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# Experimental investigation of gas hydrate plugging mechanisms in pipelines and the influence of the flow pattern

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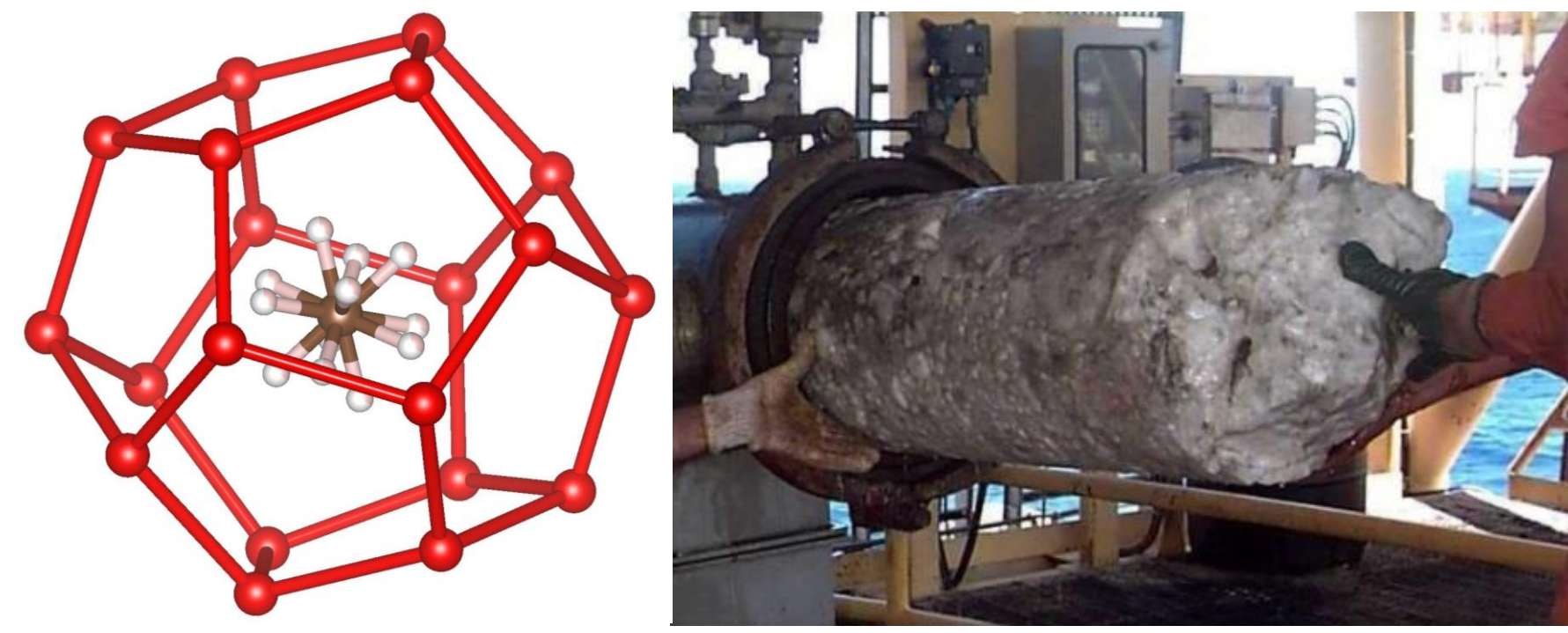
## Introduction

