



## **KAM® ML MEASUREMENT LOOP**

CREATING A CONSISTENT ENVIRONMENT FOR MEASUREMENT

## THE KAM ML MEASUREMENT LOOP



### ABOUT THE ML MEASUREMENT LOOP

Accurate oil/water measurement is a function of velocity. In production, insufficient or inconsistent velocity leads to inaccurate oil/water measurement.



## THE KAM ML MEASUREMENT LOOP



In addition, factors such as viscosity, inconsistent droplet ratio, temperature and more can make it difficult or impossible to achieve a homogenous mixture for accurate measurement.

**NO HOMOGENEITY= NO ACCURACY**

## THE KAM ML MEASUREMENT LOOP



The unique design of the KAM ML Measurement Loop creates a consistent measurement environment with a consistent velocity above 7 fps.

- consistent velocity
- consistent droplet size ratio
- consistent homogeneity
- consistent accuracy

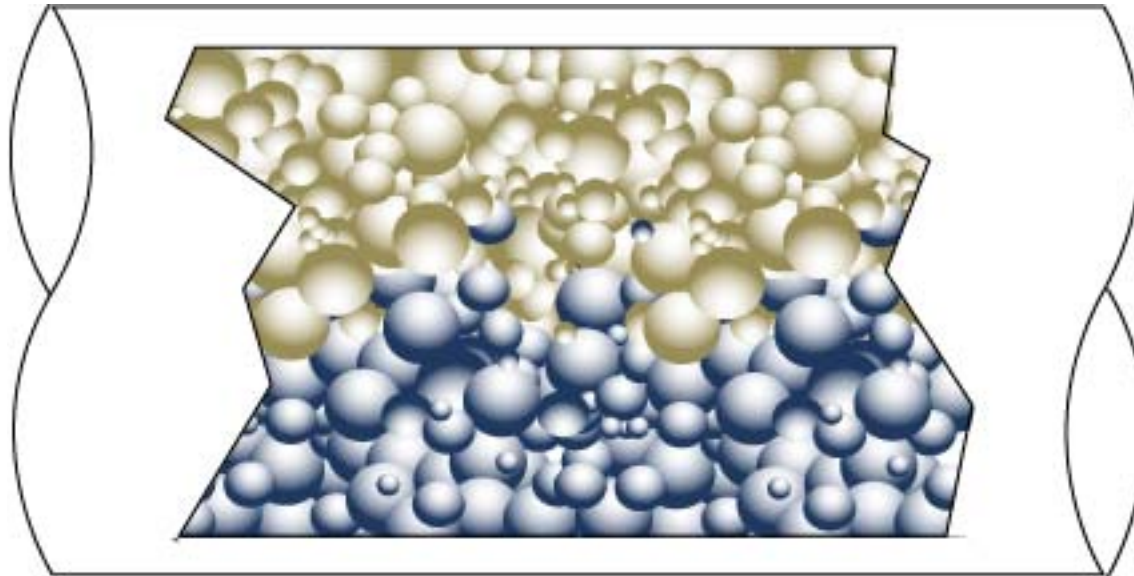


*Regardless of viscosity, velocity, and temperature*

## THE KAM ML MEASUREMENT LOOP



### HORIZONTAL INSTALLATION

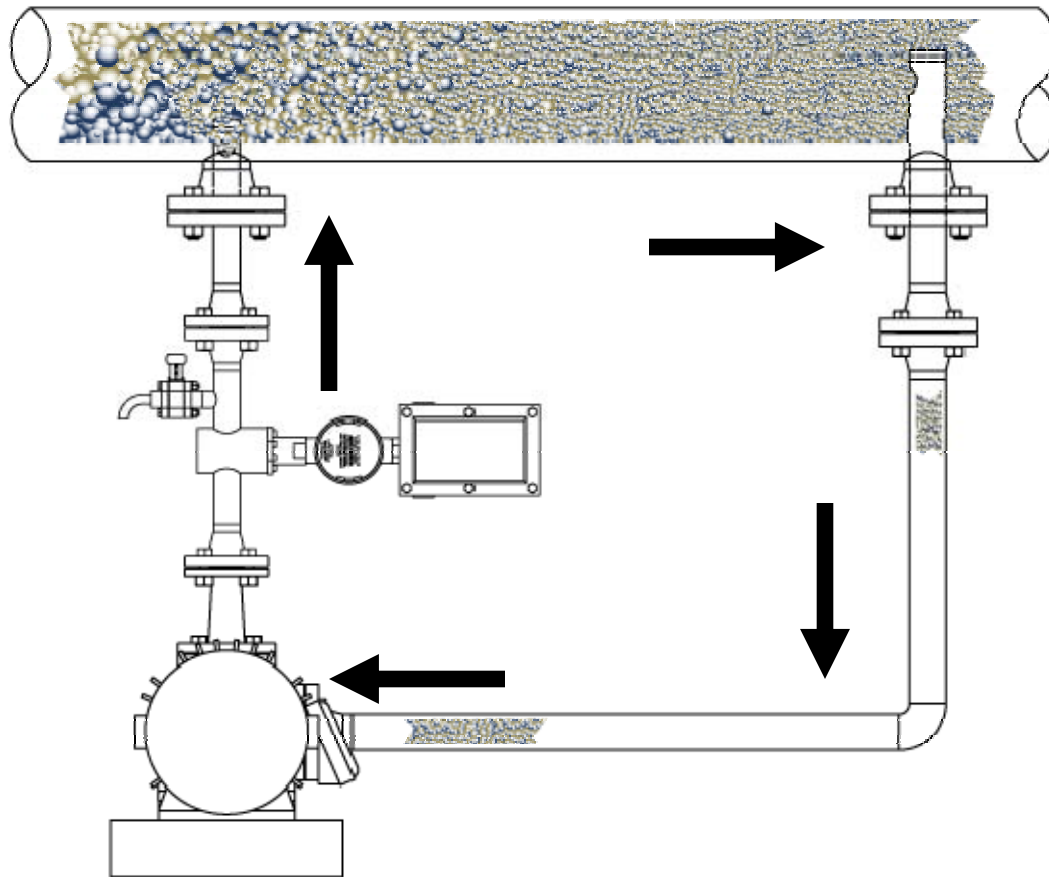


A stratified, low-velocity flow is impossible to measure accurately. Bringing it to API measurement standards can be difficult and expensive.

