

TRIMAX NEXT GENERATION SYSTEM





TriMax

DEEPWATER DRILLING FLUID – NEXT GENERATION SYSTEM

- **Downhole Performance** achieved by providing engineered **Downhole Rheology** under **Downhole Temperatures** and **Downhole Pressures**.
- Designed for **Narrow ECD Window Drilling** operations.
- Superior Control of **LSYP Progression** and **ECD generation**
- Gulf of Mexico **Environmentally Compliant**.

TRIMAX SYSTEM - INITIAL RESEARCH AND SIMULATIONS / FANN 77

- Reviewed the conventional “Flat Rheology” DW SBM systems to assess weaknesses and benefits
- Mixed numerous formulations to come up with a new system that lowered ECDs downhole
- Utilized 2x Fann77; 1x Fann77 in Villahermosa for testing the formulations
- Compared Fluid Rheological Profiles of Flat Rheology vs TriMAX systems utilizing HYDRAULICS SOFTWARE



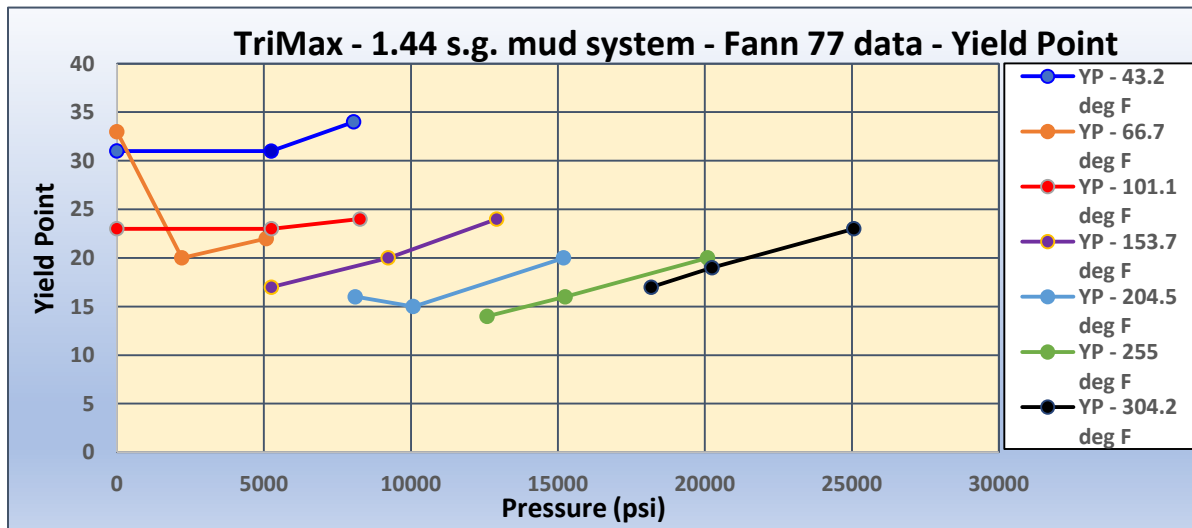
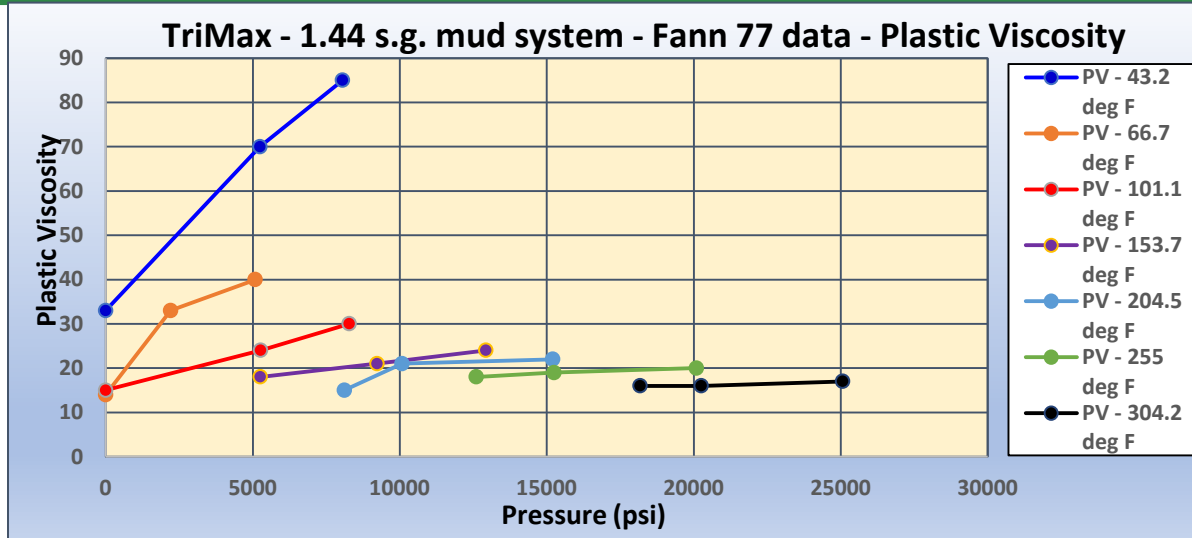
TRIMAX SYSTEM TESTING