### Context

- Flow assurance with gas hydrates in oil and gas pipelines

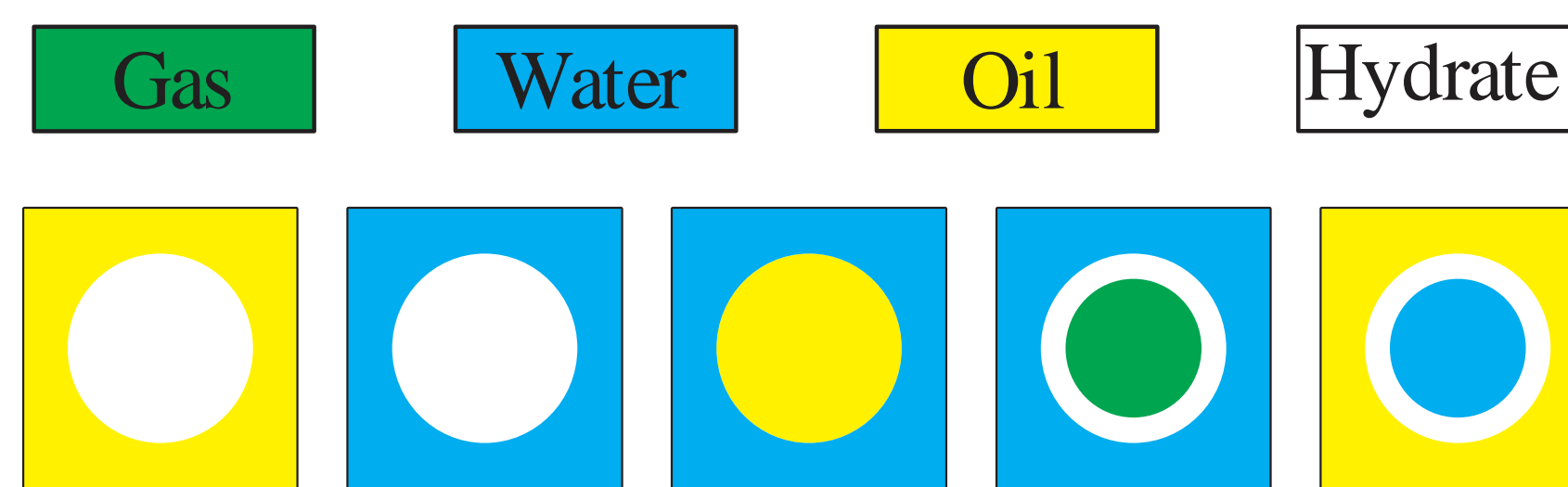
### Objectives:

- Influence of GLL flow pattern on hydrate formation and plugging
- Agglomeration and deposition over time and space
- Understanding the mechanisms of Anti Agglomerant additives



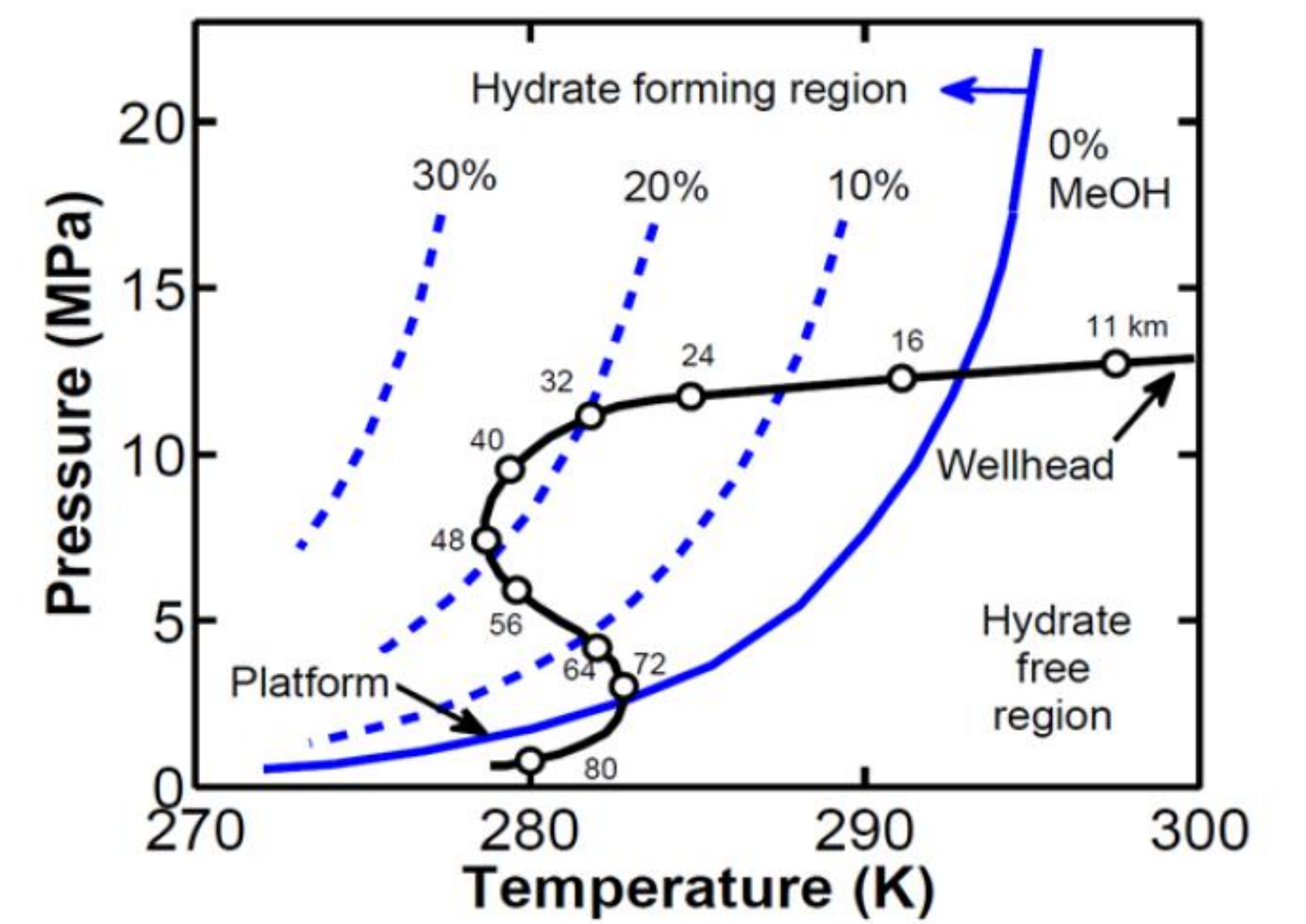
Cage S1 (WordPress, 2018)