# THE KAM ML MEASUREMENT LOOP



## HORIZONTAL INSTALLATION

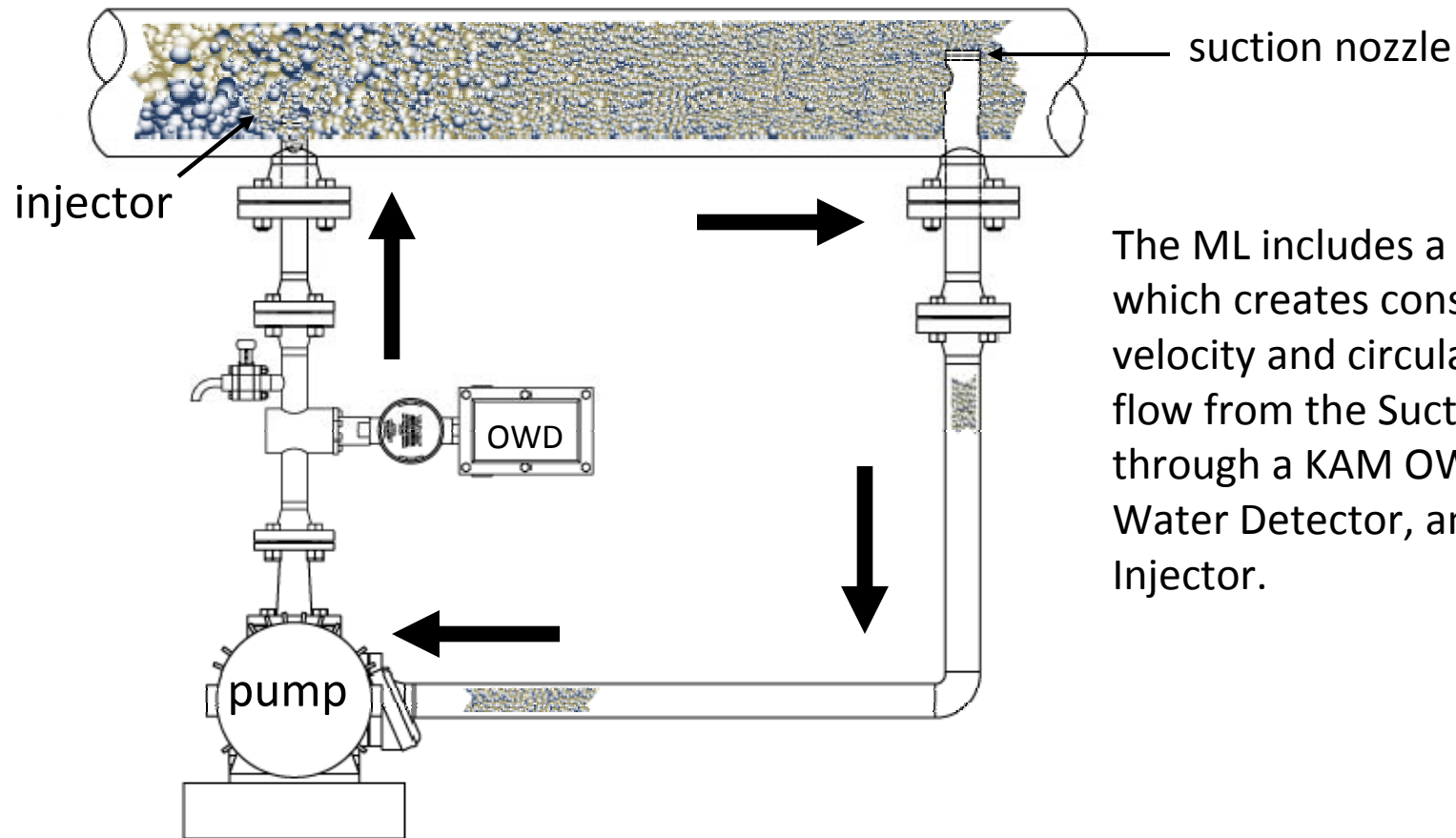


The KAM ML Measurement Loop creates a consistent velocity, and homogeneity fully compliant with API Chapter 8.2

# THE KAM ML MEASUREMENT LOOP



## HORIZONTAL INSTALLATION

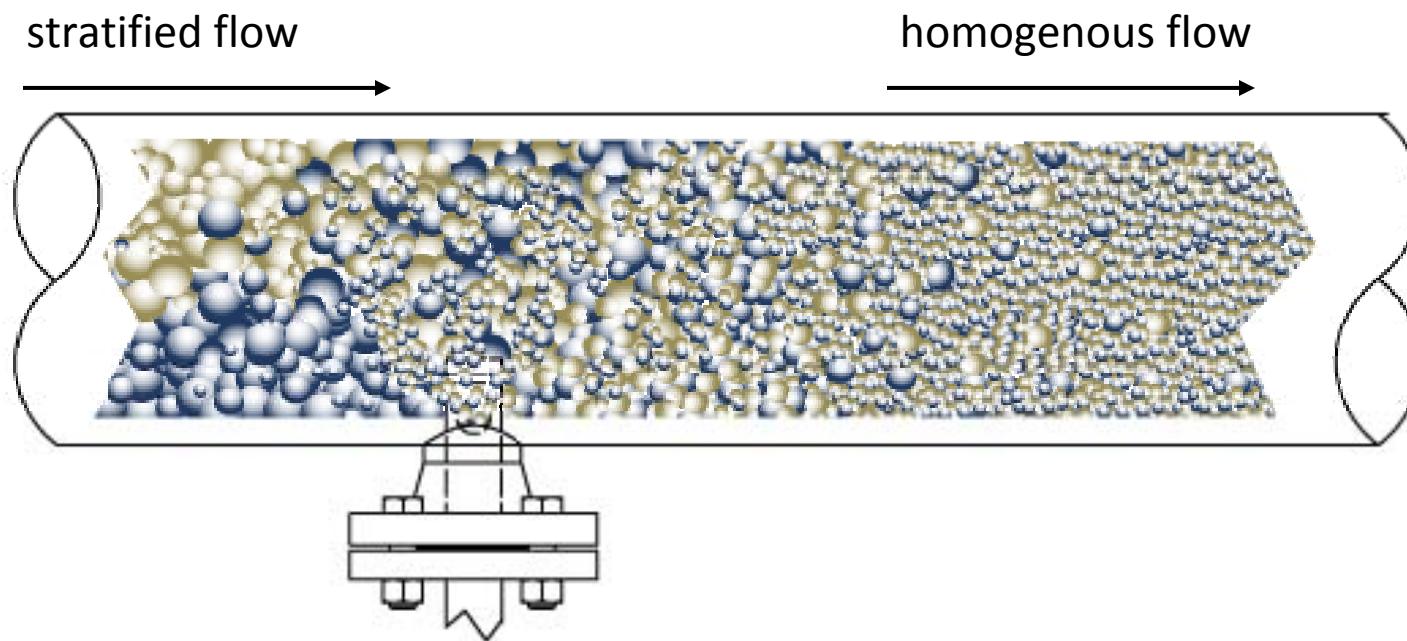


The ML includes a pump which creates consistent velocity and circulates the flow from the Suction Nozzle, through a KAM OWD Oil Water Detector, and out of an Injector.

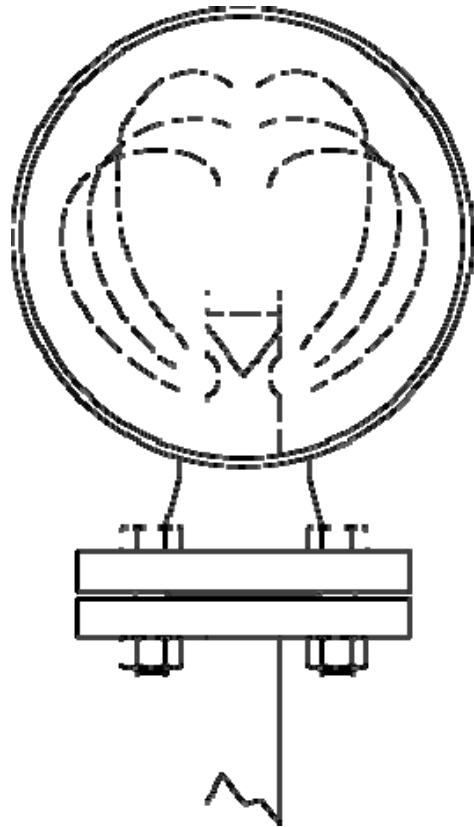
## THE KAM ML MEASUREMENT LOOP



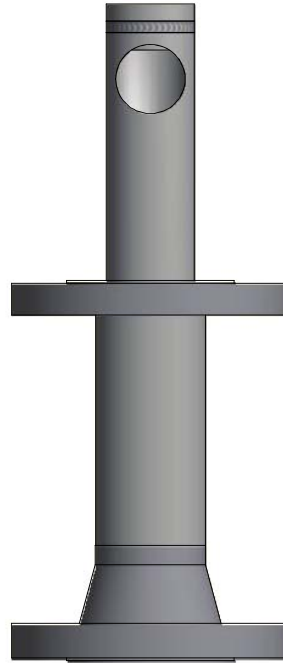
The unique design of the injector creates a turbulent flow with homogeneity and a consistent water/oil droplet size ratio.



