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SPE Workshop “Brownfields Redevelopment – The Journey Continues”
Session 3: Reservoir Management - Maximising the Existing Barrels

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Outline

• Common LTRO workflows
• Improved LTRO:
  – Contacts based
  – Displacement based
• Managing uncertainties – way of controlling the risks
• Rapid analysis and opportunities search - making fast decisions
• LTRO Examples
• Conclusions
LTRO workflows

**STATIC MODEL**
- Static model driven

**DYNAMIC HISTORY MATCHED MODEL**
- Dynamic model driven

NEW WORKFLOWS

- **Fluid contact tracking method**
  - Applicable for fields with aquifer/gas cap where the main driving mechanisms – contacts rising (movement)

- **Displacement driven saturation mapping method**
  - Suitable for fields with intensive areal displacement due to aquifer influx and/or injection activities

COMMON WORKFLOWS EXAMPLES

- STOIIP - bubble map

REALISATIONS

[Diagram showing the workflow processes and models]
Contacts tracking

**Approaches:**
- 2 phase (WOC or GOC only) & 3 phase (WOC & GOC)
- Segregated flow / High perm segregated flow / Diffuse method

**Plot new contacts & derive OWC / GOC per well or per layer**
- Reiterate with Static model to calculate volumes in place
- Build remaining oil maps
Displacement driven saturation mapping

MATCHED in the run:
- Volumetrics (Oil produced & Current In-Place)
- Saturations @ wells (WCT derived)
- Observed saturations @ wells (Logs derived)
Uncertainties management

HIGH / MID / LOW CASE SCENARIOS CAN BE ADDRESSED AT THE SAME TIME FOR THE BEST OPPORTUNITIES UNDERSTANDING

PRODUCTION ALLOCATION UNCERTAINTY

- Allocation Process
- Allocation Datasets
- A Set of Scenarios
- Static Data Uncertainty
- Layered Properties Maps Variations

SCENARIOS OUTPUT – OPPORTUNITIES ASSESSMENT

- Fast calculation method allows many iterations / cases to run
- Automated match on the fly - no further HM required
- Rapid opportunities assessment based on calculated maps & defined criteria
- Rank opportunities
Opportunities identification

**BEHIND PIPE | INFILL**

**BEHIND-PIPE OPPORTUNITY IDENTIFICATION**
- Automatically interrogates the available well stock vs. predicted Oil saturation at present time
- Seriatim of opportunities generated for multi-criteria ranking

**INFILL OPPORTUNITIES IDENTIFICATION USING ADVANCED, MULTI-CRITERIA FILTERING**
- Within specific area/radius
  - Target oil volume
- Suitable range of water saturation
- Constraints on net thickness and other reservoir properties
- Comparing the targets from different layers (maps) for joined opportunities
LTRO Example 1 - comparison with simulator

**Absolute saturation error distribution**
red – negative, blue – positive, white - zero

**Relative saturation error**
~15% ~30%

**Saturation @ wells**

**Saturation maps**

Simulator saturation

Displacement driven optimised saturation (new workflow)
LTRO Example 2 – field case
Conclusions

• An integrated LTRO workflow has been presented

• Workflow advantages:
  – Rapid remaining oil maps calculation
  – Auto-matching the general field observations
  – Managing uncertainties (ex. Production allocation, G&G…)
  – Easy to analyse new opportunities:
    • Infill
    • Behind pipe
  – Multiple scenarios concept for managing the risks

Thank you!