Removal of a hydrate by Petrobras (Koh et al., 2011)



Hydrate particles morphology

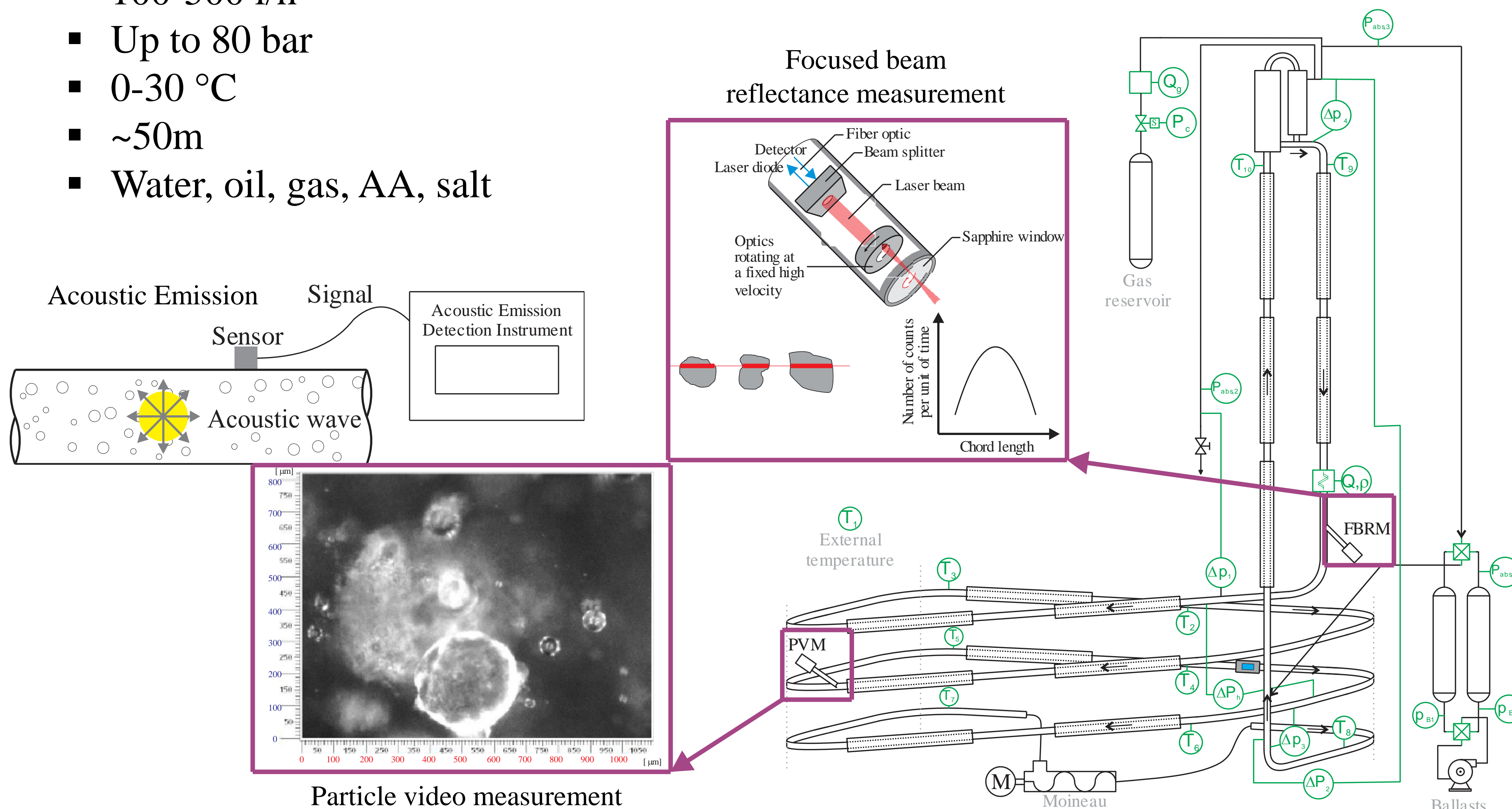
Typical hydrate formation pressures and temperatures in subsea flow line (Sloan et al. 2011)



