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Integration of Downstream and Upstream Capabilities for Field Wide Production Optimization

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Abstract

The demand for oil and gas is ever increasing. At the same time much of the new oil is in challenging environments and is increasingly becoming more difficult to produce. This, together with exponentially increasing communications capacity and computing power, has led to several initiatives in the area of Digital Oil Fields, Smart FieldsC_ etc. In all these initiatives, optimization on multiple economically relevant time scales plays an important role. The downstream refining and chemicals businesses have faced similar questions and have developed a well-established hierarchy for optimization on multiple time scales (Long Term Planning, Scheduling, Real-Time Optimization, Performance Monitoring, APC, Base-layer control) in which the scope, time scales, integration, interfaces etc. have been clearly defined.

There are several differences between the production system in the upstream and downstream supply chain. For example, diverse environments and workforces, significant and dynamically changing subsurface uncertainty and time scales of decades with respect to reservoir systems can characterize the upstream supply system. However, many principles of optimization and uncertainty management, such as the "division of time scales principle", are equally valid for upstream and downstream systems. This allows great opportunities to integrate and synergize upstream and downstream technologies.

This paper describes how such an optimization hierarchy can be constructed for field-wide production optimization, integrating downstream and upstream concepts. This paper will propose solutions based on the above concepts, while considering business decision requirements, engineering workflows and collaborative working. It will also indicate the challenges that need to be addressed to implement and maintain such applications reliably in the oil and gas production environment. A number of concrete field cases where (part of) this principle is successfully applied will also be presented.