Well Analyzer

for

Producing Oil & Gas Wells

Reservoir Volume Monitoring

GOM Gas Condensate Well Example

Pro-Active
Automated Real-Time Surveillance

Oilfield Data Services, Inc.

Automated Real-Time Surveillance (ARTS)
Real-Time Reporting on Wells / Field KPI's

The ARTS Concept: Physics + Automation + Experienced Surveillance Engineers

Rates & PVT	Production & Reservoir Performance Optimization		Flow Assurance	Topsides/Facilities
3-Phase Rate and BHP Calculations	Auto Real-Time PTA & Reporting	In-place, Connected and Recoverable Volumes	Wax, Hydrates, Asphaltenes, Scale, Corrosion, Emulsion Detection & Mitigation	Automated Facilities Debottlenecking & Optimization
Flow meter Validations	Scale and/or Asphaltene detection in reservoir, completion & well bore	Producer-Injector Interaction		Recognition of Inefficiently Operating Equipment
Automated PVT Tuning & Calibration	Recognize Wellbore Lift Issues & Gas Lift Optimization	Tracking on Moving Oil-Water, Gas-Oil, Gas-Water Contacts with time		
Water Cut and GOR or Yield Calculations	Recognize Completion & Reservoir Performance Issues (Skin, Scale, Compaction, Velocities)	Know the Maximum Safe Flow Potential of the Well (Spare Capacity)		

Asset Modeling, Monitoring & Diagnostics

Raw sensor data → Data Communication → Intermediate Data Repository → Real-Time Data Management

Well Analyzer Wellbore Model

- The only existing software based on a direct numerical integration to the Mechanical Energy Balance (MEB) eq.
  - Does not rely on correlations
  - Provides **more accurate** and **reliable results**

- The wellbore model
  - Accounts for dynamic temperature behavior
  - Adjusts the fluid properties accordingly
  - Performs wellbore flash calculations to determine the composition of the fluid in the wellbore

"It is a capital mistake to theorize before one has data. Insensibly one begins to twist facts to suit theories, instead of theories to suit facts."

Sir Arthur Conan Doyle, Author of Sherlock Holmes stories

ODSI
Oilfield Data Services, Inc.

- Gas Condensate well (~ 15 bbl/mmcf)
  - Tree Gauge
  - Measured Gas Rate

Objectives:

