TECHNOLOGY FOR A BETTER WORLD

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“PVT in a Chip”

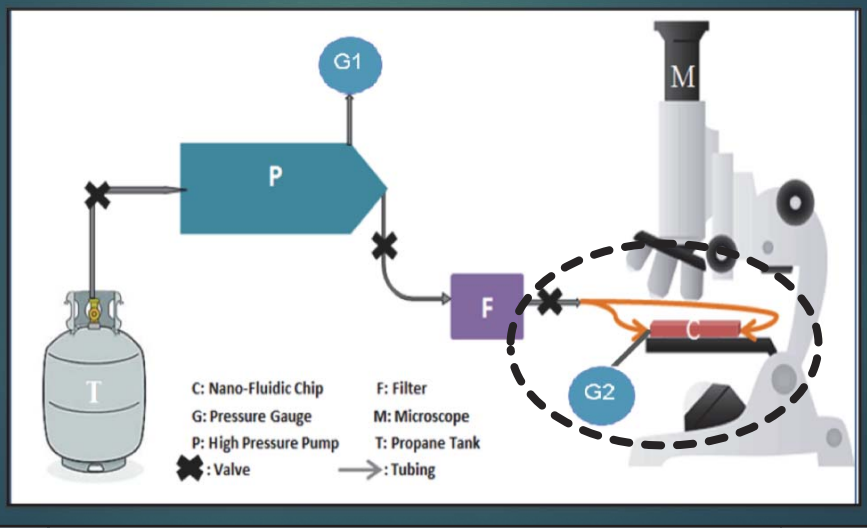
Outline

- Background
- Goal
- Approach
- Challenges & Solutions
- Current Focus
- Remaining Challenges
- Vision for the Future

Background

Elham Parsa's Ph.D. Dissertation

"Phase Behavior in Nanopores"



Elham Parsa's Ph.D. Dissertation

"Phase Behavior in Nanopores"

Identified Challenge:

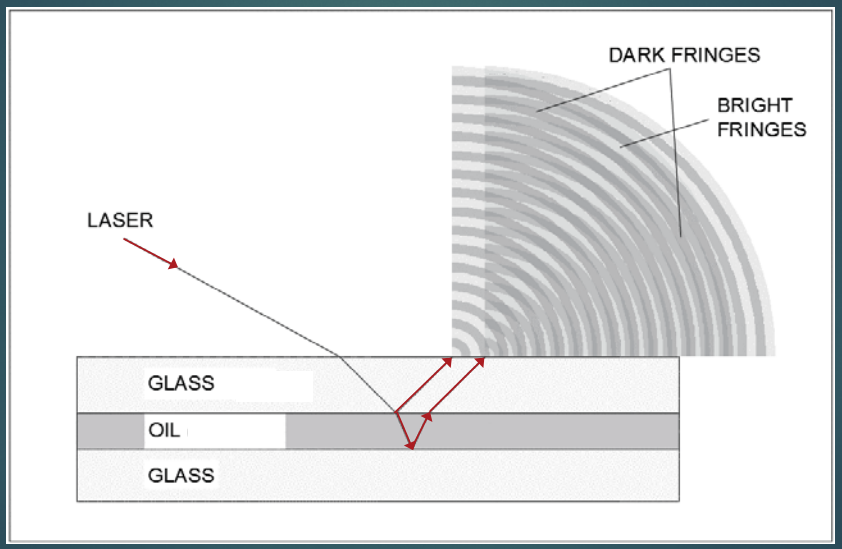
Pressure and Temperature within the Channels

Goal

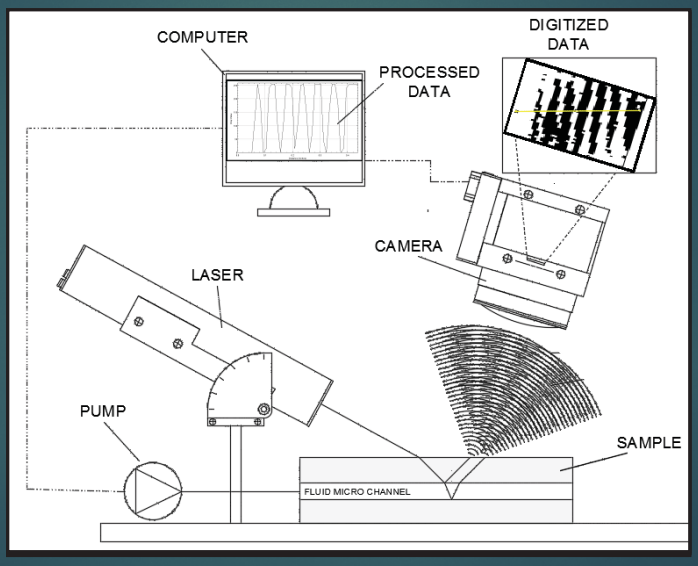
"A procedure and equipment for measuring PVT (e.g., phase characteristics) of hydrocarbons within channels simulating deep flow networks."

