

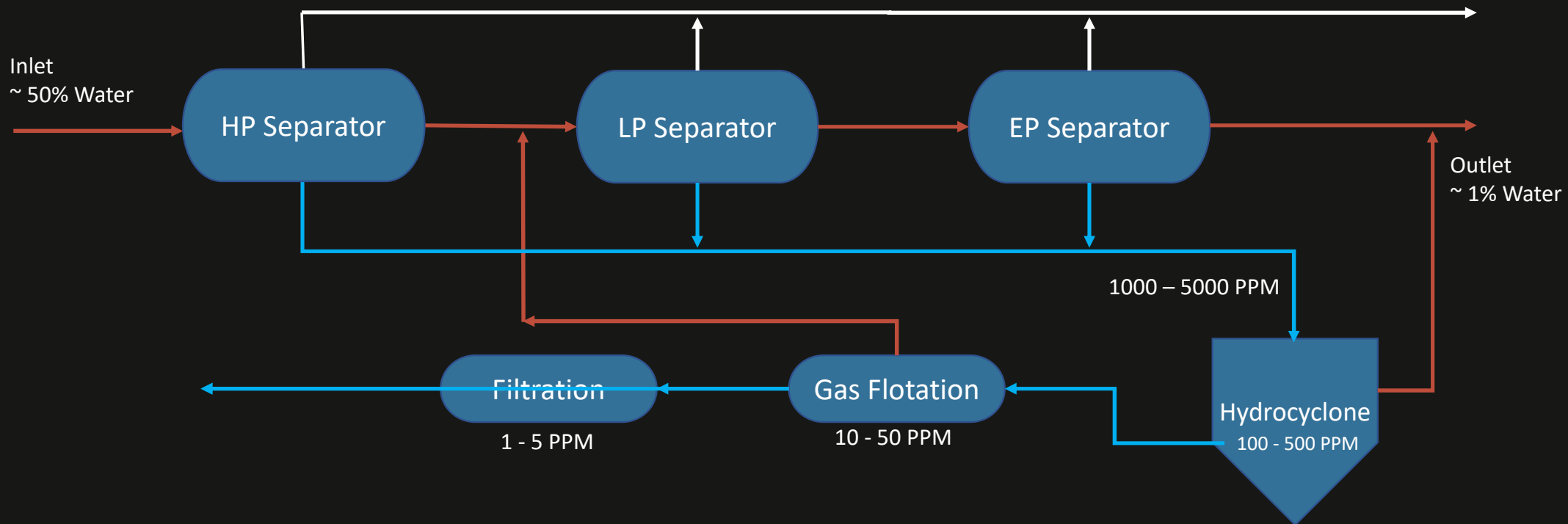


# Oil Slug Detection to optimized water treatment systems

- Chip Westaby
- Turner Designs Hydrocarbon Instruments, Inc.



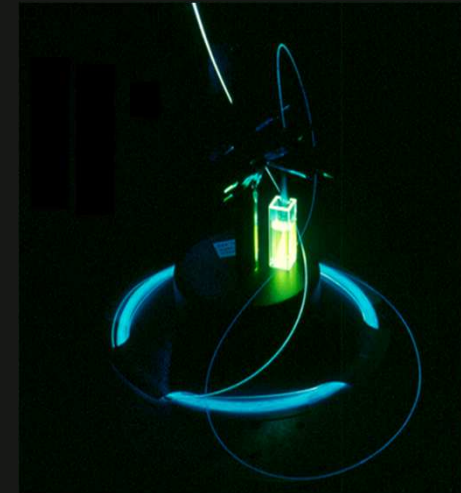
# “Typical Water Treatment System”



# Fluorescence Technology

## Oil IN WATER MONITOR

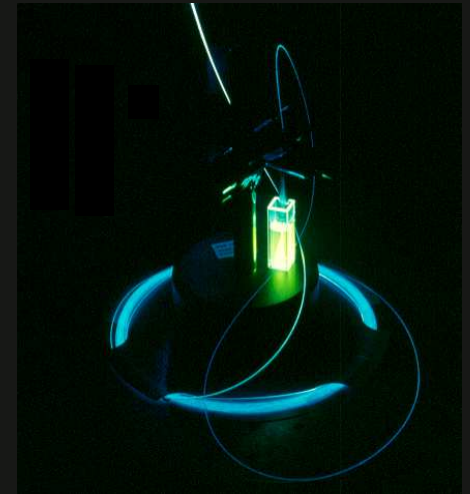
- ☞ Petroleum based oils and fuels absorb light and spontaneously emit fluorescent light at longer wavelengths
- ☞ Selected wavelengths can affect sensitivity and measurement range
- ☞ Fluorescence light intensity is linear with concentration
- ☞ Most common specified technology for produced water monitoring