- Calculate BHP at mid-perfs
- Demonstrate auto-PTA
- Demonstrate **reservoir volume** calculation feature
  - **In-place**
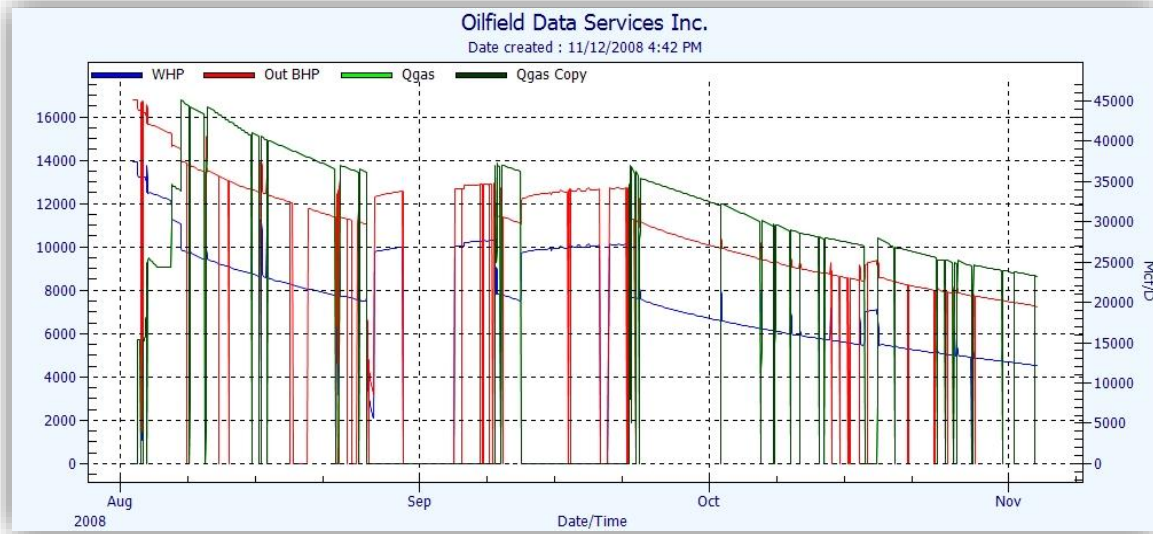 - **Hydraulically connected**
  - **Mobile gas**
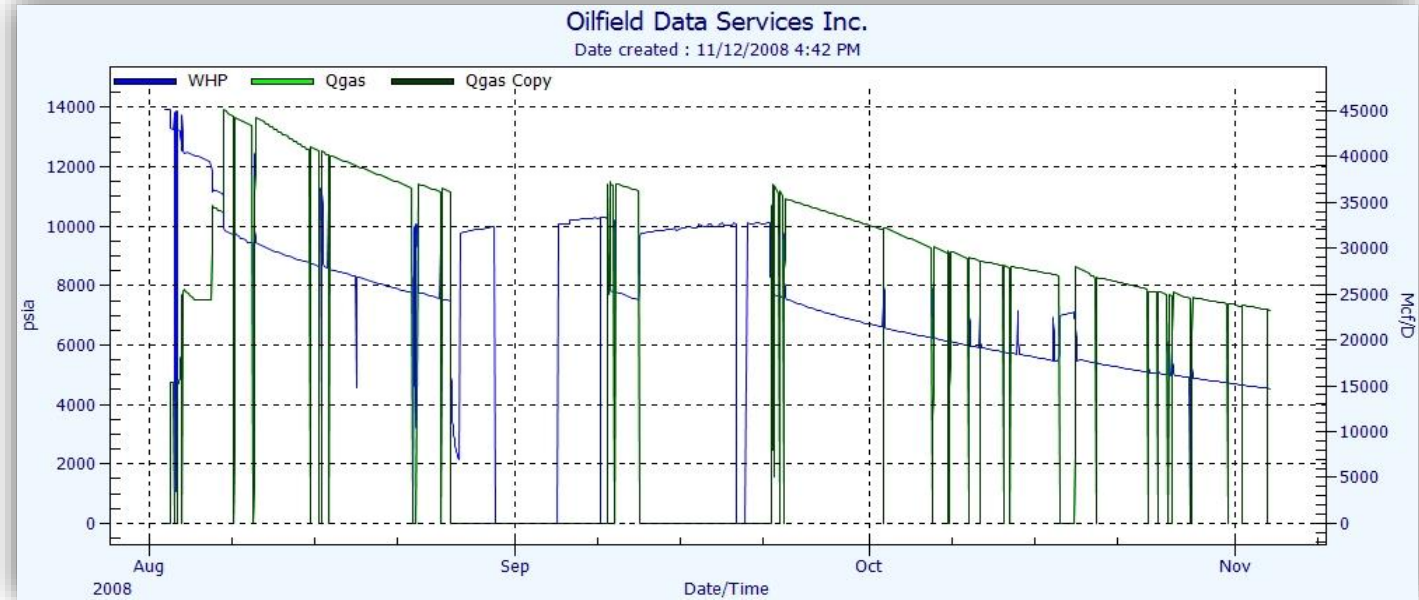
System Inputs: WHP/T & DHGP/T

- BHP was calculated at the mid-perf depth from the surface data
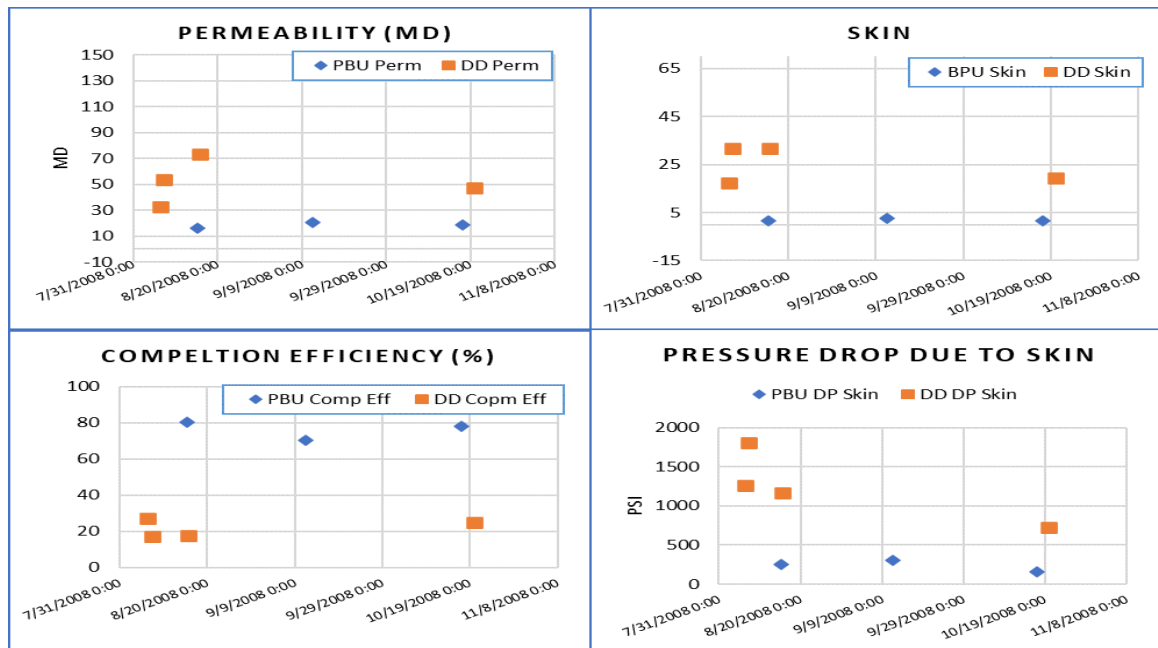
- **Each PBU and DD** are analyzed for diagnostic PTA parameters in real-time

