Optimization, Predictive Analytics, & Real-Time Process Models

Virtual Well Test with Gas Lift Optimization

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Measurement Challenges
The Need for Models

- Measuring challenges
  - Too costly or impractical to implement flow rate meters for some locations
- Solution
  - *OptiRamp* produces virtual measurements
  - *OptiRamp* process model for rate estimation
    - Accurately approximate hydrocarbon behavior
    - Calculate well flows in real time
    - Determine optimal gas lift for well based on well productivity

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Modeling

- Model complex production systems
  - Reservoirs
  - Production Wells
  - Separators
  - Pipelines
  - Choke Valves
  - Control Valves
 - Compressors
  - Turbines
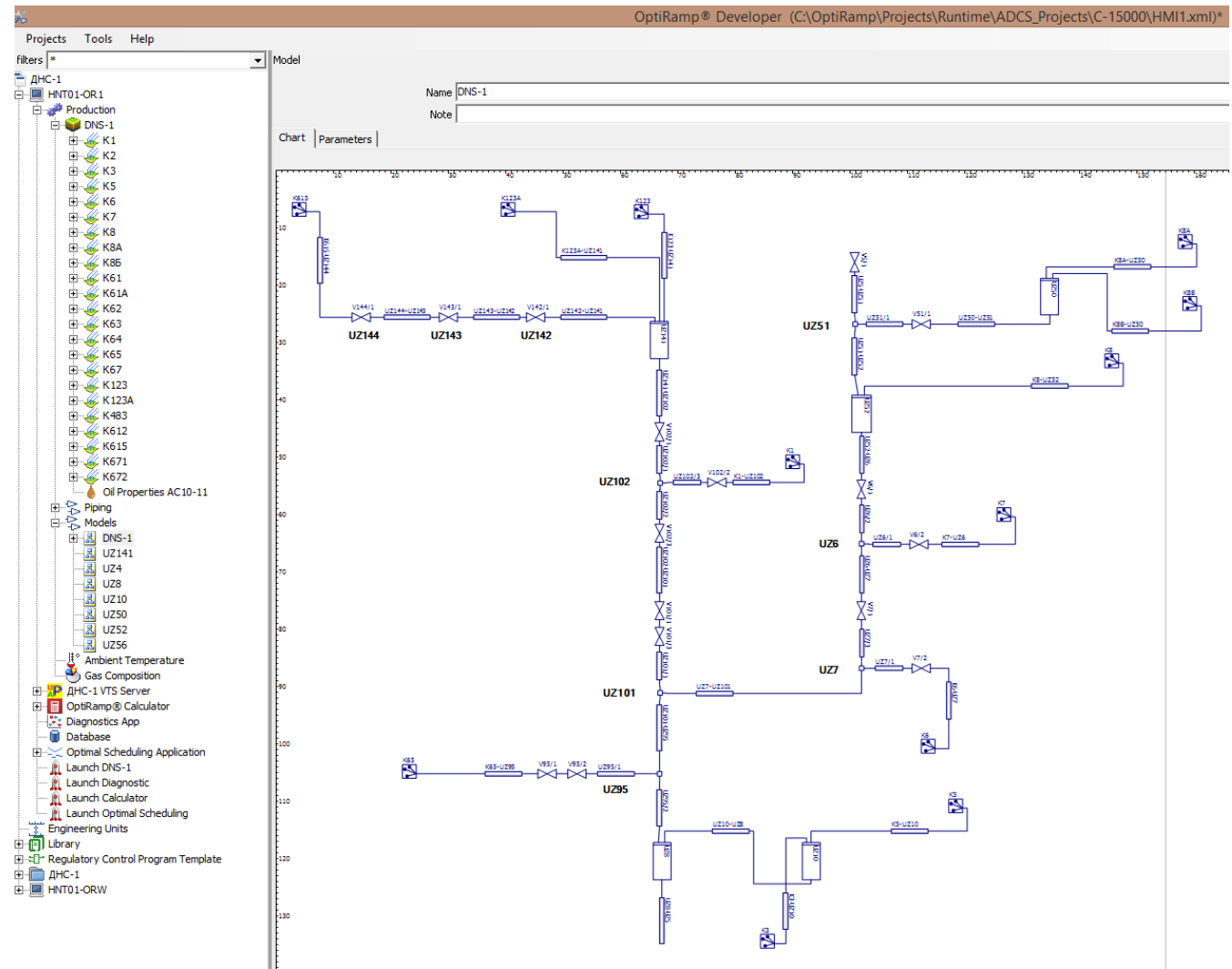
Virtual Well Test

