

ResSureSM Live Reservoir Modeling Services

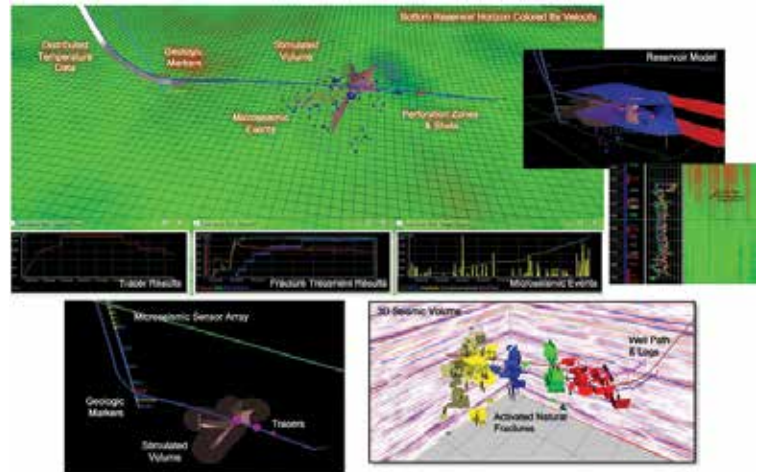
Q: What is the value of real-time monitoring of stimulation data?

A: Analyzing the reservoir complexities along each wellbore during drilling and stimulation allows for the development of a geologically based stimulation plan, which results in higher

and more consistent production from each stimulation stage. As dynamic analysis continues, a 3D model is continually updated, which allows users to further optimize field development plans.

Q: Can additional reservoir data be included in the real-time model view?

A: **Yes.** ResSure Live software supports both time and depth data, including gridded surfaces, multiple seismic attribute volumes, faults, wells, logs, geologic markers, production logs, image scan interpretations, distributed temperature sensor data, vertical seismic profiles, and cultural data.



Q: Are there limits to the number of real-time inputs into the model?

A: **No.** Although the first release of the software only supports stimulation pump curves and microseismic event data, there is no practical limit to the number and diversity of inputs. The first

release will support more than one stimulation and microseismic input, allowing users to monitor two microseismic sensor arrays in two different boreholes.

Q: How accurate are the real-time microseismic events and can they be verified in real-time?

A: ResSure Live software can load well logs, formation image scan interpretations, geologic and geophysical interpretations, and seismic attribute data from VSP. The data can then be correlated with cross-well, surface, and microseismic events, which validates their positions. For example, if curvature data from ResSure Live or seismic operations indicates prominent

fracture orientations, we would expect the microseismic events to validate the orientations in real time. Similarly, areas along the borehole that show high levels of natural fractures in log and image scans can be correlated with microseismic event orientations and quantity during stimulation, which could lead to real-time adjustments to reduce stimulated volume.

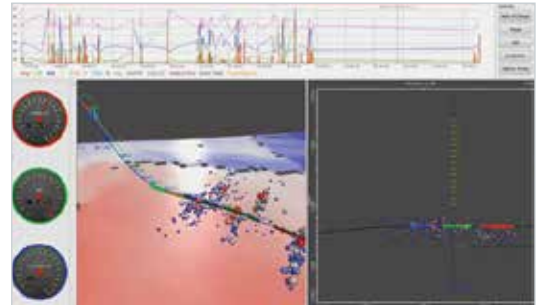
Q: Is an internet connection required?

A: An Internet connection is needed to install the software, but not to operate it unless real-time data streaming is desired for operations.

Q: What are the options for remote viewing of the real-time data?

A: The default configuration for ResSure Live installations includes offline viewers that can visualize all data contained in field generated archives. Archives are generated at any time during field operations and transmitted to the client where they can be opened and reviewed. Viewer capabilities include time animation, 2D, 3D, and time-series visualization, as well as data query and full data viewing controls.

Viewers can also receive real-time data flow from virtually anywhere in the world. Configuring viewers for real-time connectivity requires several weeks of collaborative planning between the operator and service provider to establish data flow mechanisms and address security concerns.

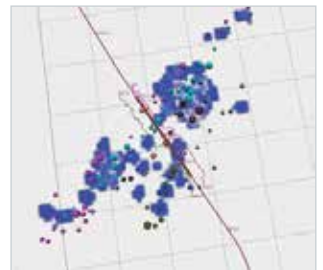


Q: What are the hardware requirements?

A: ResSure Live software operates on Microsoft® Windows® platforms with Java 1.7 installed and a minimum of 1 GB of dedicated graphics memory. Field systems will be connected to an extended local area network (LAN) using directional antennas, which allows all component services to utilize the same network.

Q: What type of analysis is included with the real-time visualization?

A: ResSure Live includes a number of real-time analysis capabilities that will continue to grow as the software develops further. Initial release capabilities include:



Dynamic Filtering

Pump and microseismic event data can be filtered in real time based on proximity to wells or any combination of attributes within the data stream. All collected data is stored, but only data that passes optional primary and secondary filters will be displayed.

Pump Alarms

Rate-of-change and range-based alarms can be defined and enabled prior to and during field operations. Historical pump curves can be used to configure and refine alarm properties to allow break-out, screen-out, and undesirable reservoir response detection.

Proximity Alarms

Based on microseismic event distance from nearby wells, faults, and surfaces, proximity alarms can be defined and enabled to maximize the stimulation effectiveness while reducing potential problems.

Estimated Stimulated Volume

During microseismic monitoring, ResSure Live software can compute a real-time estimate of stimulation effectiveness. This analysis will graphically and numerically display the estimate reservoir volumes at any point during operations.

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