# Fluorescence Technology

## Oil IN WATER MONITOR

- ☞ More sensitive than UV absorption, VIS, and IR
  - ☞ From 5 PPB to 5000 PPM depending on oil
- ☞ Can detect free, emulsified and water-soluble oils (WSO's)
  - ☞ Negligible turbidity effects
  - ☞ No significant effect from solids and gas



# Microwave

## Water IN OIL MONITOR

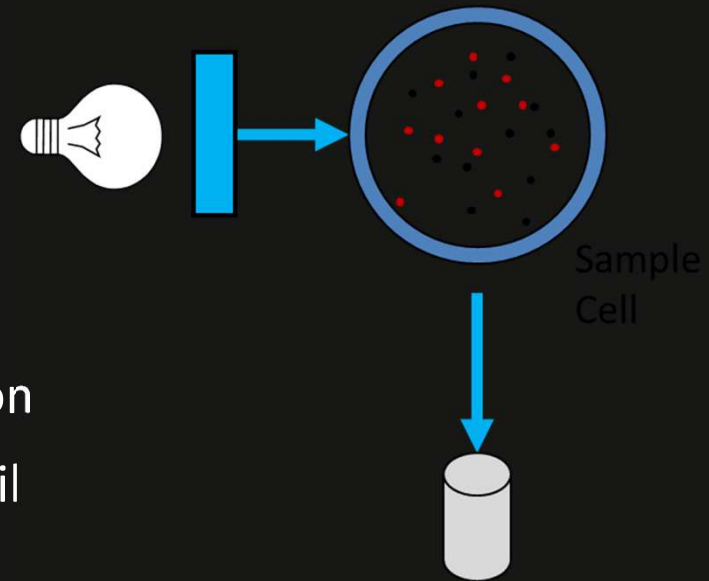
- ☞ Directly measures water concentration
- ☞ Assumes oil is everything that is not water
- ☞ Usually for low water content (10% water or less) – BS&W
  - ☞ Can measure up to 99% water in some circumstances
  - ☞ 0.1% to 1% water accuracy



# Turbidity / UV Absorption / Light Scatter

## Oil IN WATER MONITOR

- ☞ Optical measurement
- ☞ Directly measures light absorption / reflection
- ☞ Maintenance requirements increase when oil concentration rises
- ☞ Accuracy decreases when maintenance is needed



# Ultrasonic

## Oil IN WATER MONITOR

### Ultrasonic

- ☞ Measures oil above the concentration that UV Fluorescence can measure and below what microwave can measure
- ☞ No significant maintenance needed at high oil concentration
- ☞ No significant change in accuracy when some coating is present