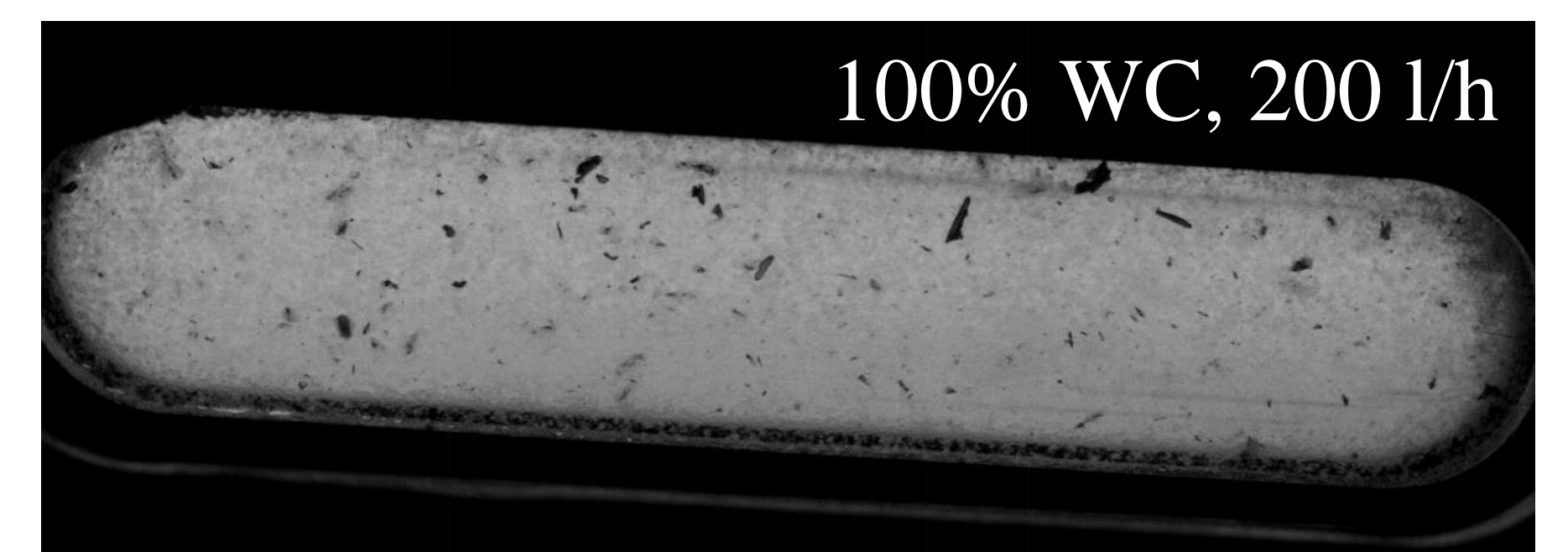
