

### 3 Simple Tools to Aid in the Optimization of Lateral / Horizontal Oil and Gas Well Completions: Saving Cost and Increasing Productivity

The industry has moved towards the use of horizontal wells in order to exploit reservoirs that are continually increasing in complexity. The majority of a well AFE is being allocated to the effective completion and fracturing in order to generate the best returns on capital. More and more Operators are seeing the need to optimize their completion strategies in order to get the largest “bang for their buck”. As a *Solutions Provider*, RECON has identified three simple tools / interpretations in order for Operators to better understand the heterogeneity along the lateral / horizontal portion of their wells in order to allocate costs to get the greatest returns. RECON has the ability to run a RBT (Radial Bond Tool) and DSN/DSD (Compensated Neutron/Density) in combination, deployed in a horizontal / lateral cased hole environment in E-Line mode through the use of either tractor or E-coil and / or deployed in memory mode through the use of the more economical conventional coil system. This allows for the retrieval of information that is critical in the decision making process of any completion engineer. These tools allow RECON to generate a Radial Bond Map, Lithology independent of Gamma Ray Plot and, in partnership with *Digital Formation™*, a Pseudo Stress Profile along the lateral / horizontal section. With these three simple controls, completions can be placed in order to optimize frac propagation and effectiveness resulting in increased Initial Production (IP’s) and shallower declines for oil and gas production. As well completion can be designed and executed in a more cost effective manner.

#### RBT (Radial Bond Tool)

Isolation is a key component to the effectiveness of any fracture/stimulation and lack thereof can be a hazardous and costly downfall. RECON’s RBT gives clients the confidence that the placement of their completions will result in translation of fracture energy to the reservoir rather than along the casing. In addition to standard bond logging CBL/VDL services RECON’s RBT includes a six segment radial map that will aid in the identification of cement channeling, de-centralized casing and estimated cement compressive strength along the lateral. Standard procedure is to run the RBT under both ambient and as a pressure pass to eliminate micro-annulus effects, resulting in increased confidence in cementing effectiveness evaluations.