- Formulations from 1.08 s.g. to 2.16 s.g. are being tested with Fann77 viscometers to give a complete database of the TriMAX system to model performance with HYDRAULICS SOFTWARE
- The 1.44 & 1.68 s.g. formulation Fann77 data has been used with MAXSITE HYDRAULICS to show ECD reduction downhole
- Other formulations are modelled with MAXSITE HYDRAULICS as more Fann77 data is acquired.

TriMAX

<i>Property</i>	<i>Range (40-150°F)</i>
<i>Mud Weight – lb/gal</i>	9.0 – 18.0
<i>Plastic Viscosity – cP</i>	16 – 40
<i>Yield Point – lb/100ft²</i>	10 – 30
<i>Gel Strengths - lb/100ft² (10s /10m/30m)</i>	5-15 / 6-20 / 8-25
<i>Lime excess – lb/bbl</i>	1 - 3
<i>Electrical Stability, Volts</i>	250 – 1,000
<i>HTHP Fluid Loss - cc's/30min</i>	4.0 – 15.0
<i>Oil/Water ratio (OWR)</i>	65:35 – 95:5

TRIMAX - FANN 77 DATA REVIEW



Plastic Viscosity & Yield Point

Response to Temperature and Pressure

1. Plastic Viscosity

High 6.1°C response for 8000 psi

Pressure at 2590m = 5300 psi

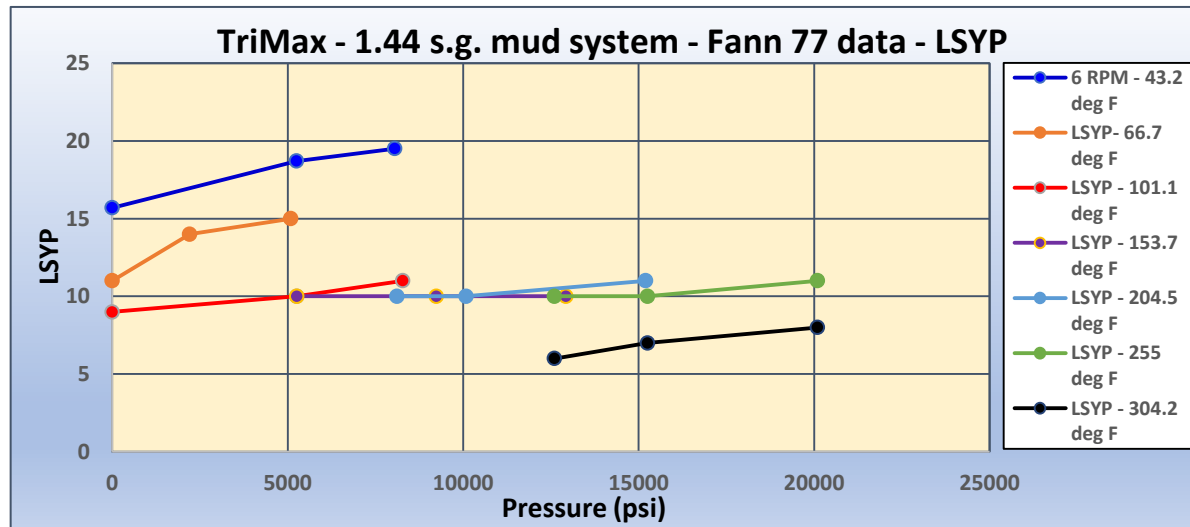
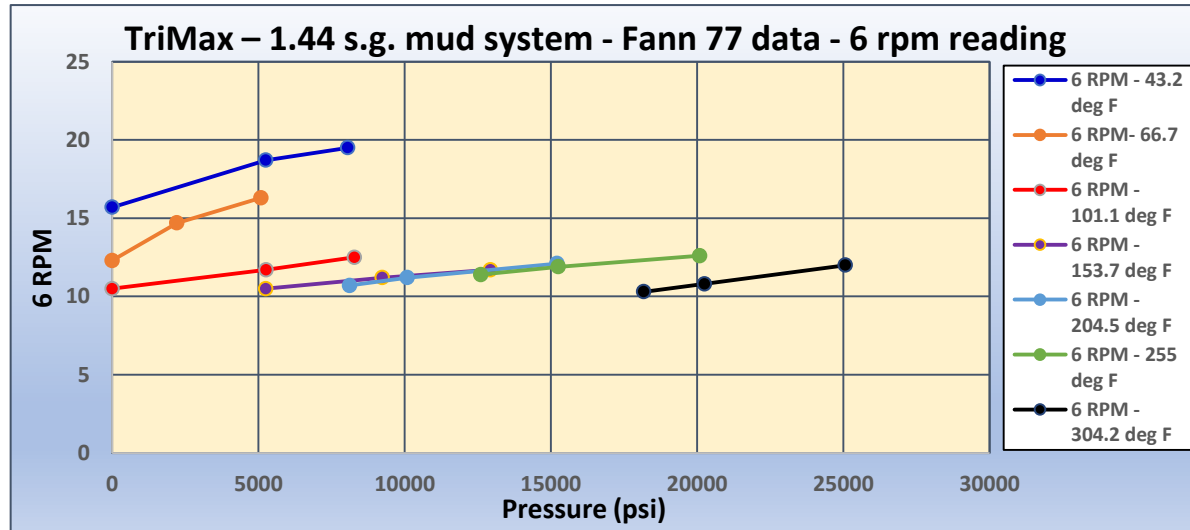
PV – 70 at 5300 psi

