Experimental Analysis of n-Butanol Solubilization in Seawater by Pure-Phase Digital Holography

MINES Alès

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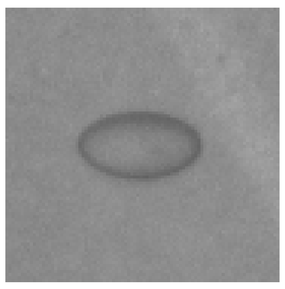
LAUM

Previous Results

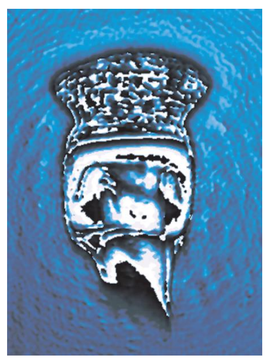
High Speed Imaging
n-butanol droplet rise
$n_{n\text{-}but} = 1{,}399$



Diffuse Backlight

Direct Shadow

New Results



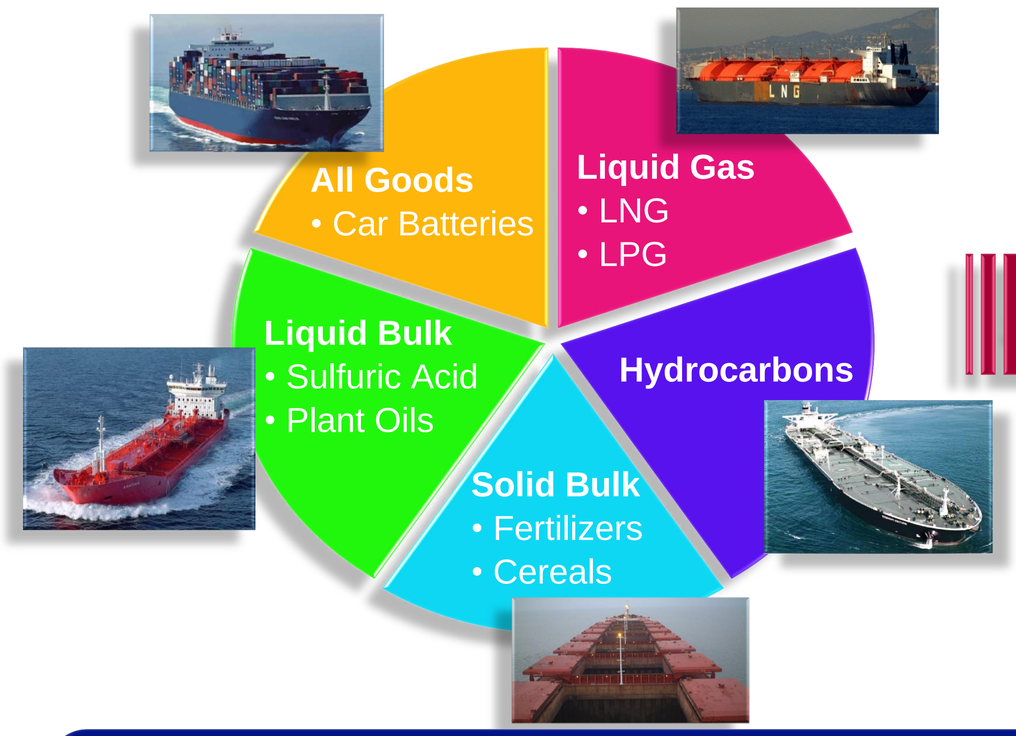
Time - Resolved Pure Phase DH

Future Results …

Large Seawater 4m-high Column

MARINE POLLUTION

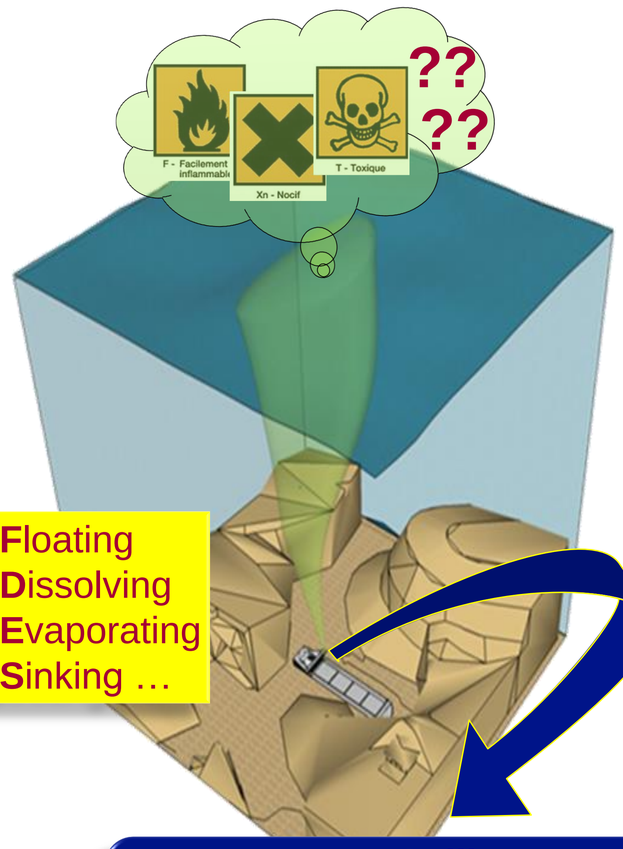
Super Tankers and Deep Water



Hazardous
Noxious
Substances

SHIPWRECK

Floating
Dissolving
Evaporating
Sinking …



Solid
Liquid
Gas

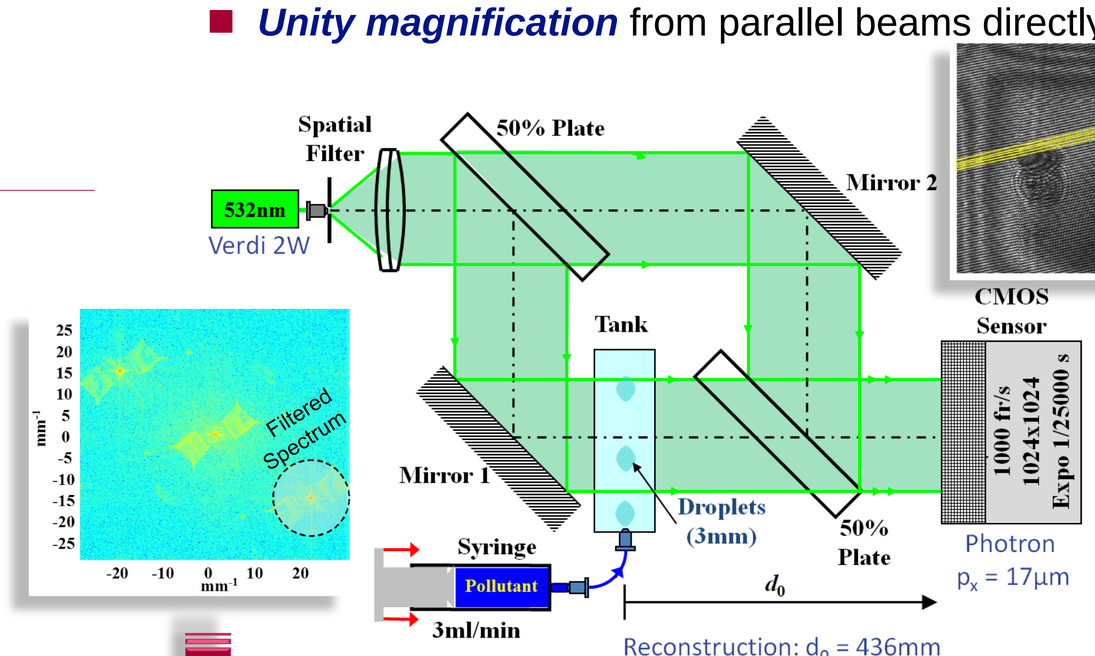
Deep Spill
Pressure: 800m => ~80bar
Temperature: 800m => ~277K