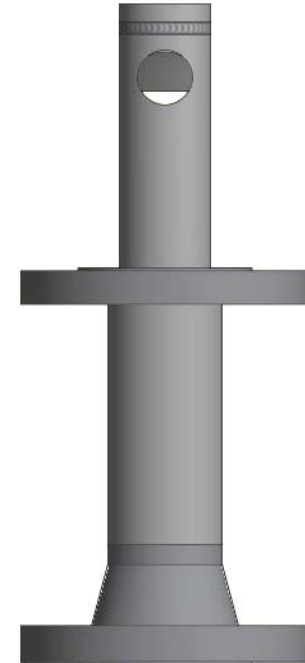
# THE KAM ML MEASUREMENT LOOP



Flow Pattern at  
Injector Discharge



Suction  
Nozzle



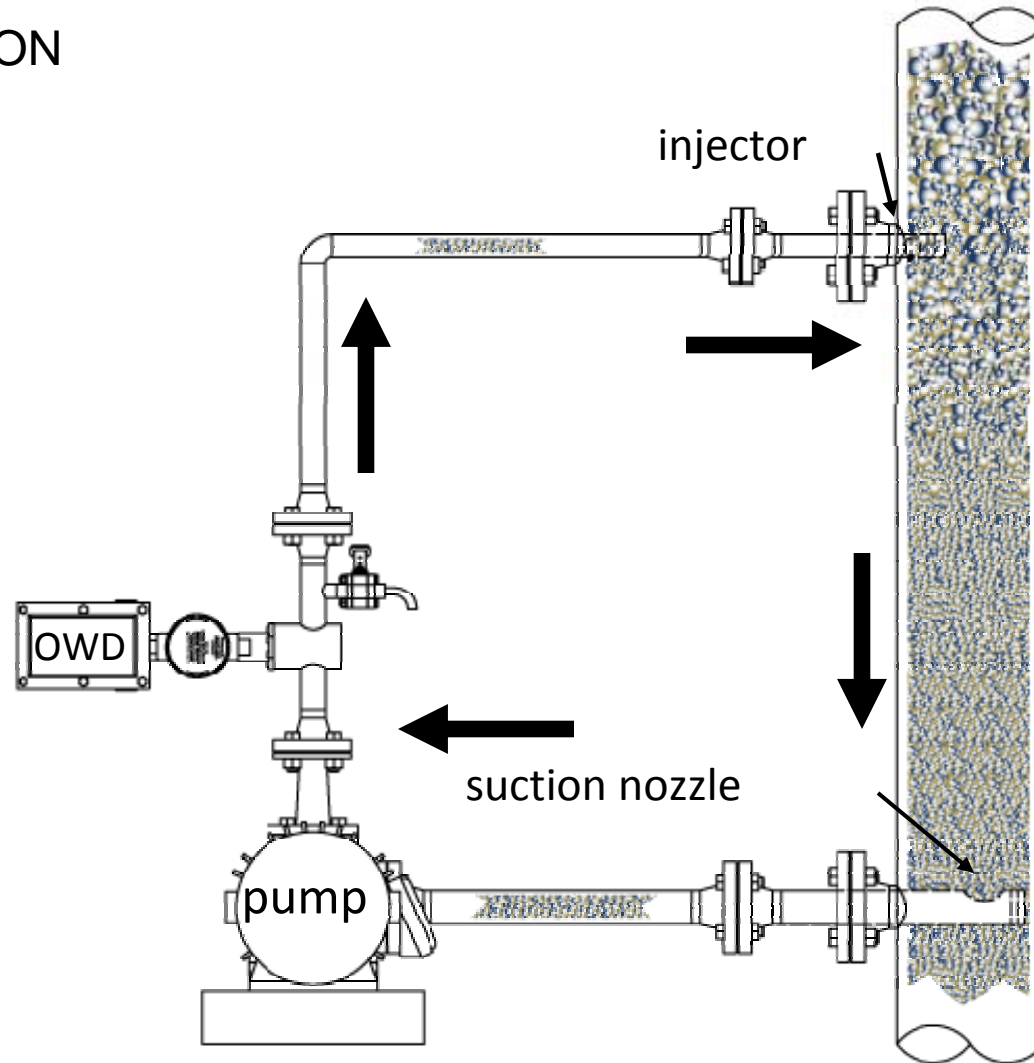
Injection  
Nozzle

# THE KAM ML MEASUREMENT LOOP



## VERTICAL INSTALLATION

Even in a vertical installation velocity and droplet size inconsistencies can lead to inaccurate measurement.



## THE KAM ML MEASUREMENT LOOP



### SOME DETAILS

- Loop size: 1.5"
- Main pipeline: 2" and up
- Suction nozzle: 1.5"
- Injector: 1.5"



## THE KAM ML MEASUREMENT LOOP



### ABOUT THE KAM OWD OIL WATER DETECTOR

- Patented 3-antenna design
- Automatically shifts between oil continuous and water continuous phases
- True 0-100% range
- Automatically adjusts for temperature
- No salinity offset required



## THE KAM ML MEASUREMENT LOOP



### APPLICATIONS

- AWT Automated Well Test
- Separator
- Production management and automation
- Custody transfer



SALES@KAM.COM

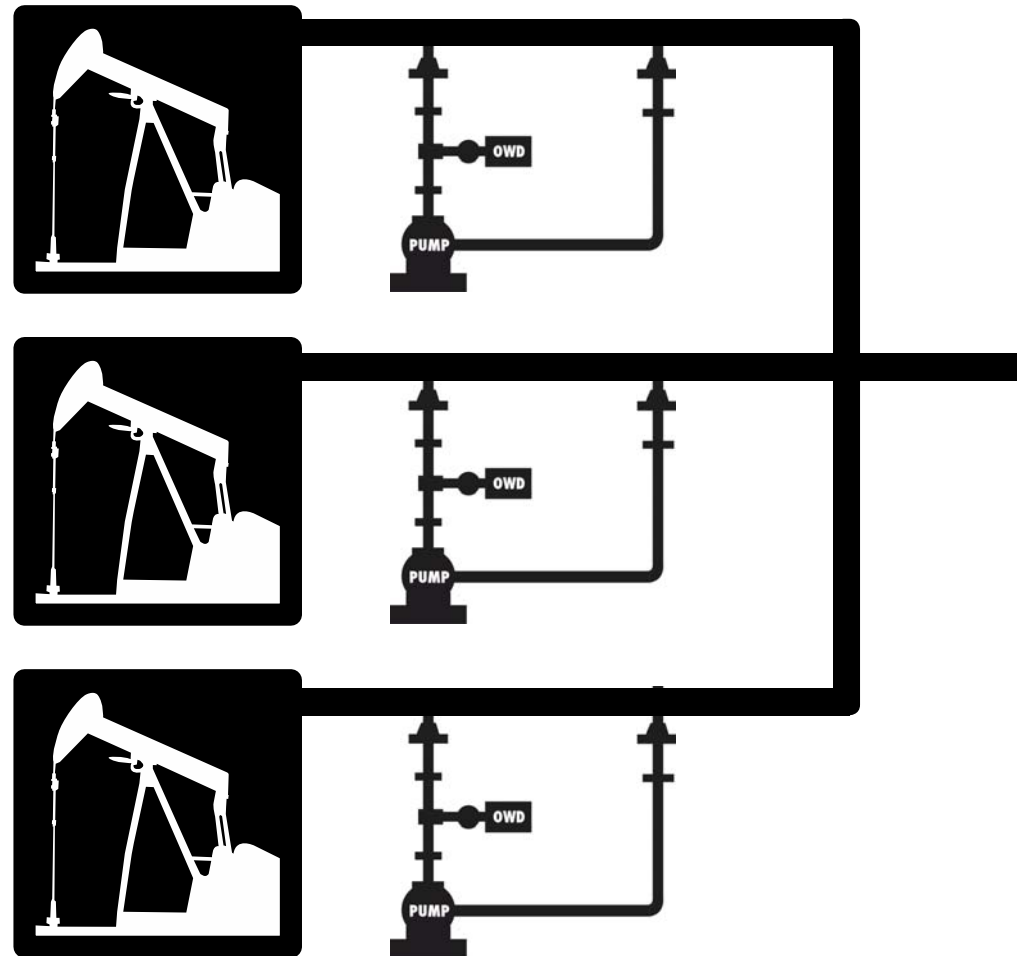
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## THE KAM ML MEASUREMENT LOOP

### APPLICATIONS

In an Automated Well Test (AWT) application, the measurement loop can be placed on the outflow pipe of each well . . .

