

## INFLOW PRODUCTION PROFILE MONITORING IN HYDRAULICALLY FRACTURED MARGINAL GAS HORIZONTAL WELL USING QUANTUM PLT™ MARKER TECHNOLOGY

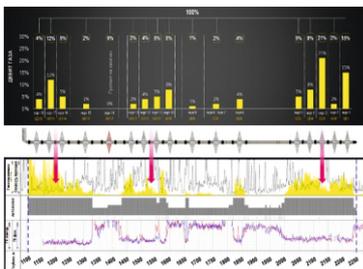
### CHALLENGE

One of the gas fields in China operators a reservoir with unusually low permeability shale sediments occurring at relatively shallow depth (950 - 1000 m). The field development is based on using hydraulic fracturing over 1000 m long laterals. Effective production from the field is impossible without stimulation using hydraulic fracturing. It facilitates more effective production and expands the coverage at drainage. However, in this case each fractured sections shall be constantly monitored to follow productivity and depletion of the site being studied. The production profiling of wells with complex trajectories cannot be regularly performed with conventional methods such as coiled tubing conveyed and wireline conveyed production logging tools. The reason being higher operational risks, difficulties in obtaining accurate interpretations in multi-phase horizontal flows, high operational costs. The cost-effective result can be achieved by using more advanced and informative methods of flow profile assessment such as Quantum PLT™ using chemical tracers to perform accurate inflow production profiling without well intervention.

### SOLUTION

GEOSPLIT offered breakthrough technology solution based on using marked proppant with unique tracers; quantum dots. The actual fracturing design, unique marker placement was jointly done with the operator. Gas samples after 18-stage fracturing were taken by setting a sampler unit on a bypass flowline at a well-head. The markers conveyed by a gas flow with different codes accumulated in the sampler screen filter. Inflow production profile analysis was done by analyzing surface fluid samples using flow cytometry and inhouse patented software applying machine-learning algorithms. The codes of marker-reporters® of each code were identified by after being irradiated by laser light in flow cytometer device. Further profile flow analysis showed the performance dynamics of hydraulic fracture in the horizontal gas well.

### APPLICATION



Quantitative rating in each of 18 sections was carried out updating horizontal well effective working length. The analysis helped find out both the most producing frac stages and areas of low or no production at all. It was noticed that most of gas flow was coming from «heel» and the «toe» of horizontal section, while the middle part showed almost no production. The result has been compared to the gas saturation obtained from LWD. The results show the high accuracy of the technology giving the operator confidence in applying Quantum PLT™ technology.

### CONCLUSION

The technology application in gas wells proved to be effective. The estimated longevity of marker reporters is beyond 3 years. Getting inflow profiling without any well intervention allows customer to obtain more frequent data cheaper and thus allowing better reservoir modelling, field development and ultimate better recovery factor. Additional 3 sets of samplings planned under survey program in 2020 will allow to trace the changes of the entire borehole performance in the real-time, consequently being good and valuable information regarding current state of reservoir production.

Adoption of GEOSPLIT technology at the very initial stages when design the wells or preparing a draft of planned well interventions allows to reduce well logging costs significantly, and also provides with opportunity better decision making, risk reduction and optimize production.