#### THE NEXT STEP IN PVT TESTING Unlocking the UNCONVENTIONALS

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- Who We Are- What are We Doing
- Problem Definition
- Approach
- Tests
- Measurements
- Results
- Next Steps

#### Who We Are - What are We Doing

Kaia offers technology development services for custom design solutions.

Our flagship product is being developed for the oil and gas industry to understand and characterize fluid behavior in unconventional reservoirs.

## **Problem Definition**

## Problem

#### **Traditional PVT Tests are Insufficient!**

- Pore sizes neglected
- Fluid properties and behavior data Limited and lack accuracy

## Problem

- Conventional PVT data may cause up to 50% error in recovery estimation for unconventional reservoirs
- Accurate description of phase behavior is essential to determine the diffusion coefficient of a displacing fluid into the crude oil it contacts both for conventional and unconventional EOR

# Approach

#### **KAIA's Solution**

"Optical Pressure Measurement in Micro-Fractures"\*



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#### **KAIA's Solution in CSM labs**





#### **Microfluidic Chip with Geometric Variations**



Depth IOO micron

Width 50-100 micron

#### **Traditional vs Kaia**

	Traditional	Kaia
Pore sizes represented	×	
Reservoir flow network model	×	
Data accuracy	×	
Diffusion coefficient	×	
Provide data to select a displacing fluid	×	
Confirm EOR efficiency	×	
Test time	Weeks	Days
Required sample amount	Liters	Milliliters

## **Value Proposition**

- The current ultimate oil recovery from unconventional shale is about 6%.
- If the operators can be sure that ethane or propane EOR works for their crude, it has been estimated that the oil recovery can go to about 8%.

#### Knowing fluid properties in the flow network (i.e., micro-fractures and micro-pore) increases oil recovery up to 33%

#### Measurements

#### **Dew Point Test Video**



#### **Test-Pressure Calculation for Butane**

Dew Point = 20.2 psi Bubble Point = 19.4 psi T= 68 °F - 70 °F

## Results

#### **Test Results**

 Liquid Butane was waiting in the smaller channels of the microfluidic chip patterns

 It suddenly came out when the pressure 9.1
Psig below bubble point, increasing the pressure back to 18.6 Psig

# **Next Steps**

### **Industry Feedback**

"Run tests with fluid mixtures and compare with actual data."

- Methane-Decane
- Methane-Butane-Decane

### **Industry Feedback**

"Run tests with sub-micron channels."

- 800 nm
- 400 nm



What would be your opinion and feedback?

What do you expect to see?

### **Next Steps**

Sub-Micron Fluidic Chip Design for PVT processes

- Recombination-mixing
- Gas Oil Ratio Analysis
- Constant Composition Expansion

Isothermal Depressurization Above Saturation Pressure

- Constant Volume Depletion

Isothermal Depressurization Below Saturation Pressure

- Same Tests with Network and Pore effect included Chip

## **Pressure Mapping**



## **KAIA's Solution**

#### Commercialization design



#### **Next Steps**

#### - Diffusion Coefficient Measurements

### What do We Need?

#### Partners

- Funding for next steps
- Field data
- Commercialization support
- Advocates & Customers

# **Thank You!**

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