- Offers following functions
  - Continuous Well Diagnostics
  - Auto-tuning of wells deliverability characteristic
  - Well Performance Trend Analysis
  - Continuous individual phase flow rates allocation for each well
  - Computed vs. tested flow rates accuracy analysis
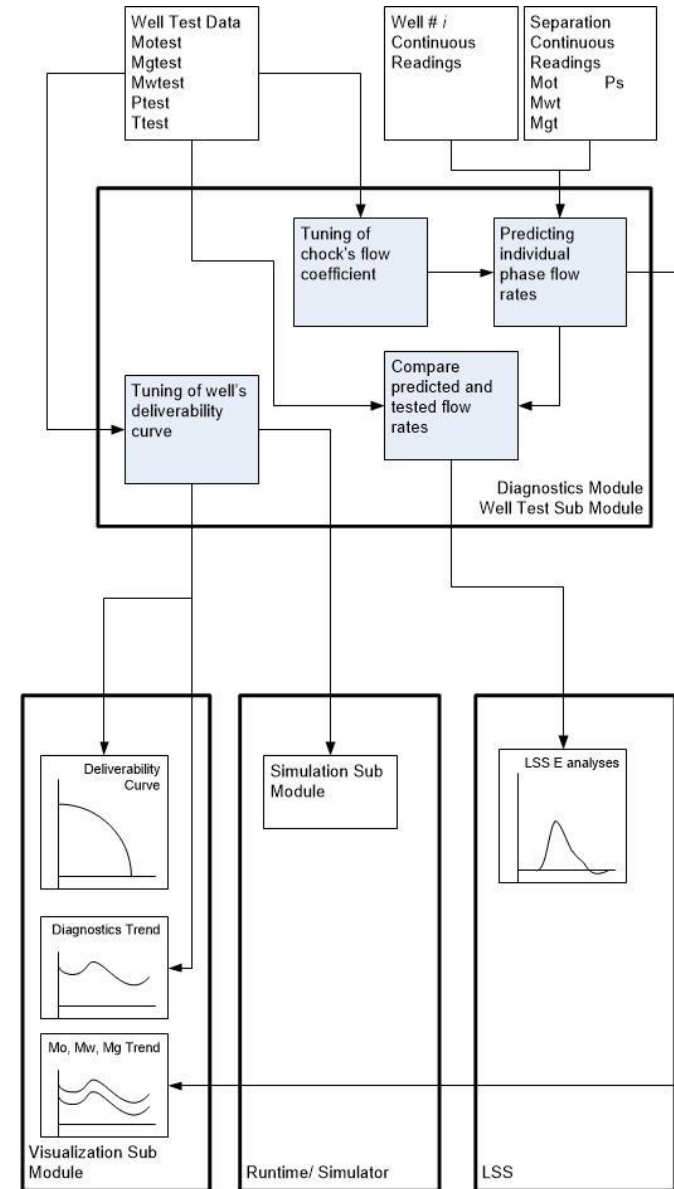
Required Input data