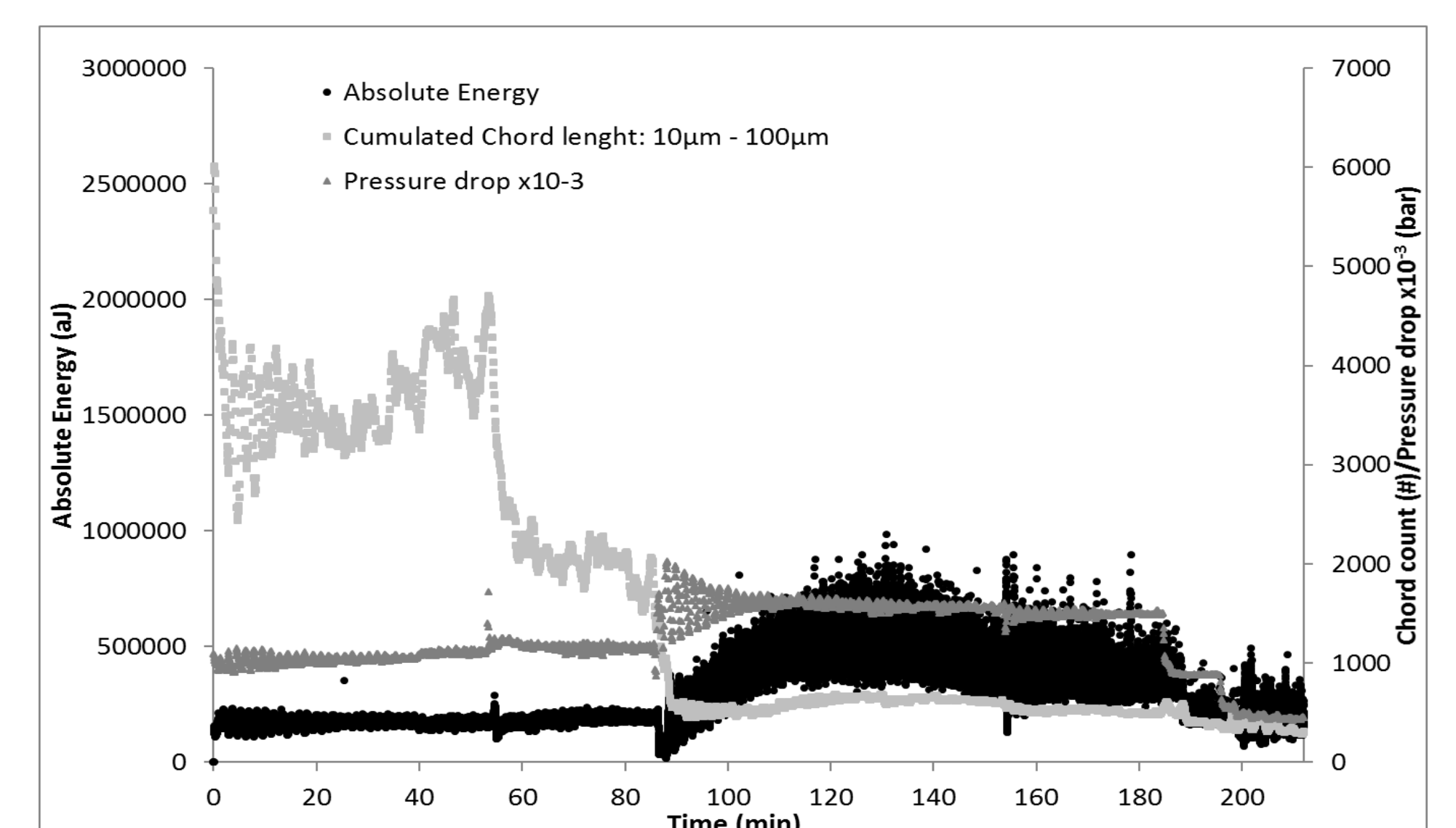
## Experimental methodology