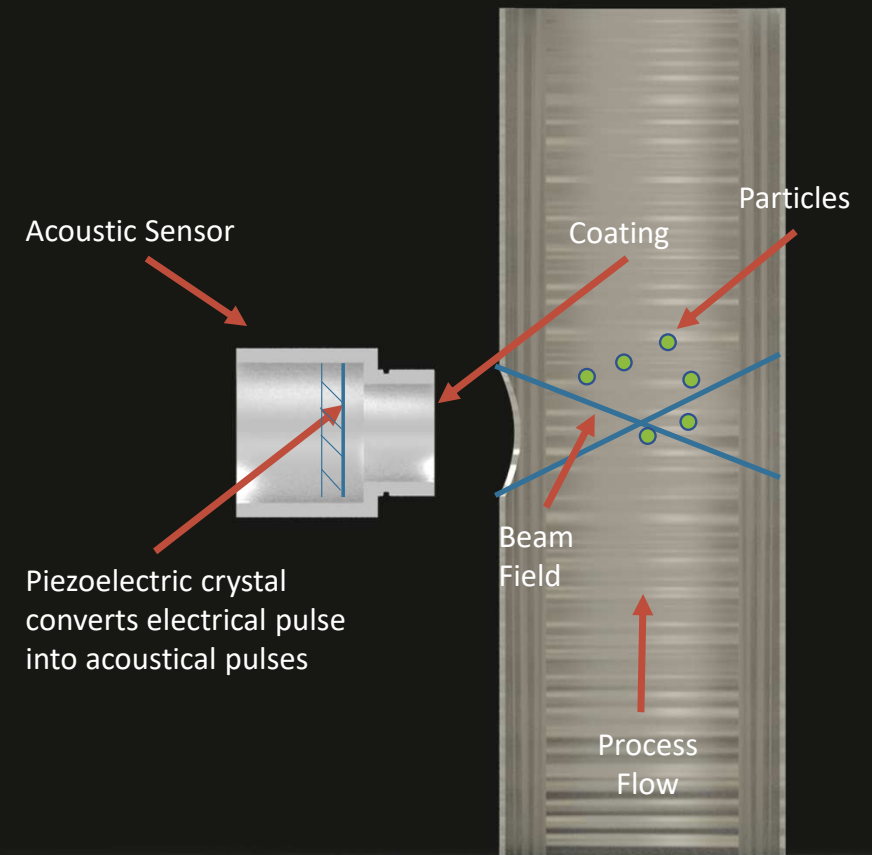


# Ultrasonic

## Oil IN WATER MONITOR

### ULTRASONIC MEASUREMENT METHOD

- 💧 Transducer applies electric pulse to a piezoelectric crystal creating acoustic energy
- 💧 Acoustic pulse emitted 128 times / sec at 5 or 15 mhz



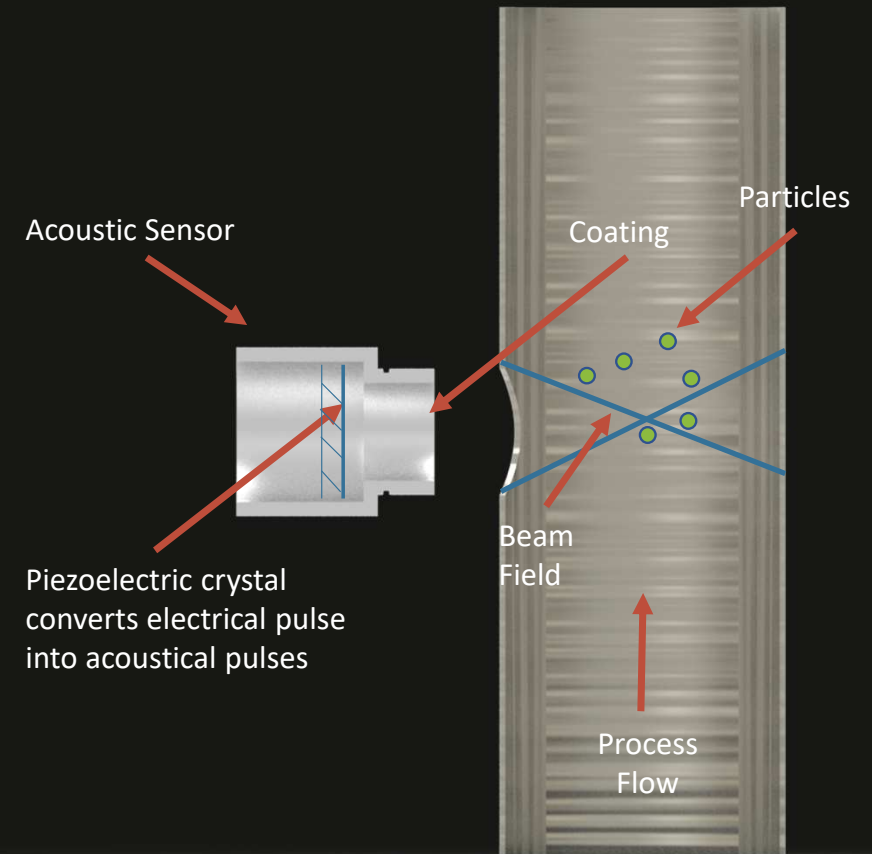


# Ultrasonic

## Oil IN WATER MONITOR

### ULTRASONIC MEASUREMENT METHOD

- Return “echo” reflected off particles in sample
- Amplified acoustic reflections compared to reference & converted to concentration