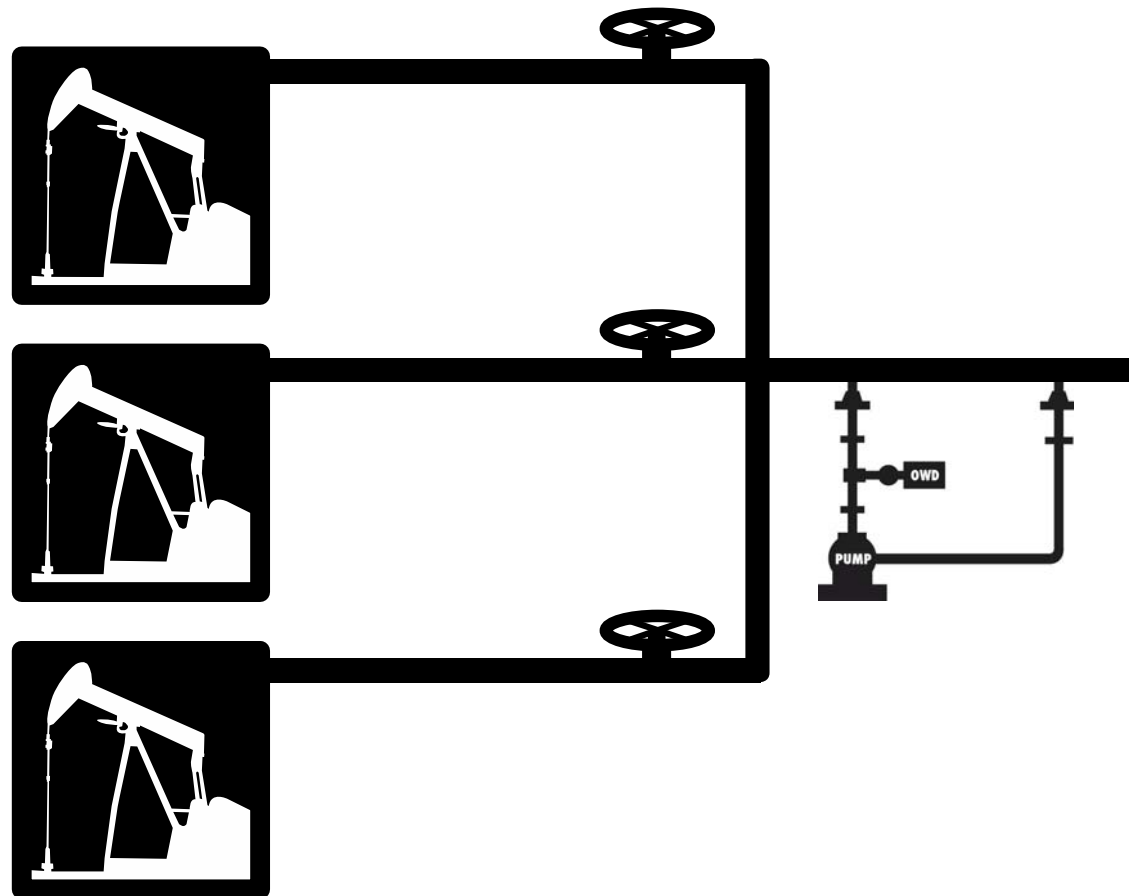


# THE KAM ML MEASUREMENT LOOP



## APPLICATIONS

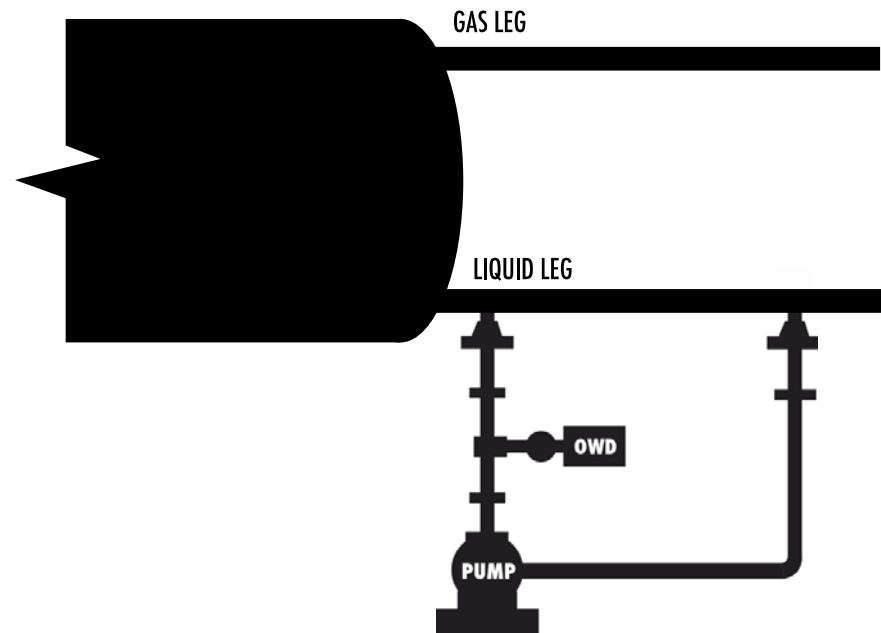
... Or on a central line downstream of multiple wells.



## THE KAM ML MEASUREMENT LOOP

### APPLICATIONS

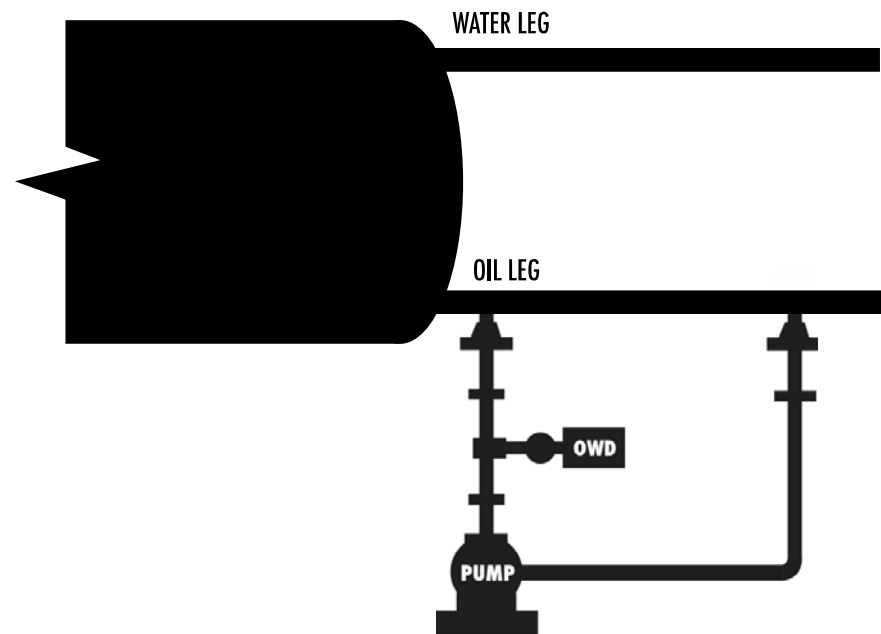
In a 2-phase separator application, the Measurement Loop can be placed on the liquid leg to monitor separator performance.