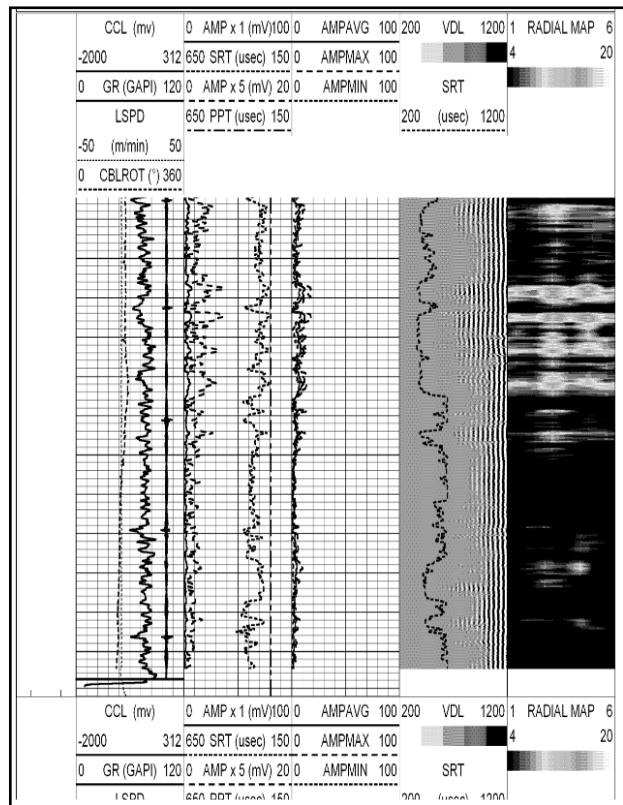
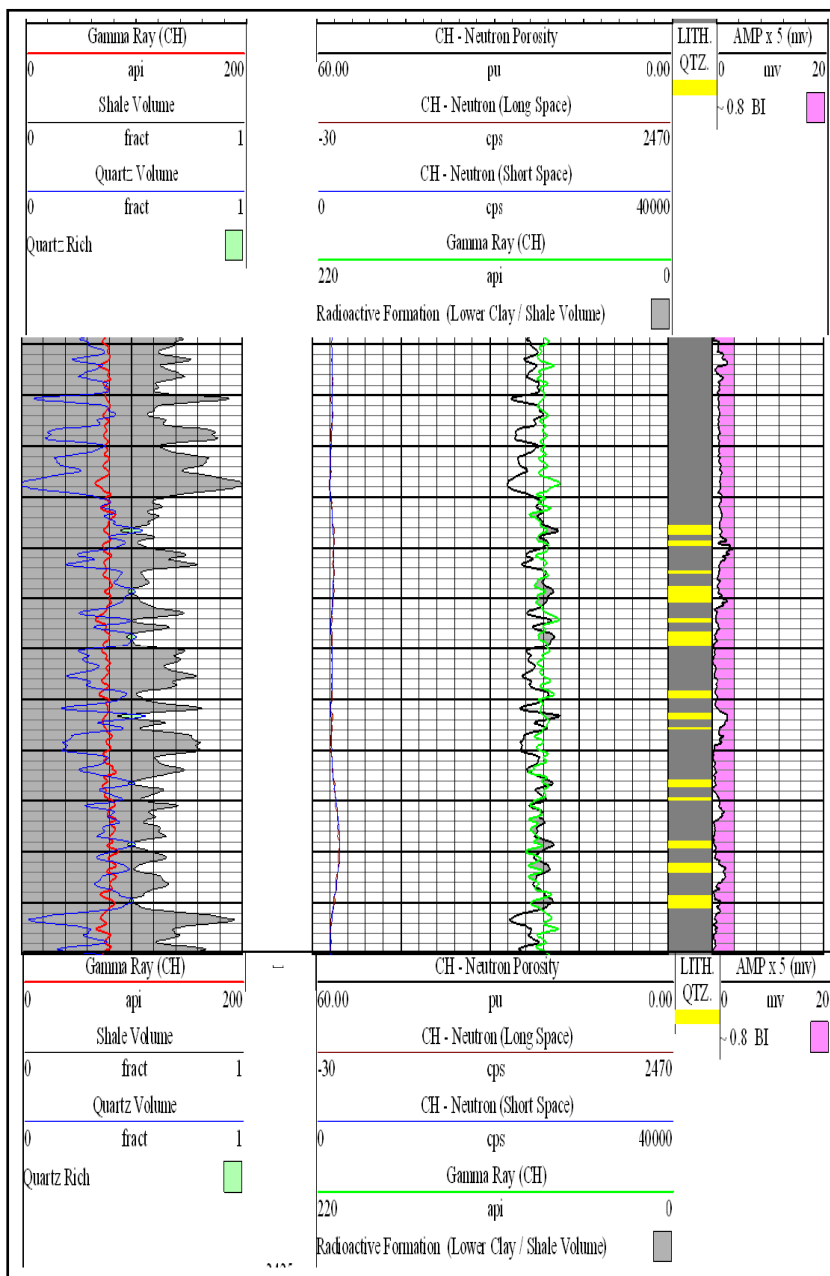


Figure 1. RBT cement map display from a HZ well.