2. Yield Point

30-34 at 6.1°C – not high for riser

As temperature ramps, yield point is fairly consistent in pressure range

TRIMAX — FANN 77 DATA REVIEW



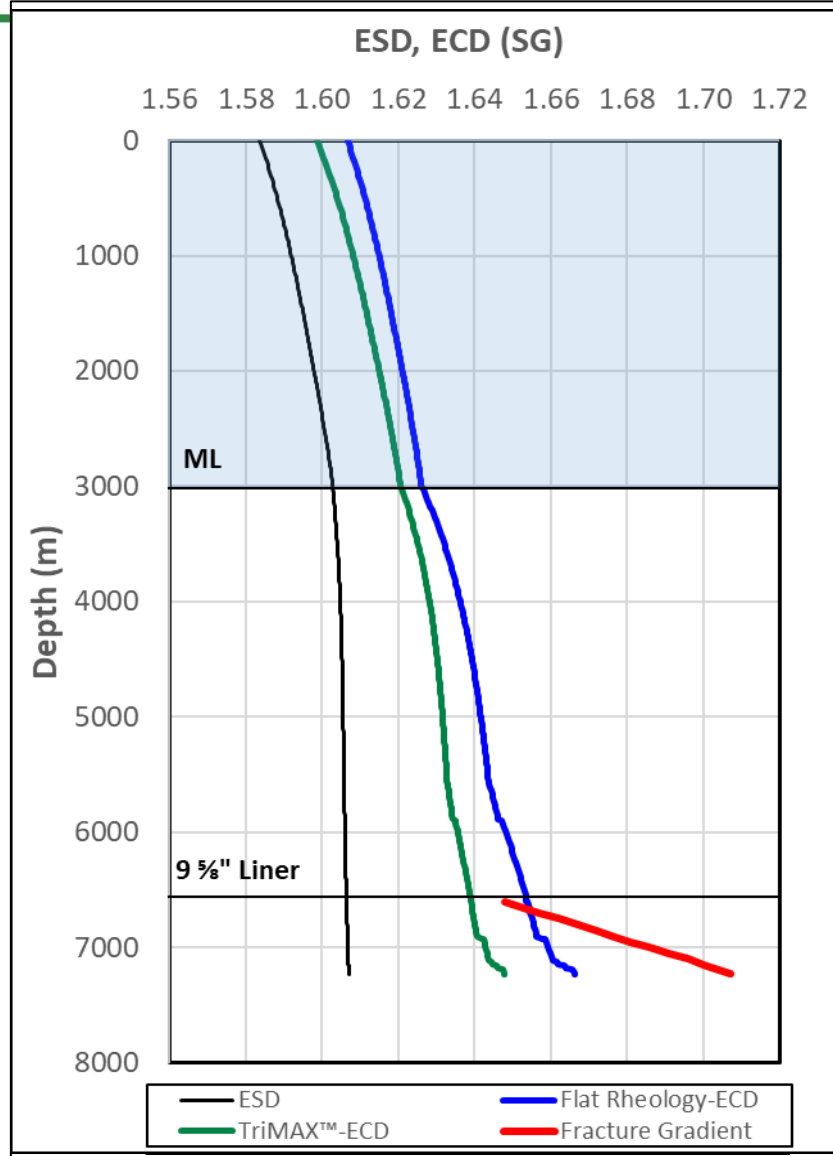
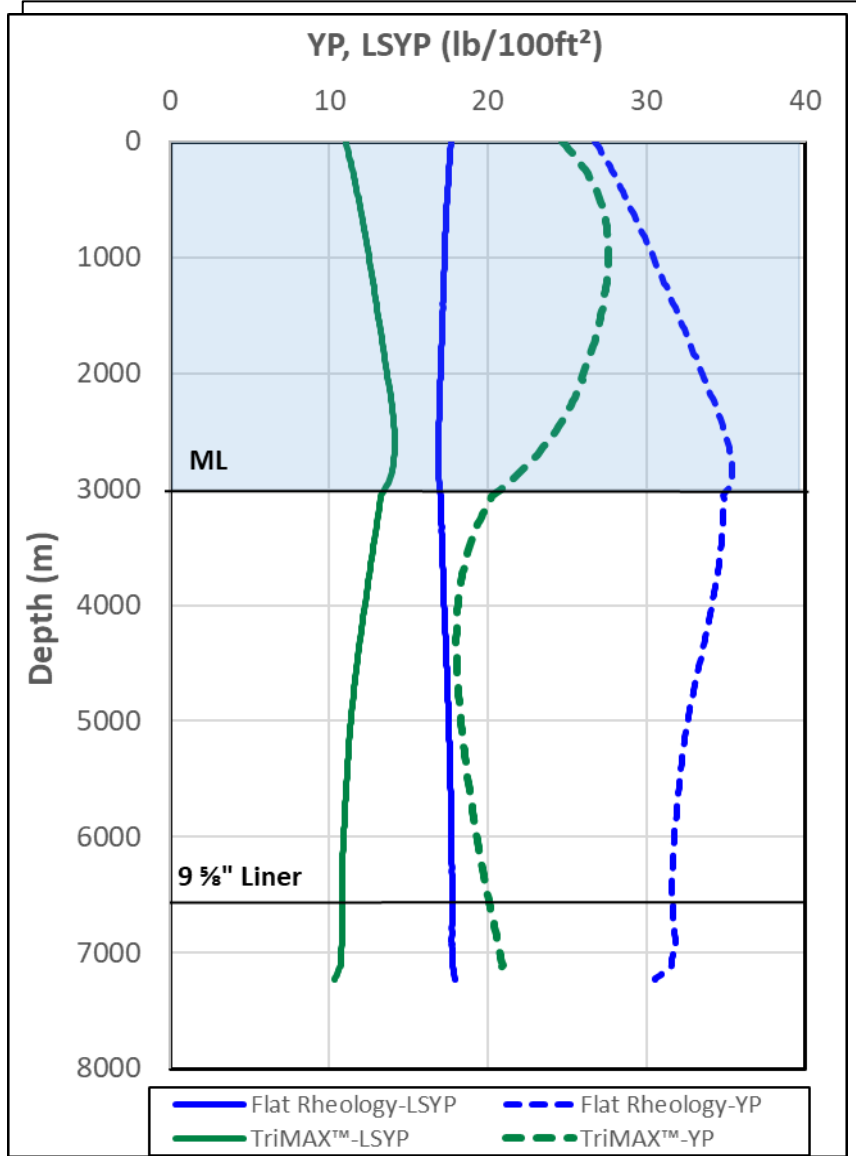
6 RPM Fann 77 Readings & LSYP

Response to Temperature and Pressure

- 6 RPM Fann 77 readings
 - 6.1°C reading not high at all
 - High enough to clean big hole
 - Fairly consistent across temp and pressure ranges
- LSYP – low shear rate yield point
 - 6.1°C reading similar to 6 rpm readings
 - Fairly consistent across temp and pressure ranges
 - 151°C – shows a drop from 123.9°C, but will help in ECD reading in higher temperature sections of the hole