## THE KAM ML MEASUREMENT LOOP

### APPLICATIONS

In a 3-phase separator application, the Measurement Loop can be placed on the oil leg to monitor separator performance.

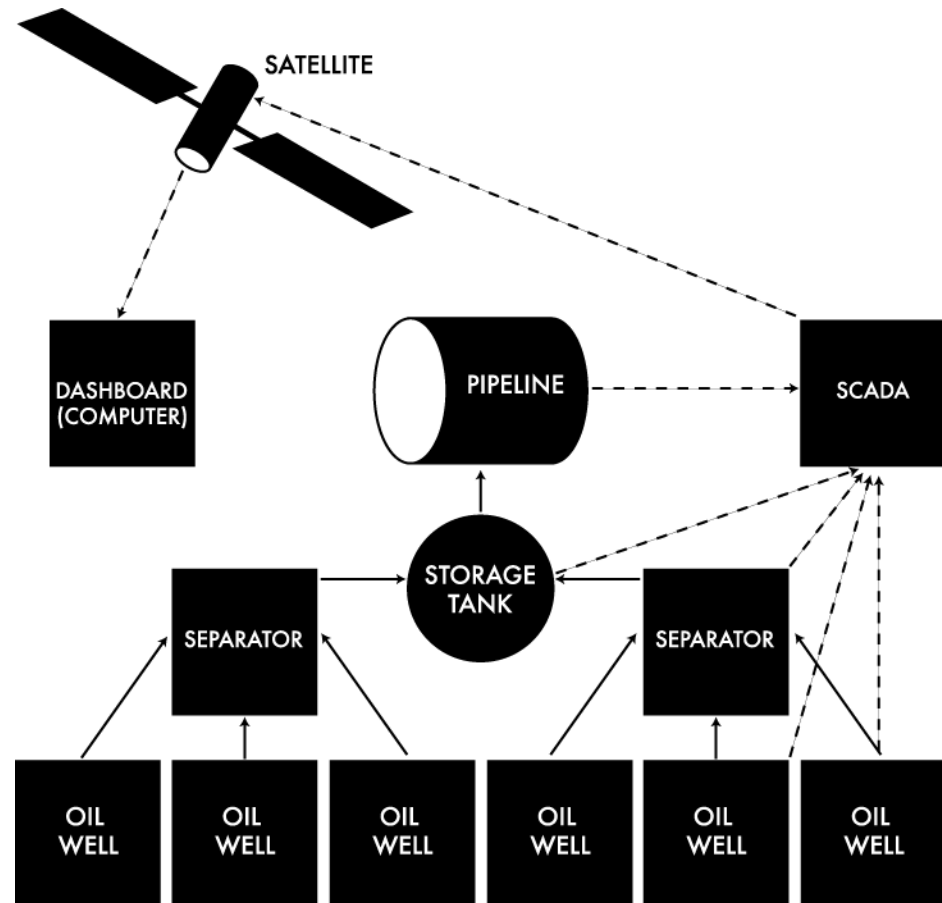


# THE KAM ML MEASUREMENT LOOP



## APPLICATIONS

Real-time oil/water data can be used to automate and optimize production management. Rather than rotating through shut-in and producing wells, operators can use data to optimize performance from high-producing wells. Data can be fed to a central computer and optimization can be based on a large number of criteria, including water content, flow rate, disposal capacity, transport capacity, energy prices, etc.



# THE KAM ML MEASUREMENT LOOP

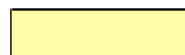


## APPLICATIONS

At no place is accurate oil/water measurement more important than custody transfer. Minor inaccuracies in measurement can result in major financial losses.

### ONE MILLION BARREL TRANSACTION

<b>COST/BARREL</b>	<b>0.05% ERROR</b>	<b>0.1% ERROR</b>	<b>0.5% ERROR</b>	<b>1% ERROR</b>	<b>2% ERROR</b>	<b>5% ERROR</b>
<b>\$30</b>	\$15,000	\$30,000	\$150,000	\$300,000	\$600,000	\$1,500,000
<b>\$40</b>	\$20,000	\$40,000	\$200,000	\$400,000	\$800,000	\$2,000,000
<b>\$50</b>	\$25,000	\$50,000	\$250,000	\$500,000	\$1,000,000	\$2,500,000
<b>\$60</b>	\$30,000	\$60,000	\$300,000	\$600,000	\$1,200,000	\$3,000,000
<b>\$70</b>	\$35,000	\$70,000	\$350,000	\$700,000	\$1,400,000	\$3,500,000
<b>\$80</b>	\$40,000	\$80,000	\$400,000	\$800,000	\$1,600,000	\$4,000,000
<b>\$90</b>	\$45,000	\$90,000	\$450,000	\$900,000	\$1,800,000	\$4,500,000
<b>\$100</b>	\$50,000	\$100,000	\$500,000	\$1,000,000	\$2,000,000	\$5,000,000



**POINT AT WHICH AN INSTALLED OWD PAYS FOR ITSELF IN A SINGLE MILLION BARREL TRANSACTION**

## THE KAM ML MEASUREMENT LOOP

### INSTALLATION DATA

An AWT installation in Colombia for PacificRubiales demonstrates the consistency and accuracy of the Measurement Loop versus sampling, in particular in high-water situations.