- A **report** is generated for each test

- **Historic PTA** tables and plots are updated every time there is a new test

- **'Notification/Alarm'** tags are outputted if skin/perm reaches a certain 'reg flag' value (customized per well)

- If a buildup is sufficiently long to provide a valid P^*/P_{res}, the tool performs Static Material Balance calculations for the **total in-place volume**

- The flowing data is used to calculate **hydraulically connected** and **mobile volumes**

Real-Time Observed Reservoir Volume Monitoring
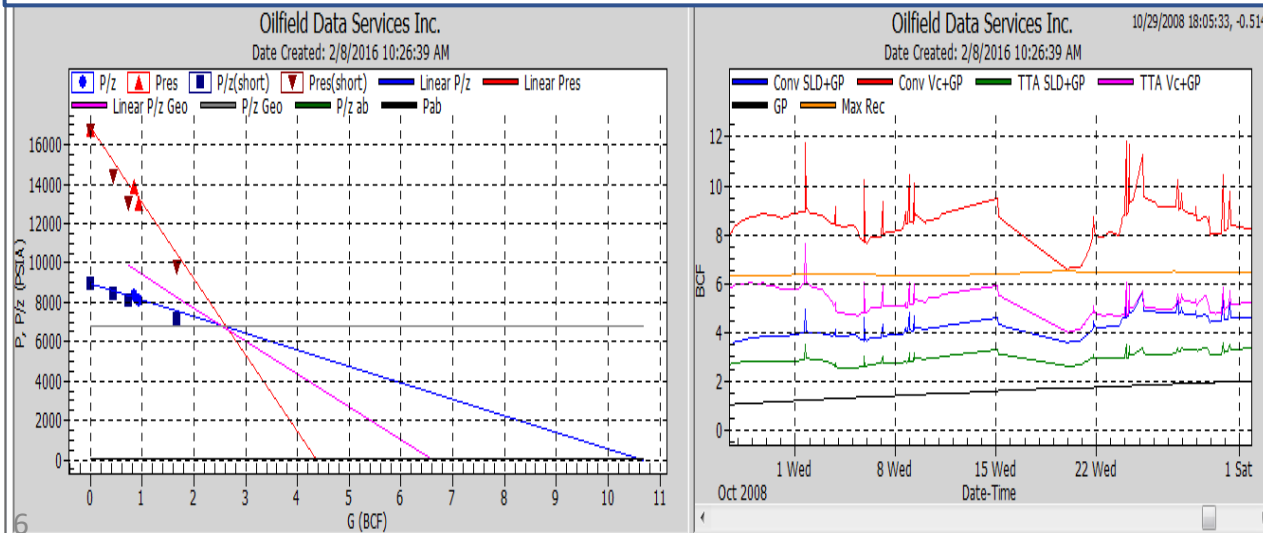
- Total in-place volume ~ **10.5 BCF**
- Hydraulically Connected Gas ~ **9 BCF**
- Mobile (i.e. recoverable) Gas ~ **5.5 BCF**
- Water (dead-leg) ~ **3 BCF** (equivalent)
- Rock Compaction ~ **1 BCF** (equivalent)
- Tight gas ~ **1 BCF**

- **Mid-perf BHP** was calculated from the surface data
  - Direct numerical integration to the Mechanical Energy Balance eq. (**No Correlations**)
- The only software that employs equations that allow to split the **in-place volume** into what is the **connected** to the well and **mobile (recoverable)** in real-time
  - Locks into solution from first months of production data

Allows engineers and asset managers to keep track of the well's performance volume-wise and aids in the decision-making process

Proactive Surveillance!

ODSI
Oilfield Data Services, Inc.