TRIMAX™ SYSTEM - WELL SIMULATION – LOWER ECD RESULT



Data from DW Mexico Well
 8.5" OH section – TD @ 7229m
 ROP = 10mph, RPM=120 TD
 Mud Weight = 1.58 S.G.
 BHST = 132°C

Results: TriMAX SBM ECD is
 0.018 S.G (0.15 ppg) lower than
 Conventional Flat Rheology
 SBM ECD during drilling
 operations

TriMAX SBM could have
 potentially saved lost circulation
 issues in the 8.5" OH section

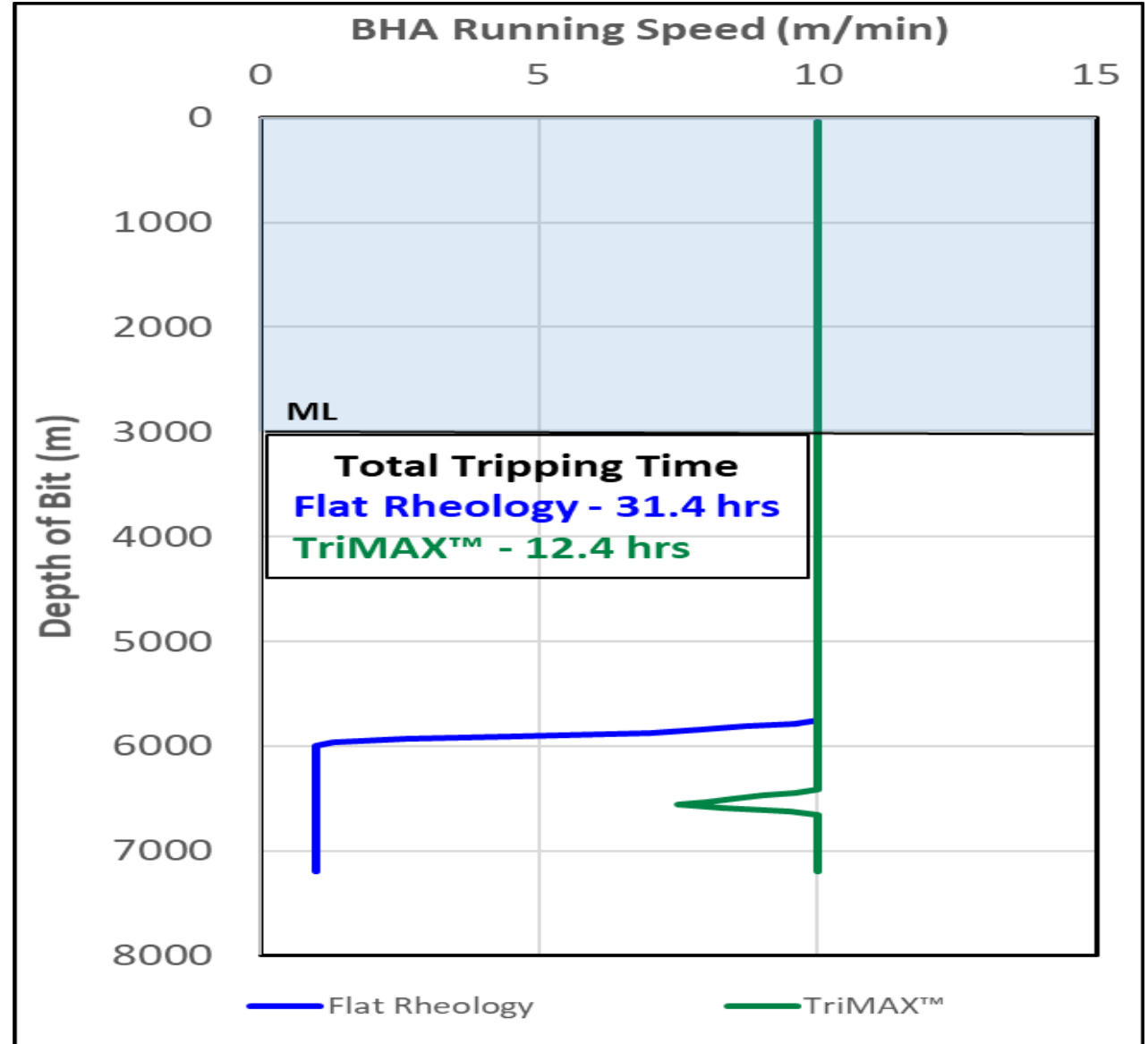


TRIMAX SYSTEM - WELL SIMULATIONS — FASTER TRIPPING SPEEDS

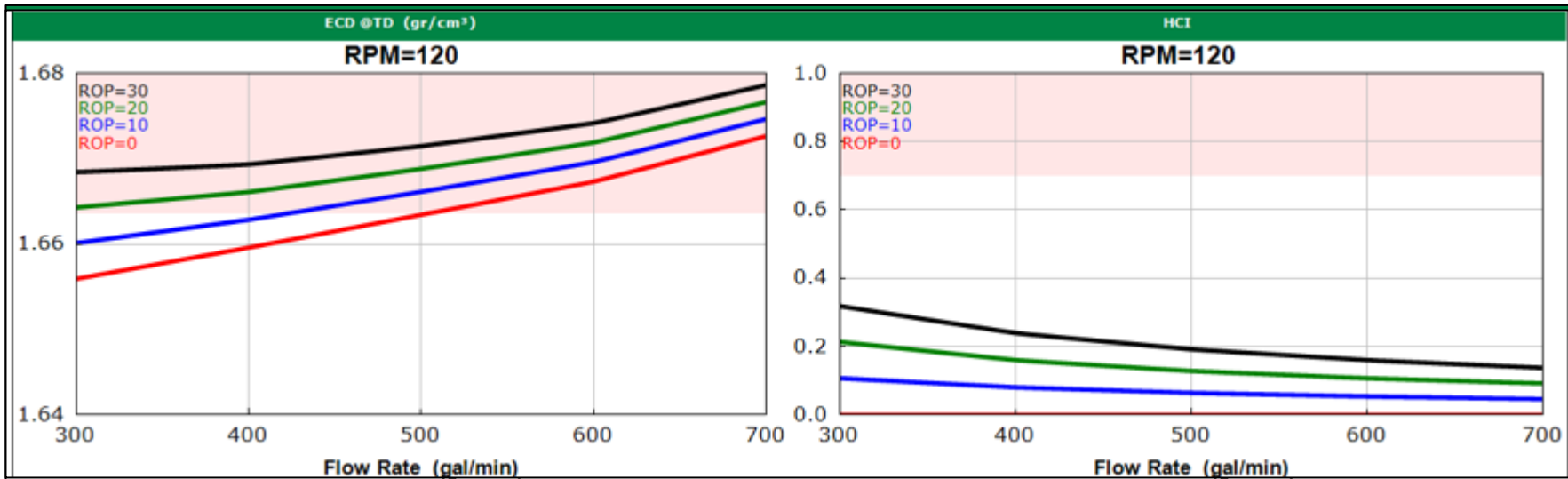
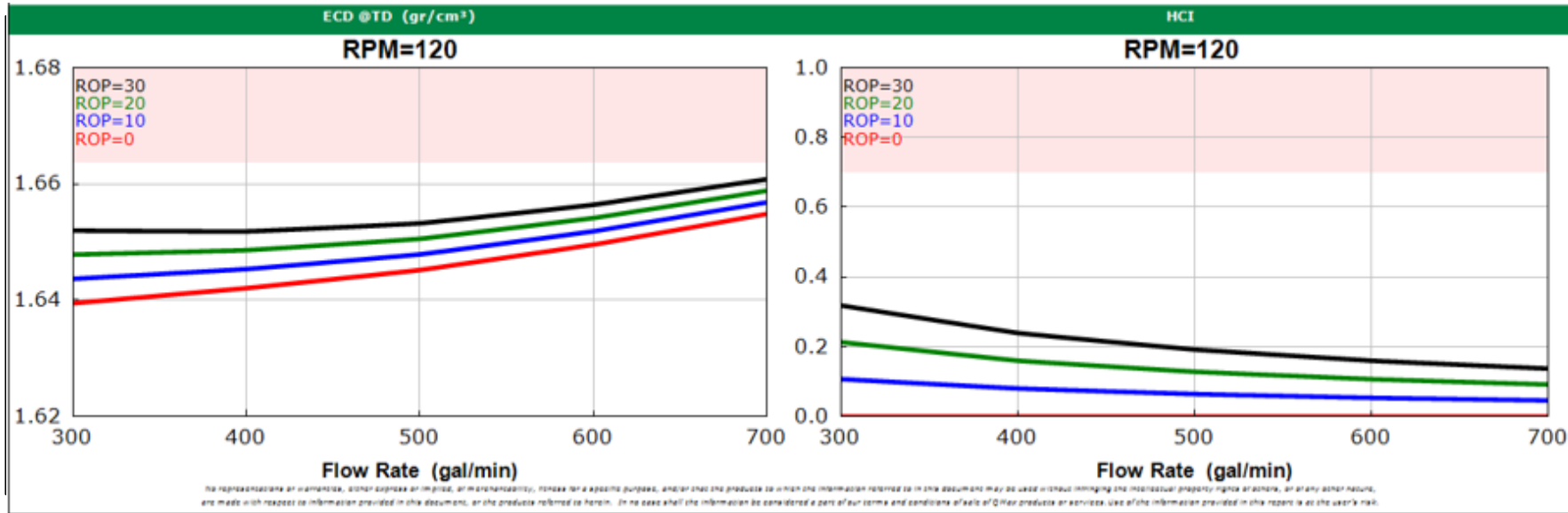
- Field Data from Deepwater Well offshore Mexico
- 8.5"OH section – TD @ 7229m
- TD Mud Weight = 1.58 S.G.
- BHST = 132°C
- Simulation: Running Drilling Assembly in hole after trip out