## DSN/DSD (Compensated Neutron/Density)

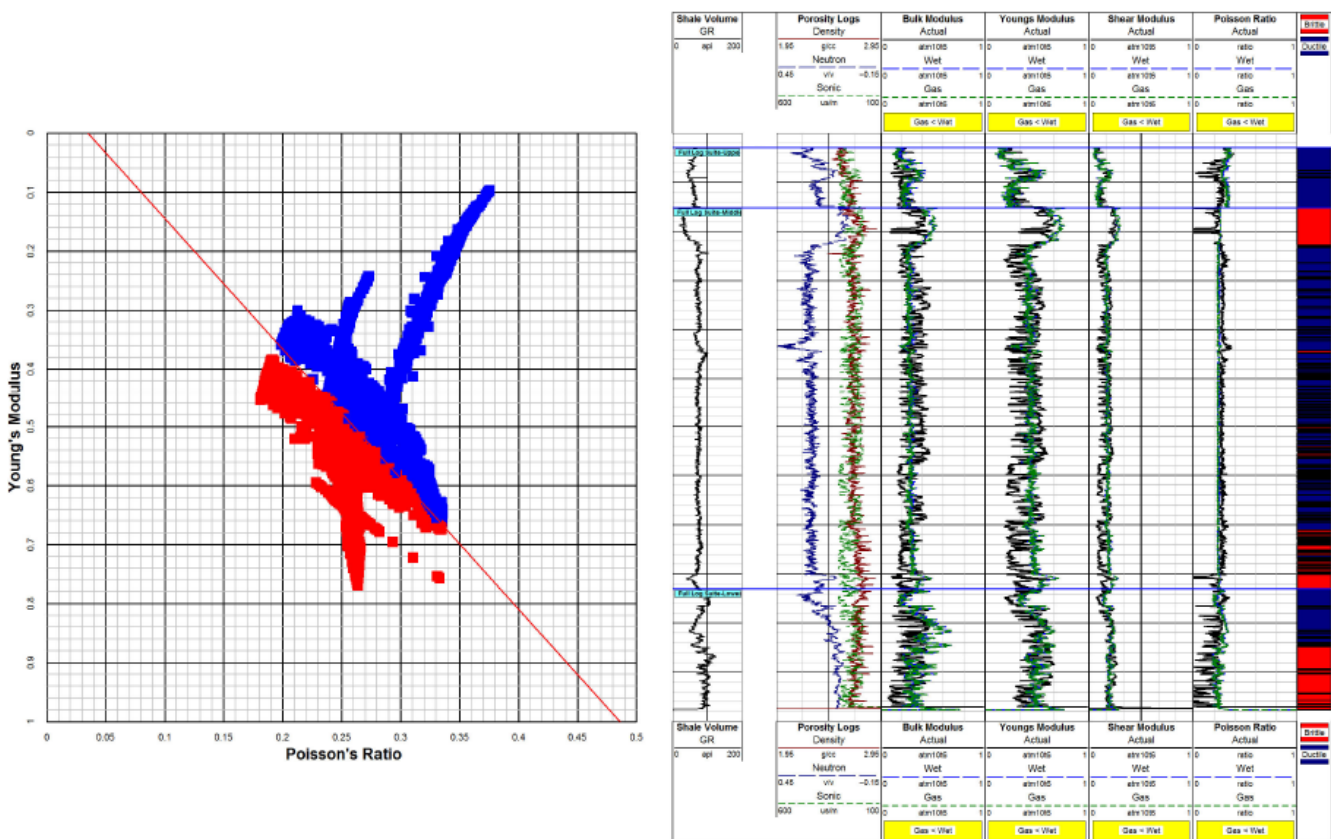
Due to the heterogeneity of lithology along the lateral/horizontal a basic understanding of the rock types represented along the length are important in the decision making process for completion placement. RECON has been a pioneer in the development of through casing Compensated Neutron/Density and have consistently shown that our through casing tools match with a high degree of confidence to open hole logs. Operators in the past have used the Gamma Ray (GR) while drilling in order to identify quartz rich rock types along the horizontal. Through work done at RECON we have realized that the GR is not the most reliable indicator and prefer to use the neutron and density data in order to qualify rock type. The neutron and density tools are more independent of radioactive materials that may affect the GR response. RECON uses the DSN/DSD tool to make a qualitative interpretation of the quartz and shale volumes within the rock along the length of the wellbore. Higher quartz volume suggests a more brittle rock which in turn suggests a higher priority area to place a completion in order to get pronounced fracture propagation and fracture splays in all directions. This in conjunction with the RBT will allow for increased confidence in completion placement.



**Figure 2.** DSN/DSD Lithology interpretation, yellow highlights areas where quartz volume exceeds a 45% cutoff.

## Pseudo Stress Profile (Courtesy of Digital Formation™)

Using the data collected from the RBT we are able to extract a Travel Time (DT) curve without having to deploy an additional cased hole sonic tool. The data is then processed by Digital Formation™ to generate a stress profile along the lateral/horizontal. Digital Formation™ models a synthetic shear curve from the DT, neutron and density data, which is incorporated into their mechanical properties analysis. The result of the mechanical properties analysis yields a Bulk Modulus, Young Modulus, Shear Modulus and Poisson's Ratio curves along the length of the lateral/horizontal. A simplified brittle vs. ductile plot is also generated and can be of use in picking completion intervals. This information can then be incorporated into the fracture stimulation program design along with the bond log and lithology interpretation, optimizing the completion efficiency of the well.



**Figure 3.** Pseudo Stress Analysis courtesy of Digital Formation™ showing relevant mechanical properties of the rock along the lateral/horizontal and Brittle vs. Ductile Plot.

## Conclusions

RECON has developed these three simple tools in order to aid Operators in their quest to optimize their lateral/horizontal developments and give us the ability to help provide solutions to their problems. These tools along with RECON's highly recognized Specialty Cased Hole Production Logging Services can allow Operators the ability to tie Bond Logs, Lithology and Mechanical Properties back to actual production profiles along the length of the wellbore. Ideally inferences can be made about

particular rock type, mechanical properties and bond quality along the horizontal and correlate them to the stimulation program designs in order to achieve the most productive wells. Cost can be saved in terms of number of stages per lateral/horizontal and intensity/density of the completions. Smarter completion program design can lead to higher IP's and shallower declines resulting in wells that will continually out produce wells completed with typical programs to date.

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