# THE KAM ML MEASUREMENT LOOP

## INSTALLATION DATA



KAM ML MEASUREMENT LOOP

KAM OWD

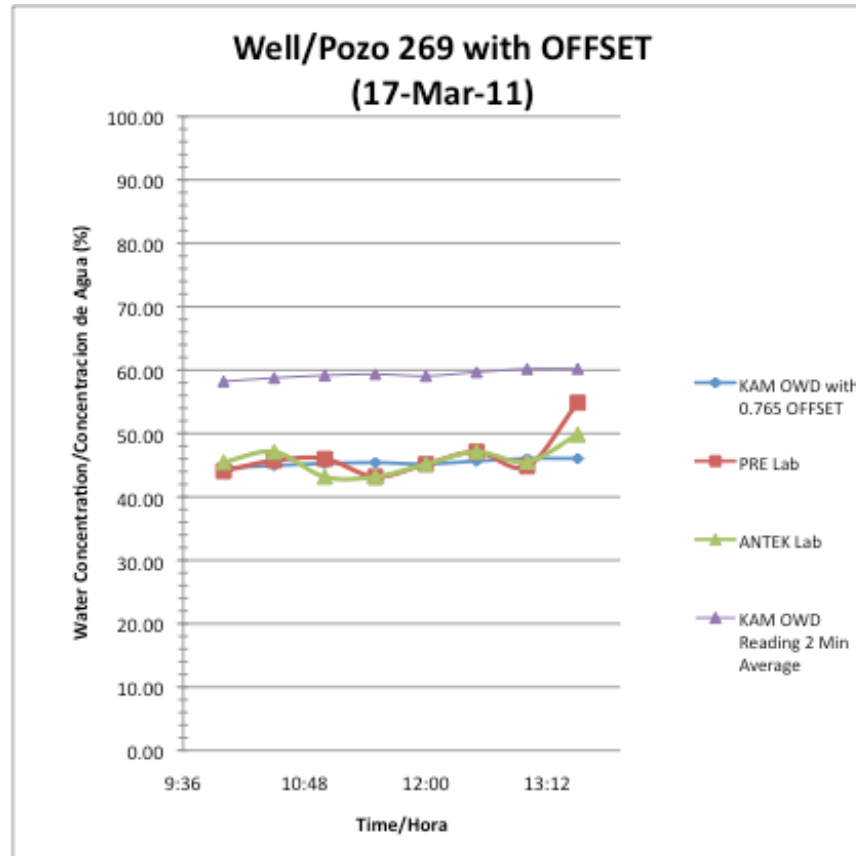
PUMP

# THE KAM ML MEASUREMENT LOOP



## INSTALLATION DATA

Measurement Loop vs. sampling

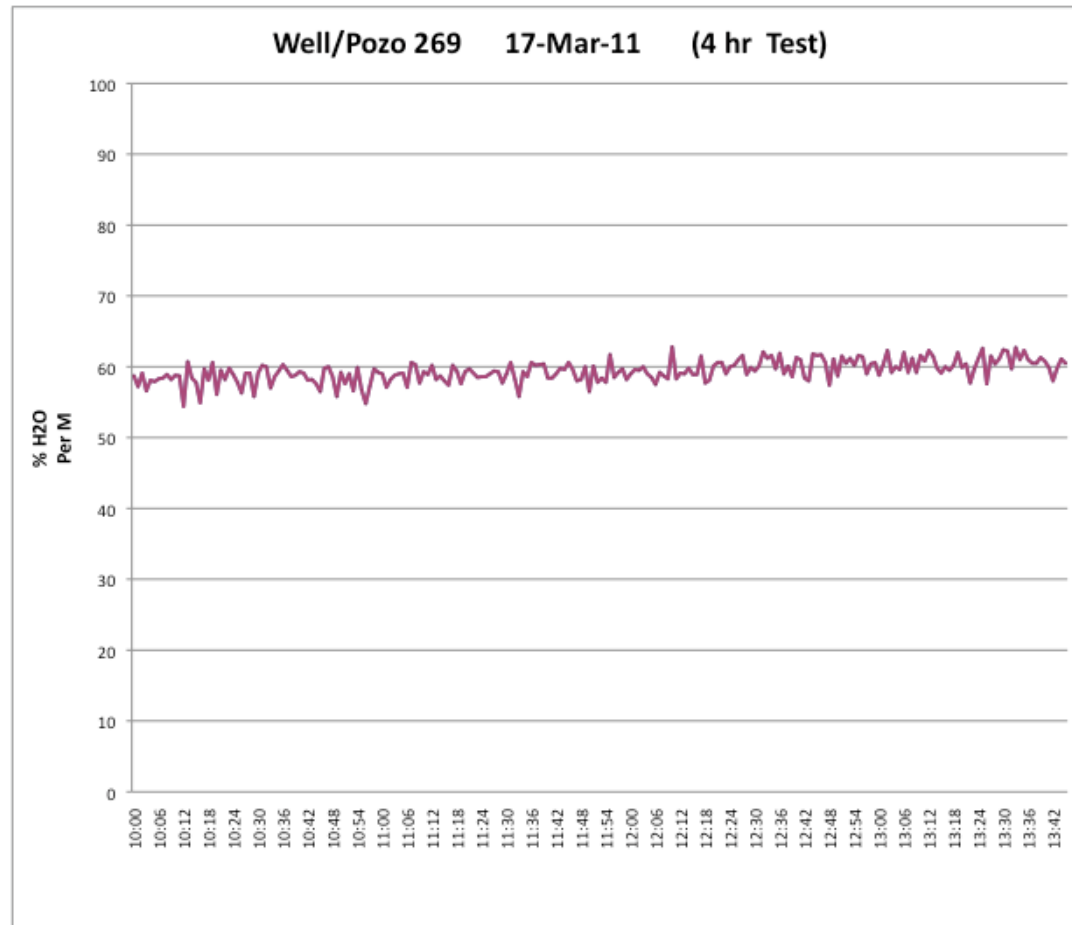


# THE KAM ML MEASUREMENT LOOP



## INSTALLATION DATA

4 hours of data  
from ML/OWD