- Required Input Data
  - Flow Line Pressure or Tubing Pressure
  - Water flow rate, well test
  - Oil flow rate, well test
  - Gas flow rate, well test
- Total flows after separation unit:
  - Water flow rate
  - Oil flow rate
 - Gas flow rate
  - Total Gas Lift
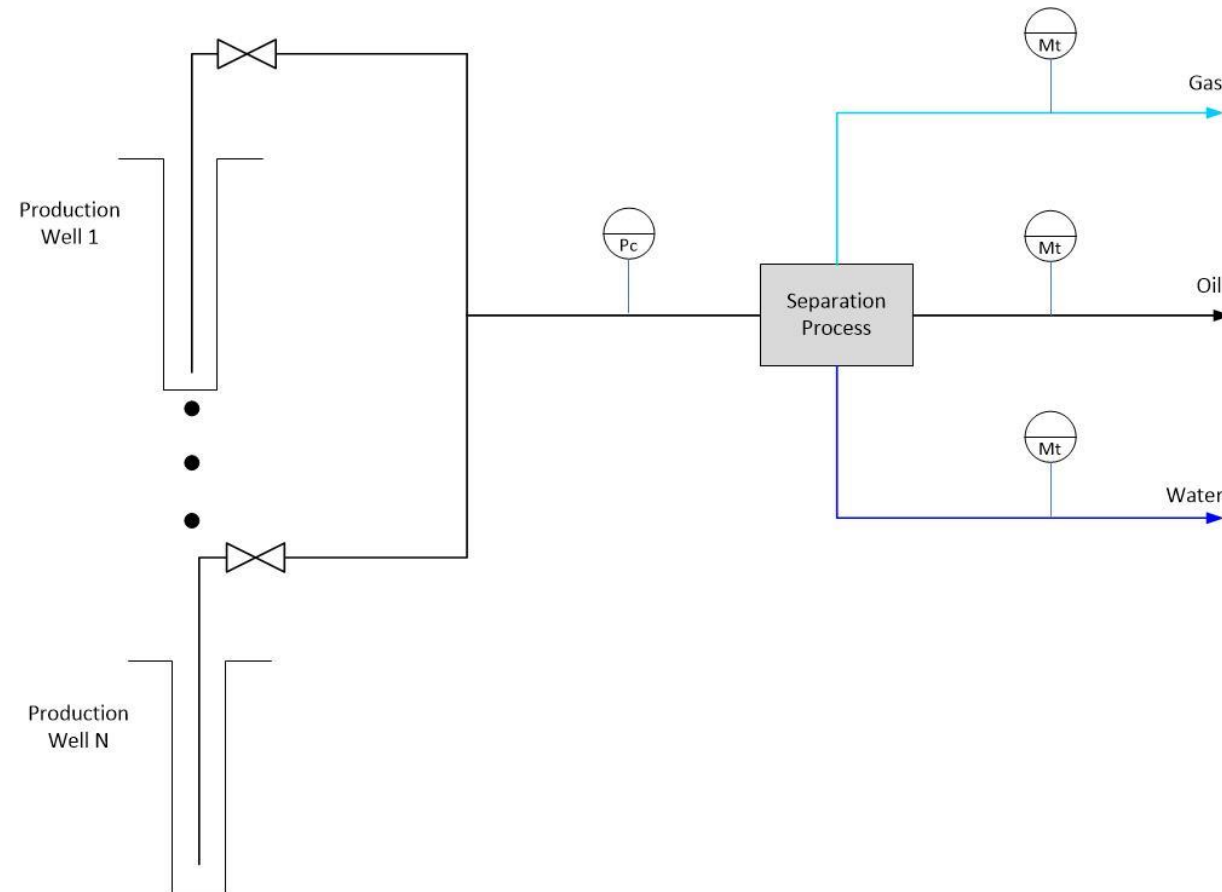
How it Works

1. Access well test data
2. Auto-tune well deliverability curve
3. Auto-tune choke flow coefficient (if needed)
4. Access real-time data
5. Compute individual phase flow rates for each well
6. Compute individual phase flow rates from trends
7. Analyze real-time well performance trend
8. Visualize deliverability curve