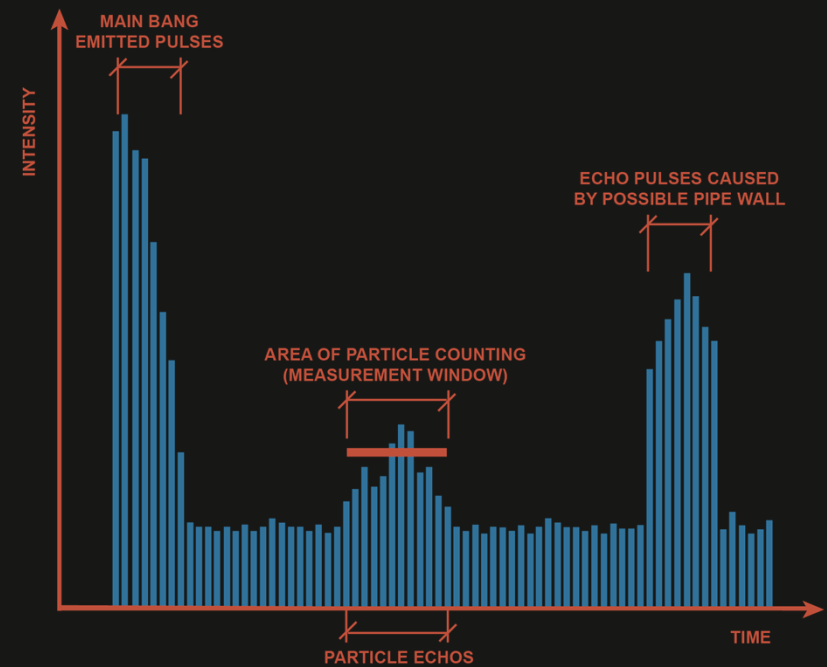


# Ultrasonic

## Oil IN WATER MONITOR

### ULTRASONIC MEASUREMENT METHOD

- Main Bang – Amplified acoustic reflections compared to reference and converted to concentration
- Receiver Window— Acoustic reflections counted

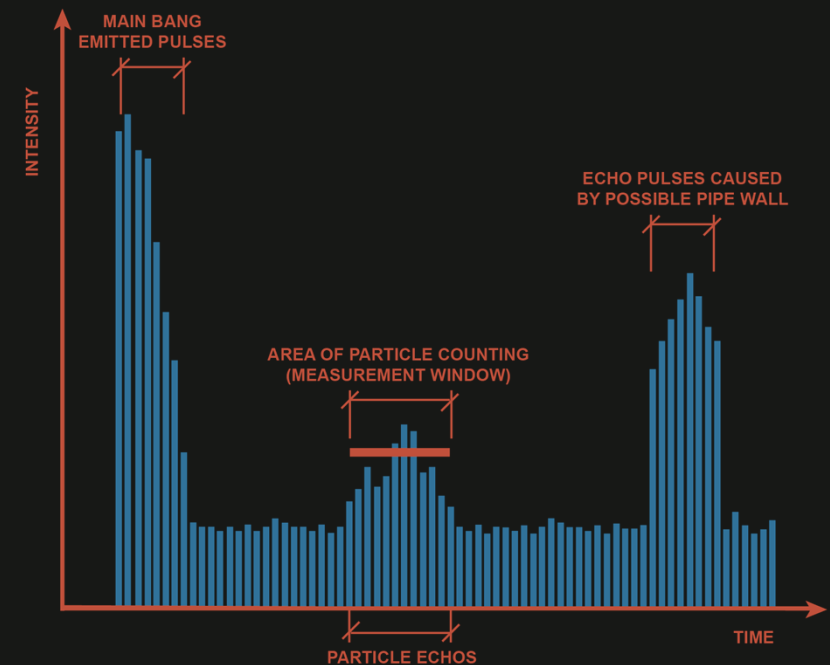


# Ultrasonic

## Oil IN WATER MONITOR

### ULTRASONIC MEASUREMENT METHOD

- Far Wall – Acoustic reflections from inside pipe transducer
- Detection Threshold — Reflection must reach defined level before being counted