- Results: Utilizing the TriMAX SBM could potentially saved about 19 hrs of tripping time (invisible NPT)

- Assuming a spread rate of \$1,000,000 for a 6th generation Semi-Submersible MODU, the resultant savings to Pemex would be \$791,666 USD.



TRIMAX™ SYSTEM — HOLE CLEANING ABILITY



Data: DW Well O/S Mexico
 8.5"OH section – TD @ 7229m
 TD Mud Weight = 1.58 S.G.
 BHST = 132°C

Results: TriMAX SBM system shows similar hole cleaning ability as the conventional Flat Rheology SBM systems



TRIMAX™ SYSTEM – SOLIDS TOLERATION

	TriMAX Drilling Fluid @ 1.44 s.g.				Contaminated with 5% Rev Dust			
Rheology Results	Rolled @ 65.5C				Rolled @ 65.5°C			
Rheology Temp @	4.4C	37.8C	48.8C	65.5C	4.4C	37.8C	48.8C	65.5C
Electrical Stability, Volts	460				508			
600 rpm reading	121	66	57	49	151	81	64	52
300 rpm reading	71	43	36	31	89	49	38	32
200 rpm reading	53	34	28	24	67	38	29	24
100 rpm reading	34	24	20	16	44	25	20	15
6 rpm reading	12	11	9	8	14	8	7	6
3 rpm reading	11	11	8	7	12	7	6	6
Plastic Viscosity, cP	50	23	21	18	62	32	26	20
Yield Point, lb/100ft ²	21	20	15	13	27	17	12	12
10-sec Gel, lb/100ft ²	14	14	12	11	13	10	9	9
10 min Gel, lb/100ft ²	21	19	14	9	17	18	15	13
30-min Gel, lb/100ft ²	27	17	13	12	20	18	13	11

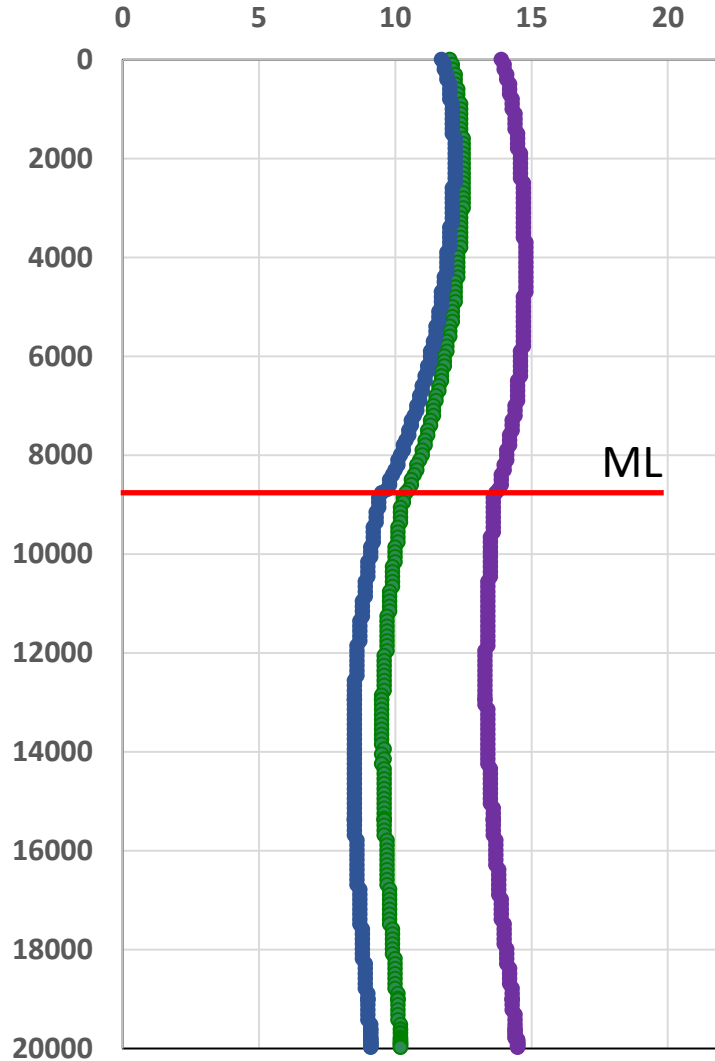
Solids Toleration – 1.44 s.g. TriMAX SBM

