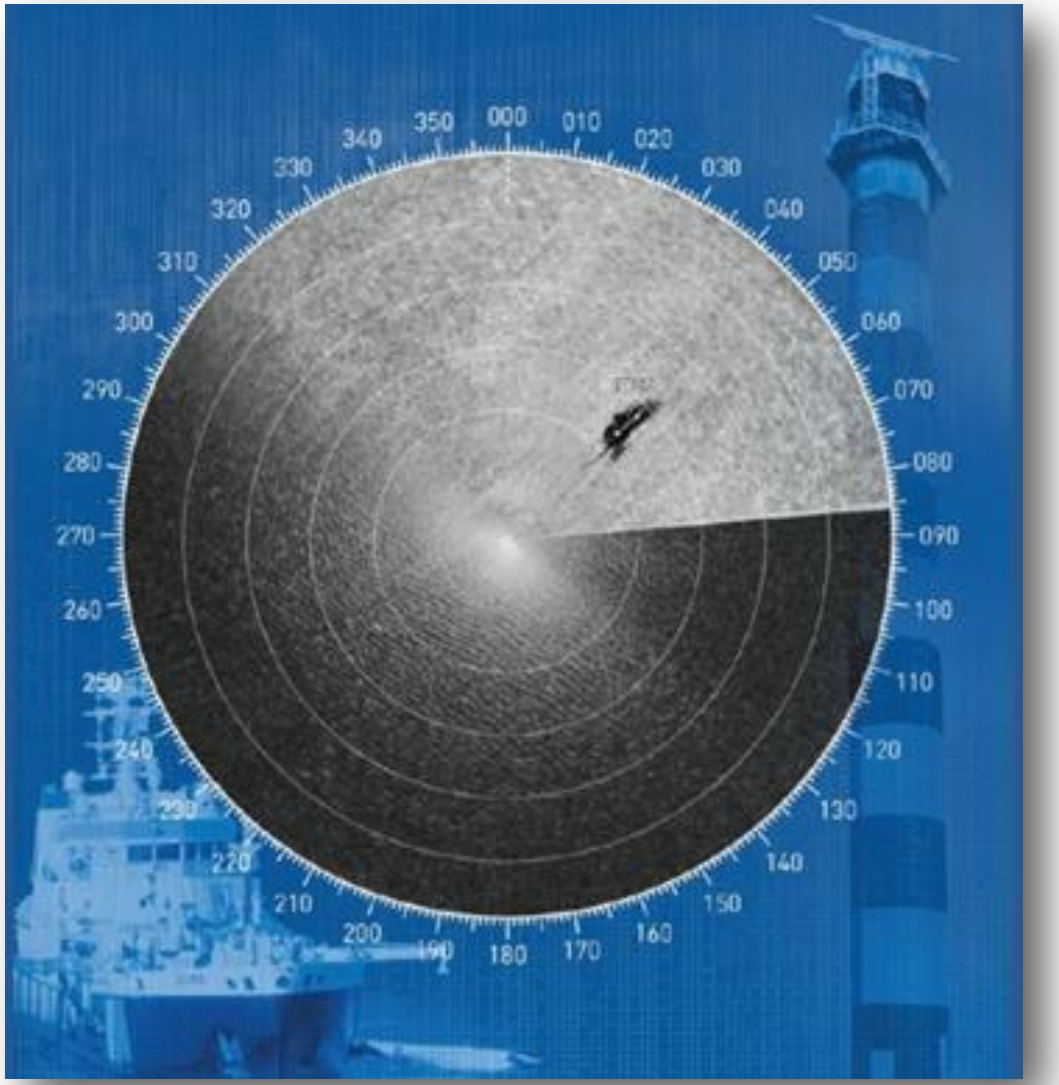
Woods Hole Group - USA

Back to the trends

Trends:

- ✓ Operator is on shore : SeaDarQ Online
- ✓ Data rates are increasing : automatic processing
- ✓ Systems: networked solutions, multi-sensor

SeaDarQ



SeaDarQ Online

NORTEK