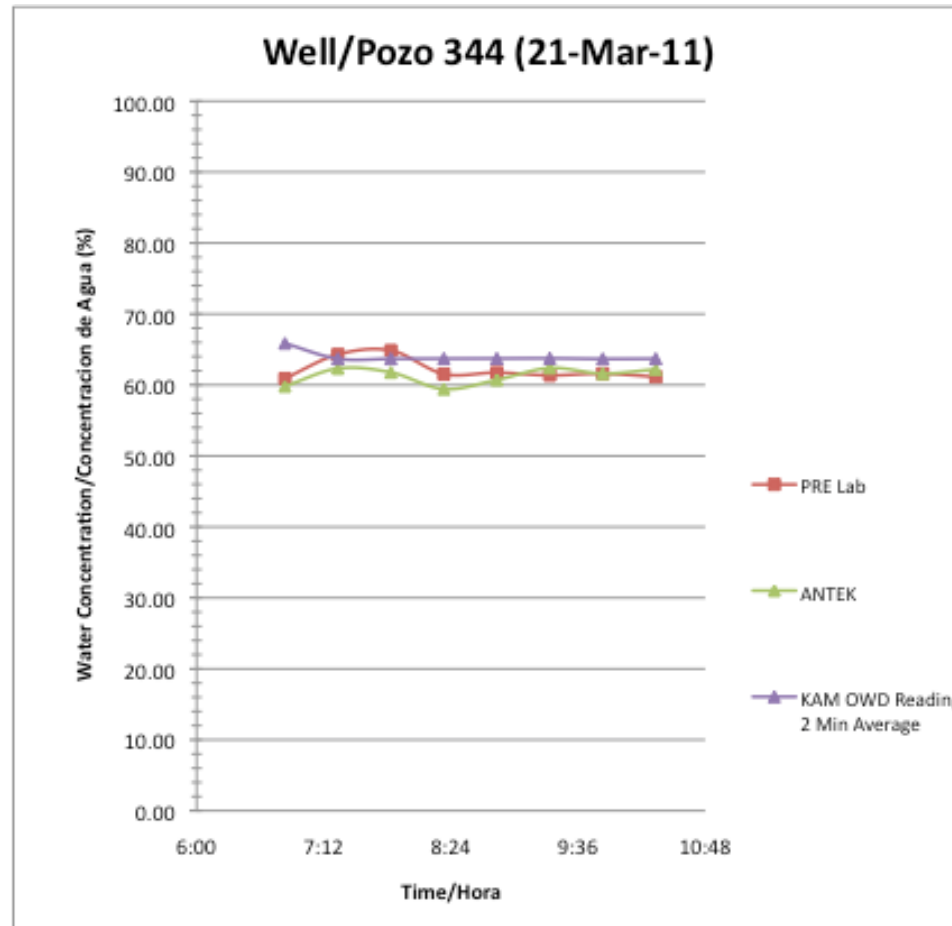


# THE KAM ML MEASUREMENT LOOP



## INSTALLATION DATA

Measurement Loop vs. sampling

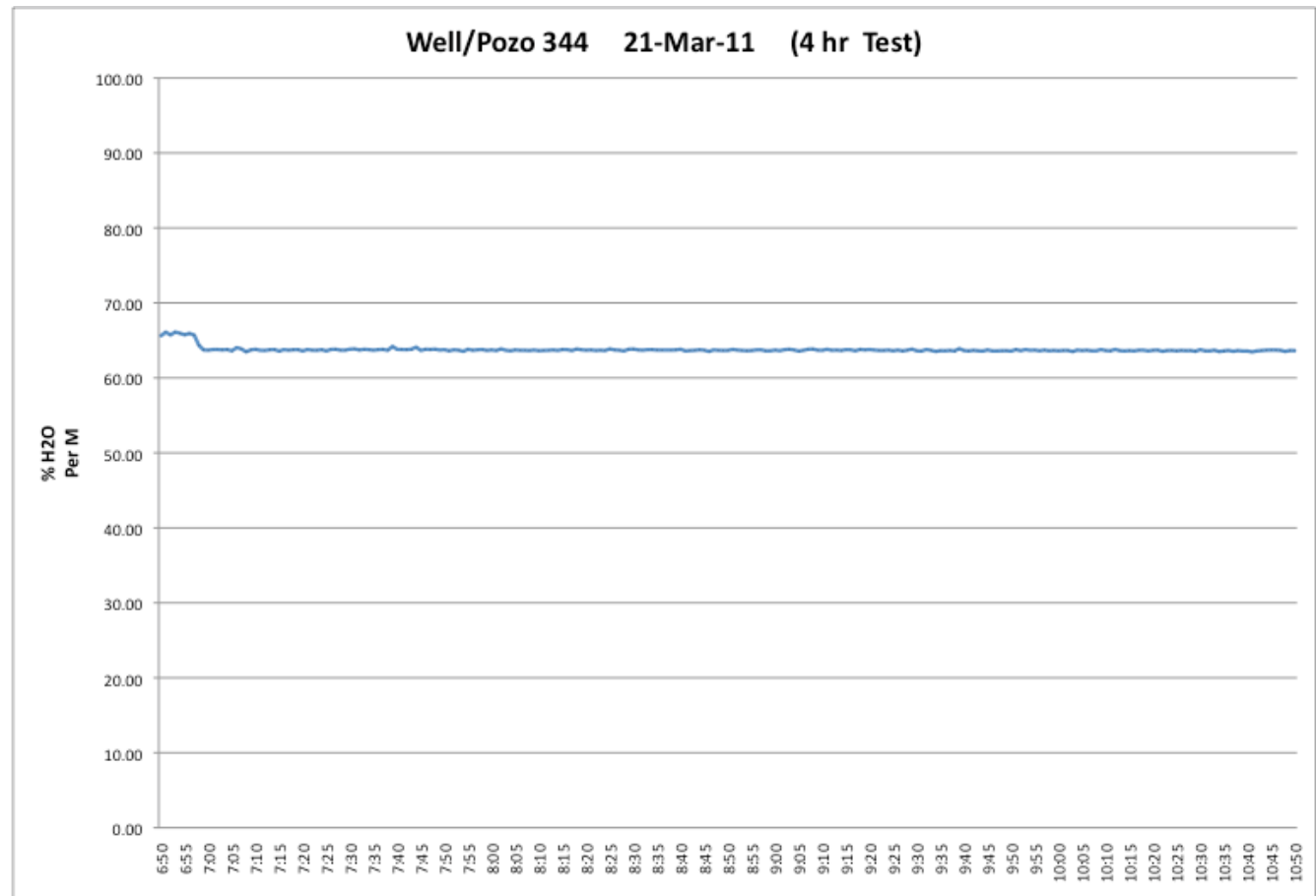


# THE KAM ML MEASUREMENT LOOP



## INSTALLATION DATA

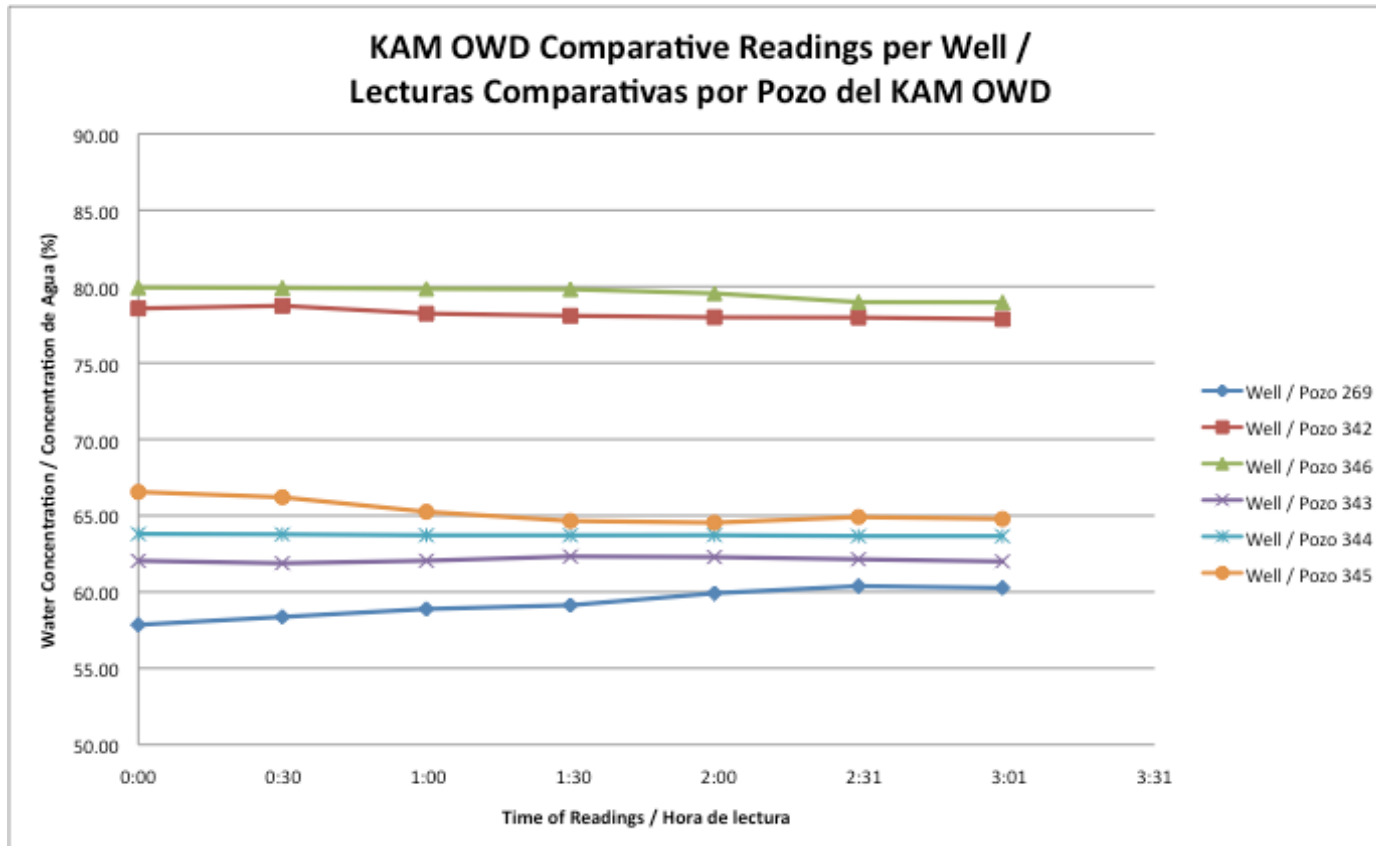
4 hours of data  
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# THE KAM ML MEASUREMENT LOOP