Approach

Laser Interferometry



Measuring Pressure Using Laser Interferometry*



**Patent Pending*

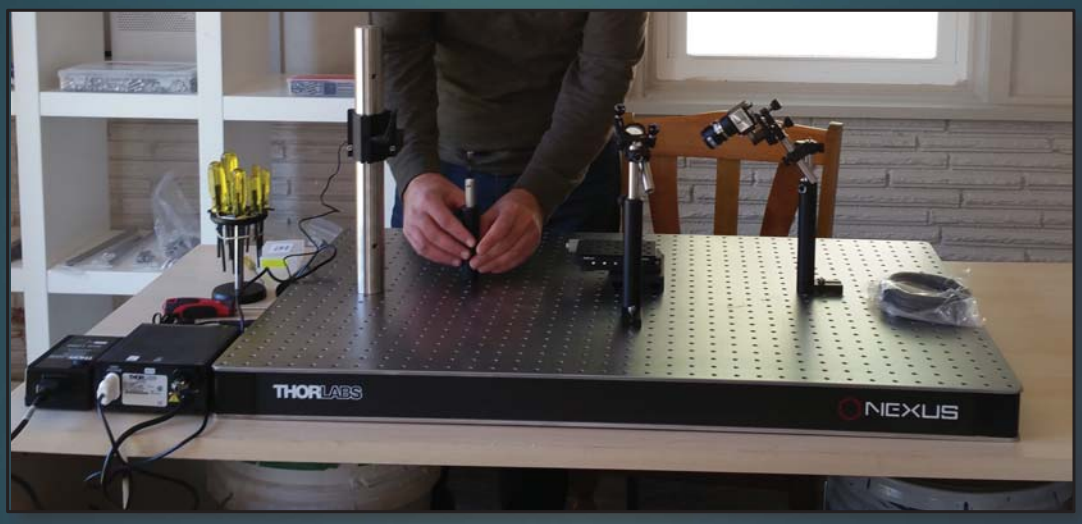
Challenges & Solutions

Financial Support

Awarded:
DOE Phase I
Small Business Technology Transfer (STTR) Grant
October 2017 - March 2018

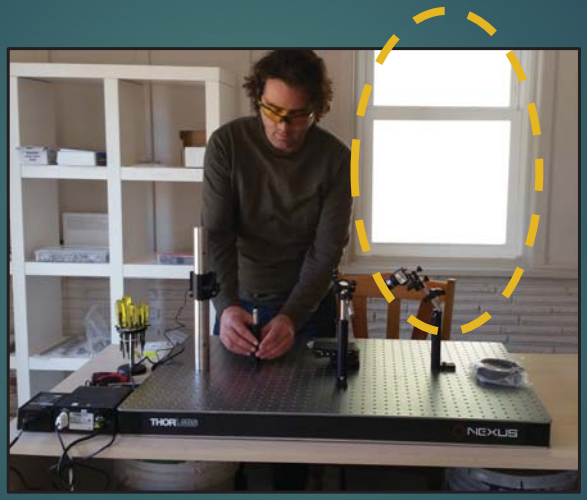
"Optical Pressure Measurement in Micro-Fractures."