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Deliverability Curve

- Use well test records to predict oil well deliverability and build curve

- Deliverability model based on real-time tubing head pressure and predicted mass flow rate

- Curves plotted on coordinates of flow rate versus tubing head pressure (Pf)

- Visualization monitors computed operating point (plus symbol) in relation to deliverability curve
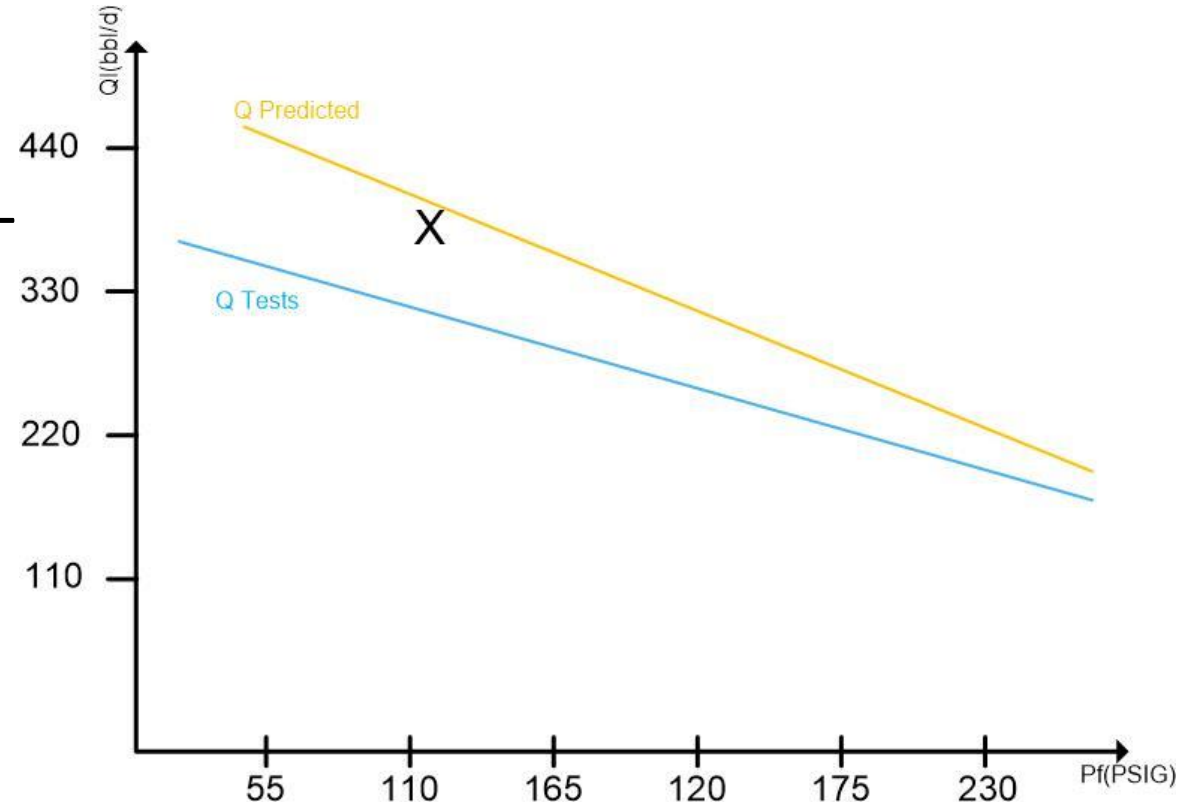
Gas Lift Optimization