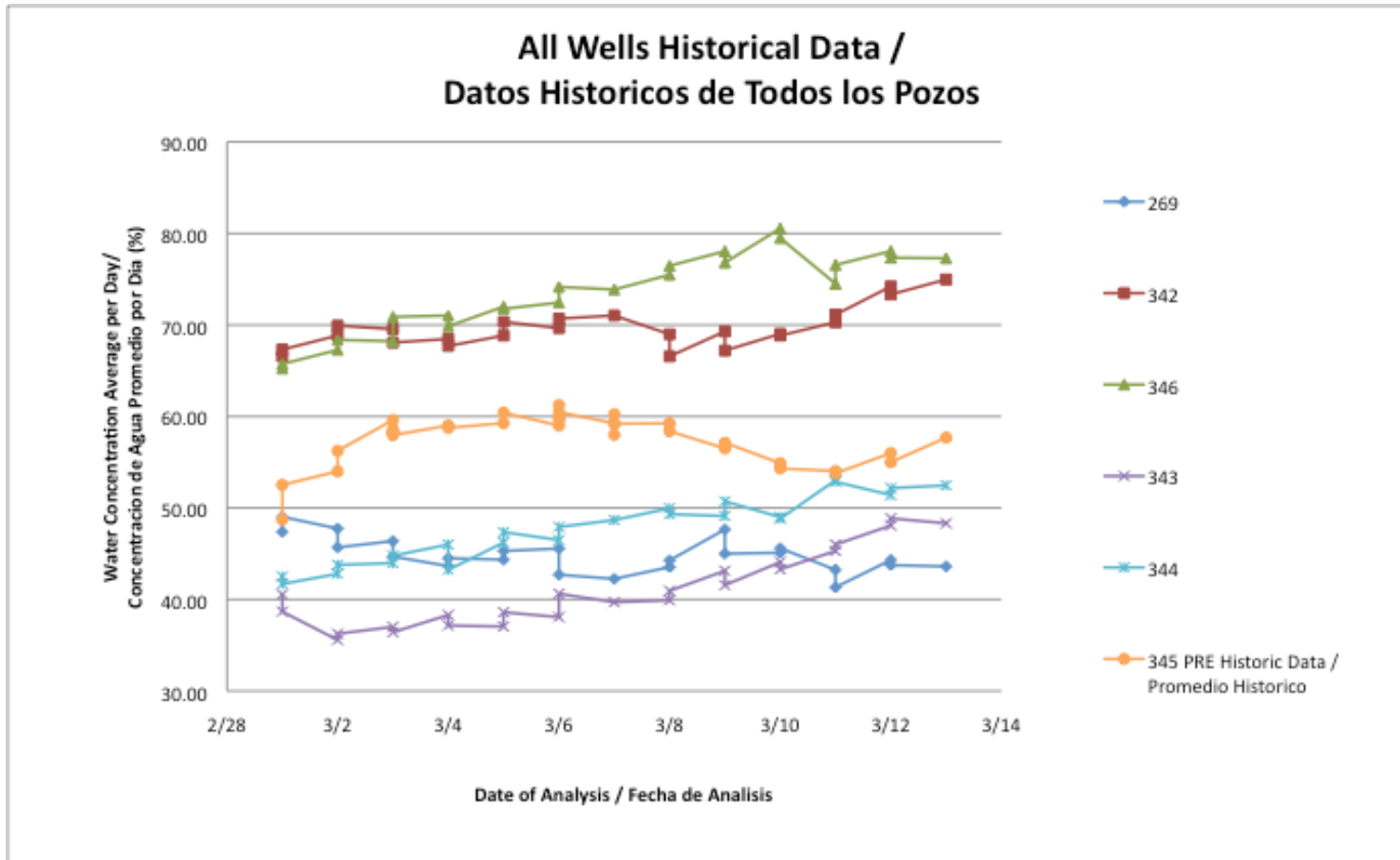
## INSTALLATION DATA



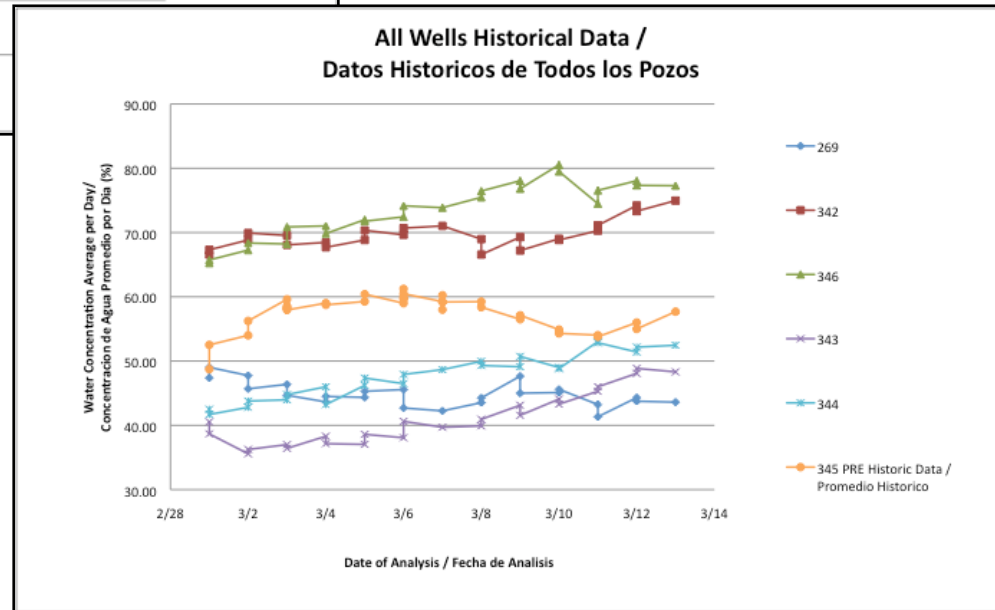
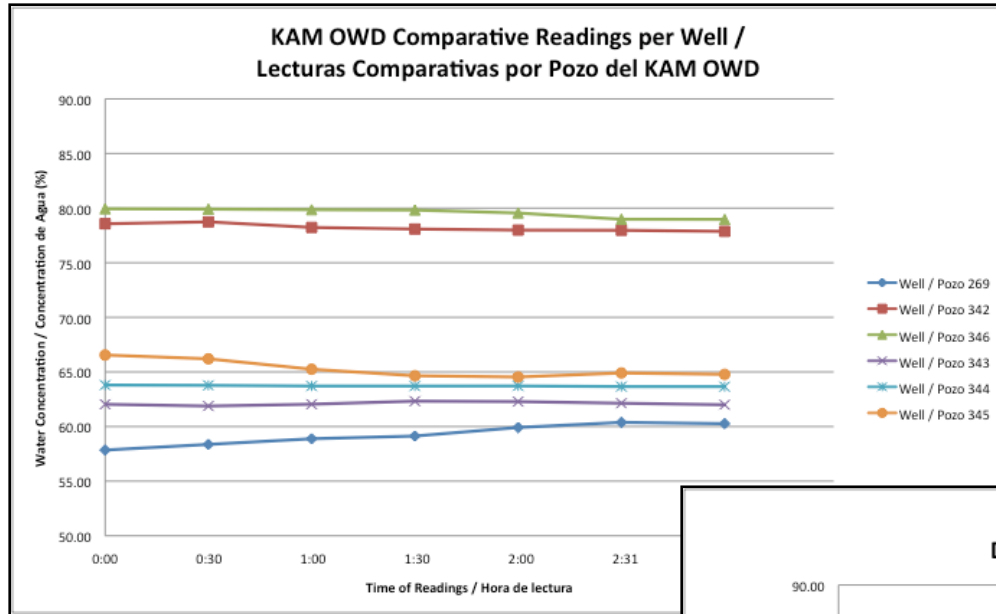
# THE KAM ML MEASUREMENT LOOP



## INSTALLATION DATA



# THE KAM ML MEASUREMENT LOOP



## THE KAM ML MEASUREMENT LOOP



The KAM ML Measurement Loop with a KAM OWD Oil Water Detector is the perfect mix for oil water measurement at the well head.

By creating the ideal environment for measurement, the loop allows instruments to perform perfectly every time.

The consistency and accuracy of performance allows operators to install AWT Automatic Well Test and automated production management systems with complete confidence.

## THE KAM ML MEASUREMENT LOOP

### CONCLUSION

Installed at the wellhead or on a separator, the KAM Measurement Loop with KAM OWD provides velocity at or better than API standards, creating highly accurate, consistent, real-time data, even in high-water applications.

Data can be used for production management, AWT, and automated production.