IDENTIFICATION OF THE BEHAVIOUR OF HNS SUBSTANCES UNDER DEEP-SEA CONDITIONS

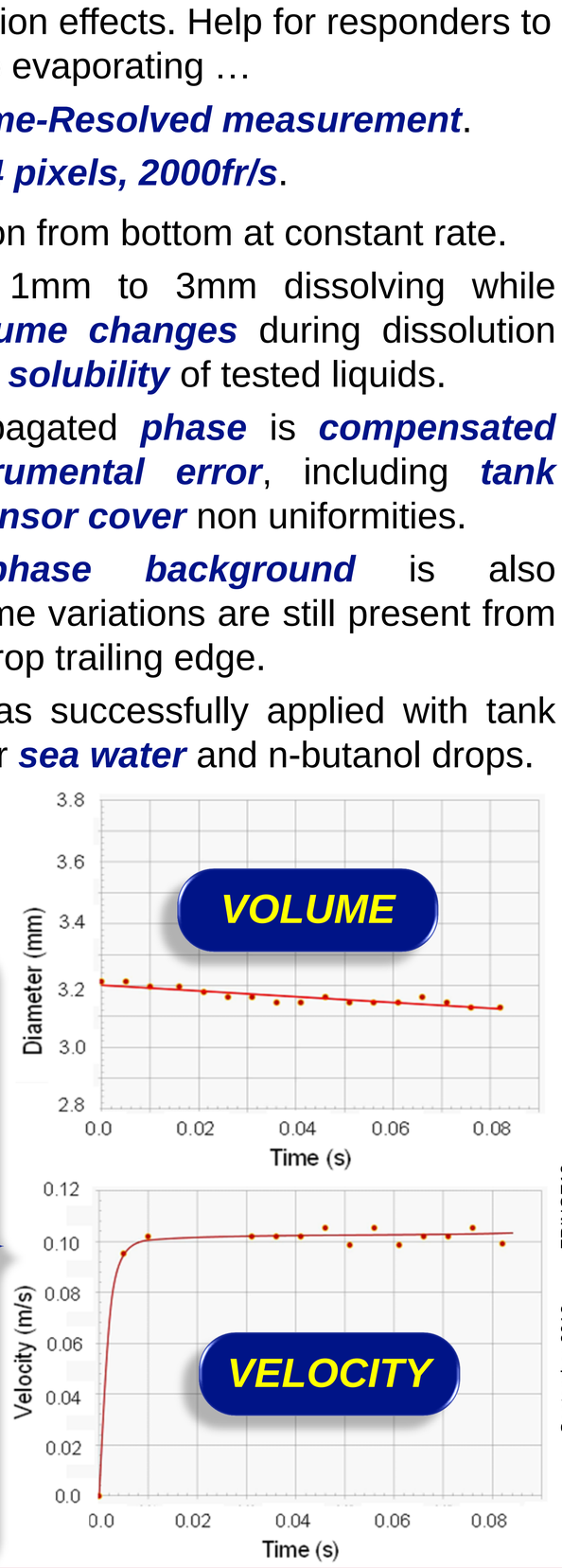
LAB EXPERIMENTS

Time-Resolved Pure Phase Digital Holography

- *n-butanol* is ***floating*** and ***dissolving*** product. Previous tests in diffuse backlight and direct shadowscopy have shown droplet behaviour, including ***trailing dissolution***.
- Trailing edge gives important information on ***droplet dynamics*** and dissolution effects. Help for responders to afford slick pollution at the water surface. Critical point if the pollutant is also evaporating …
- Mach-Zender interferometer with ***tilted beams*** enables ***interferometric Time-Resolved measurement***.
- ***Unity magnification*** from parallel beams directly on the sensor, ***1024*1024 pixels, 2000fr/s***.



- Pollutant injection from bottom at constant rate.
- Droplets from 1mm to 3mm dissolving while rising. The ***volume changes*** during dissolution and leads to the ***solubility*** of tested liquids.
- The back propagated ***phase*** is ***compensated*** from the ***instrumental error***, including ***tank*** variation and ***sensor cover*** non uniformities.
- Continuous ***phase background*** is also ***subtracted***, some variations are still present from the precedent drop trailing edge.
- The method was successfully applied with tank filled with ***soft*** or ***sea water*** and n-butanol drops.



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