- Distribute limited quantity of gas between production wells

Property	Scenario 1	Scenario 2
Objective function	Max. total oil rate	Min. lift gas rate
Manipulated variables	Gas lift rate of each well	Gas lift rate of each well
Constraints	Total gas lift flow rate Max./Min. well flow rate	Constant oil flow rate Max./Min. well flow rate
Dependent equations	Well gas lift performance curves	Well gas lift performance curves
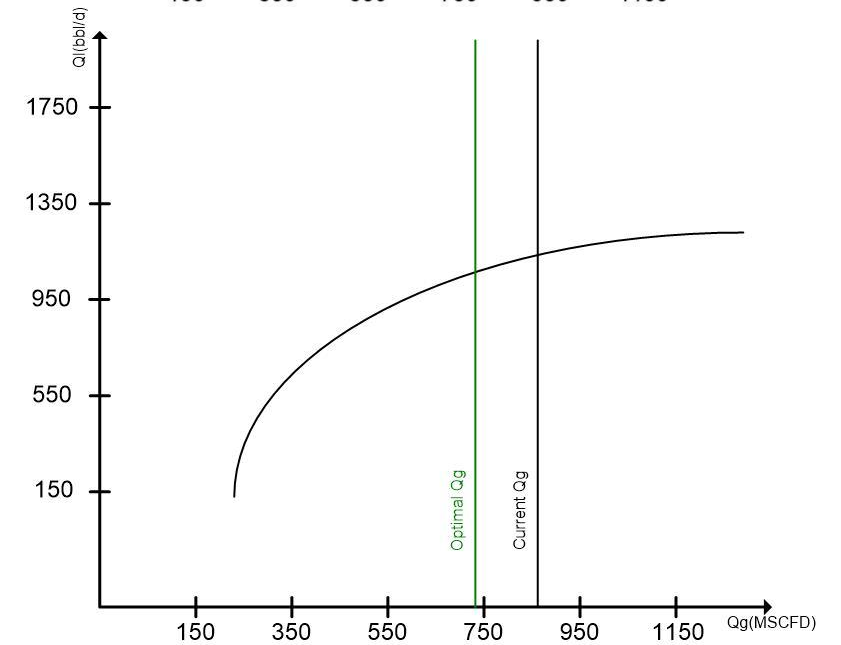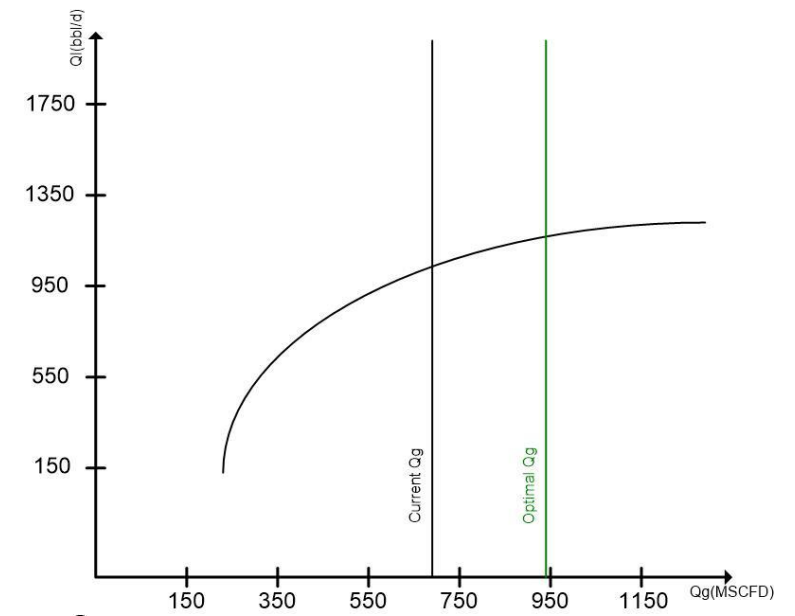
Benefits

- *OptiRamp* integrates with existing allocation factor tools—it enhances the data visualization of existing data

- *OptiRamp* Virtual Well Test provides computed data between well tests; provides performance curve for multiphase flow

- *OptiRamp* Gas Lift Optimization provides suggested set points for gas lift based on optimizing production in individual oil wells

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