# Ultrasonic

## Oil IN WATER MONITOR

### Measurement of Water Process in SAG-D

- ☞ Steam Assisted Gravity Drainage production in Alberta, Canada
- ☞ High temperature and pressure steam is recycled for enhanced oil production



# Ultrasonic

## Oil IN WATER MONITOR

### Measurement of Water Process in SAG-D

- Free oil measurement is very difficult with Fluorescence
- 10+ Ultrasonic Monitors installed at 1 location with good performance



# Ultrasonic

## Oil IN WATER MONITOR

### Feature

Low Maintenance

Probe easy removal

1 sec response time

Robust sensor design

### Advantage

Works even while coated

Will not disrupt process

Quickly alert DCS of upset

Handles 150°C and 260 psi

High pressure available

### Benefit

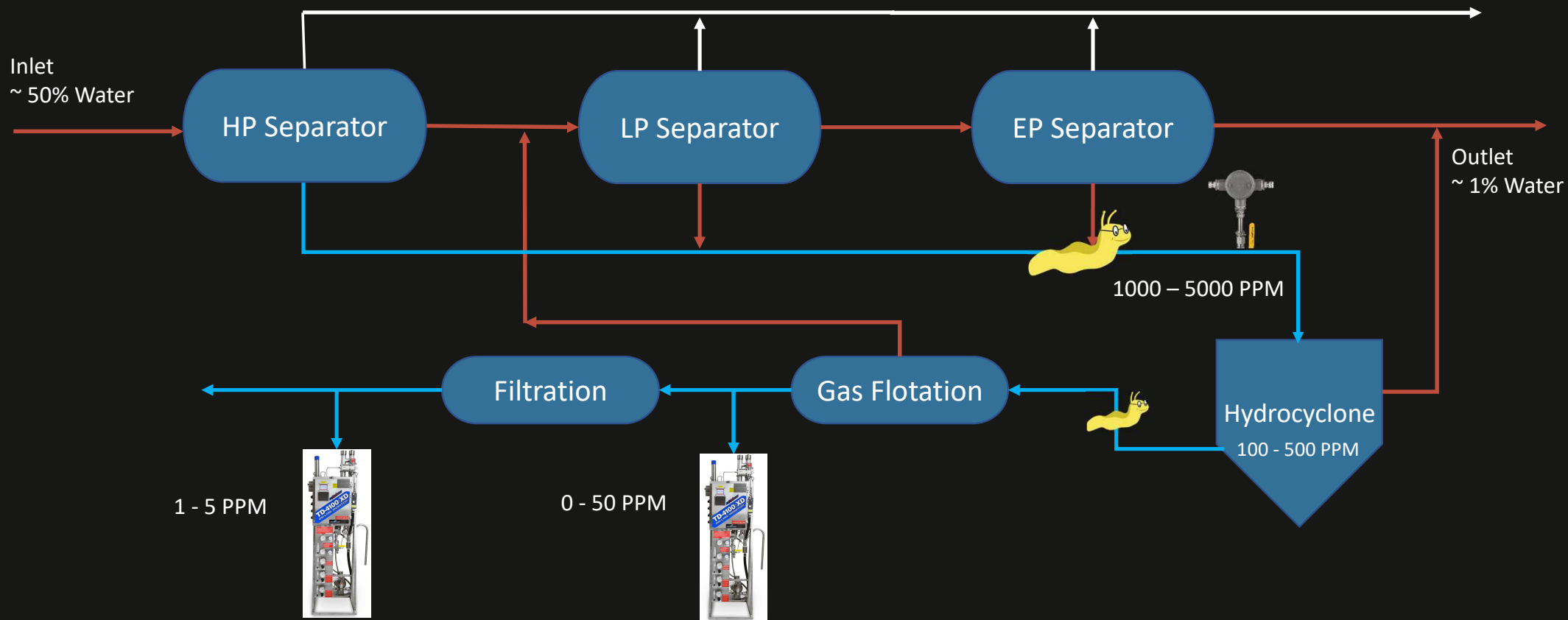
Measurement after slugs

Quickly check status

Process control / optimization

Installation in upstream processes

# “Typical Water Treatment System”



# Ultrasonic

**Oil** IN WATER MONITOR

QUESTIONS?



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