### Operational conditions:

- 100-500 l/h
- Up to 80 bar
- 0-30 °C
- ~50m
- Water, oil, gas, AA, salt



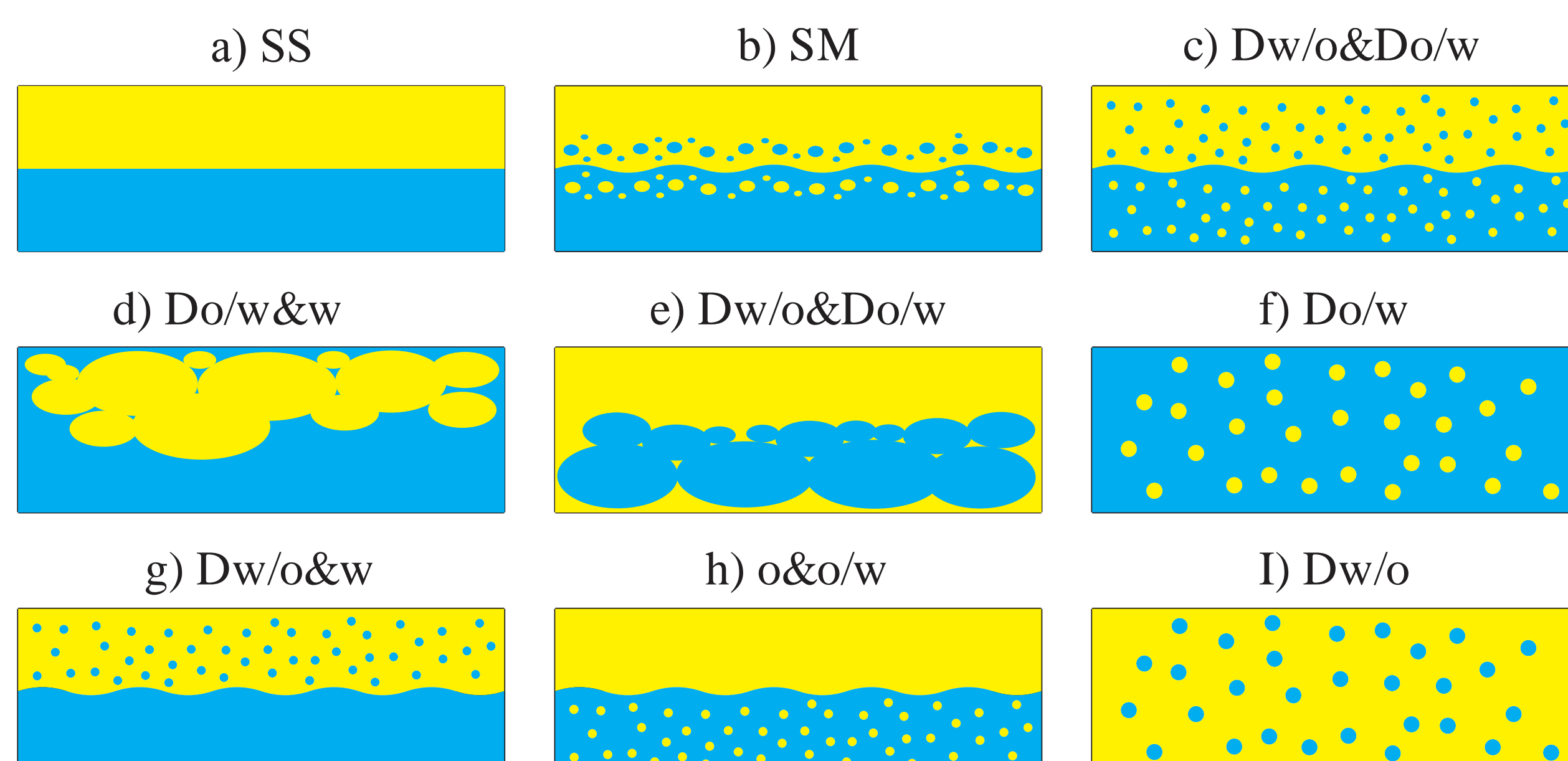
Pressure drop, chord length distribution and absolute energy for an experiment with 40% water cut and 400 L/h (gas injection at 56 min, hydrates formation onset at 85 min). (Cameirao et al., 2018)



High speed imaging showing hydrate crystals

## Expected results

- Plugging tendencies according to the oil-water flow pattern
- Influence of a commercial anti-agglomerant and salt



Oil-water flow patterns commonly reported in the literature (Adapted from Brauner, 2004)

## Conclusions

- Few understanding on literature about high water cut systems
- Acoustic emission to follow the crystallization, the flow and the deposition in the pipeline over time and space is a relatively new approach
- Anti-agglomeration behavior mechanisms are still not well understood
- Need to understand the effects of salt on reducing the risk of plugging

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