Vibrations



Vibrations

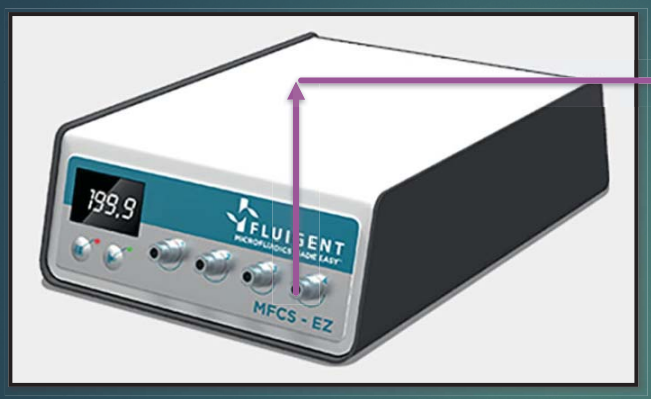
External Light



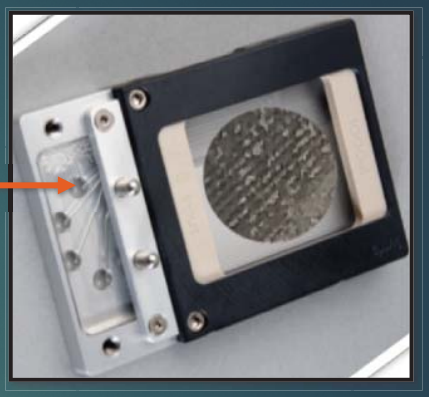
External Light

Pressure Control

Pressure Control



Pressure Controller



Rock Sample

Fluid Sample

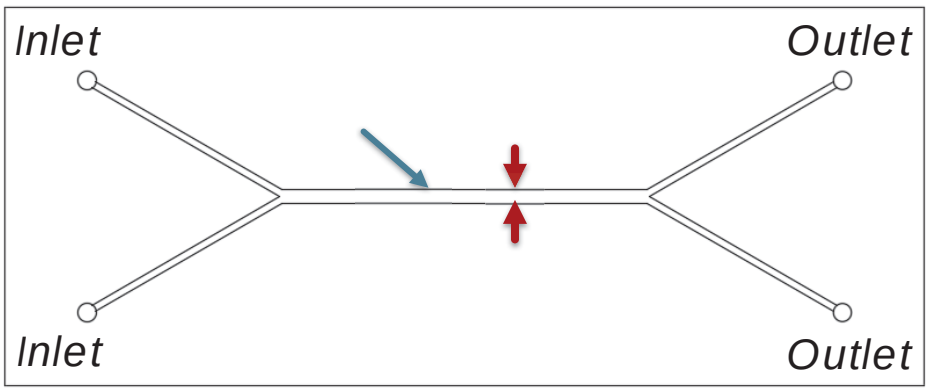
Automation

- Synchronization
  Camera & Pressure Control
- Repeatability

Calibration

- Channel Depth
- Channel Width

Chip Design for Calibration



Refractive Index

Corelate Refractive Index and Pressure for Hydrocarbons

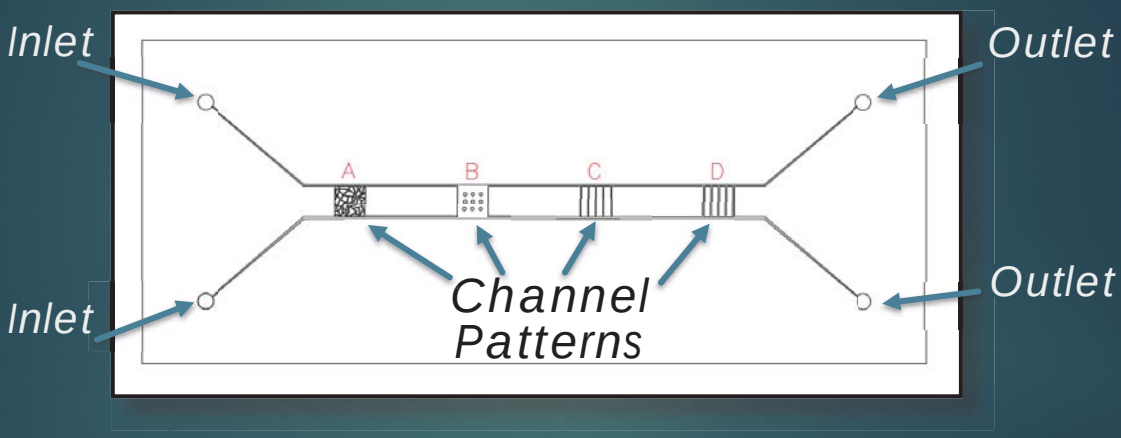
- Combined Lorenz-Lorentz Equation and Clausius-Mossotti Equation
- Corrected for the Compressibility
- Compared with Refractive Index Measurements for Methane
- Determined Error: less than 0.5%

Corrected Optical Relations for Circular Fringes

- Defined Optical Path Difference creating Fringes through Young's Interference Formula

Current Focus

Channel Variations



Current Focus

- Develop Laboratory Procedures
- Use Hydrocarbons in Channels
- Evaluate Channel Geometries
- Develop Software for Image Processing

Remaining Challenges

Remaining Challenges

- High Pressure
- High Temperature

Solutions: Upgraded Equipment

Vision for the Future

Thank You

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