- Hot rolled and tested from 4.4-65.5°C – added 5% solids to base fluid
- 4.4°C shows increase from 50 to 62 in PV – 23%, but not significant for operations
- 4.4°C shows increase from 21 to 27 in YP – not significant for operations
- Higher temperatures shows decreasing rheology effects of solids contamination
- Electrical Stability increased from 460-508 mv
- 10s/10m/30m gels – show improvement with solids contamination

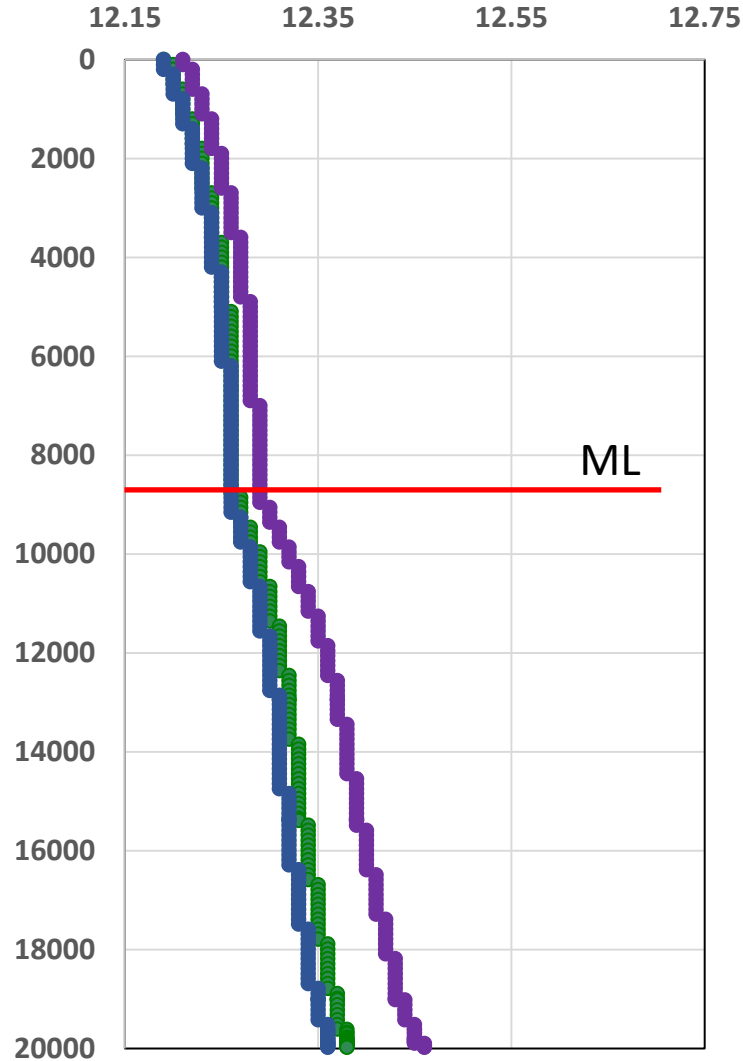


TRIMAX™ SYSTEM – CONTAMINATION WITH 10% SEAWATER

LSYP (lbf/100ft²)



ECD (lb/gal)



TriMAX:

PV@ 4.4°C = 50

YP@ 4.4°C = 21

TriMAX™ + SW:

PV@ 4.4°C = 50

YP@ 4.4°C = 24

TriMAX™ Treated:

PV @ 4.4°C = 41

YP @ 4.4°C = 19

Treatment:

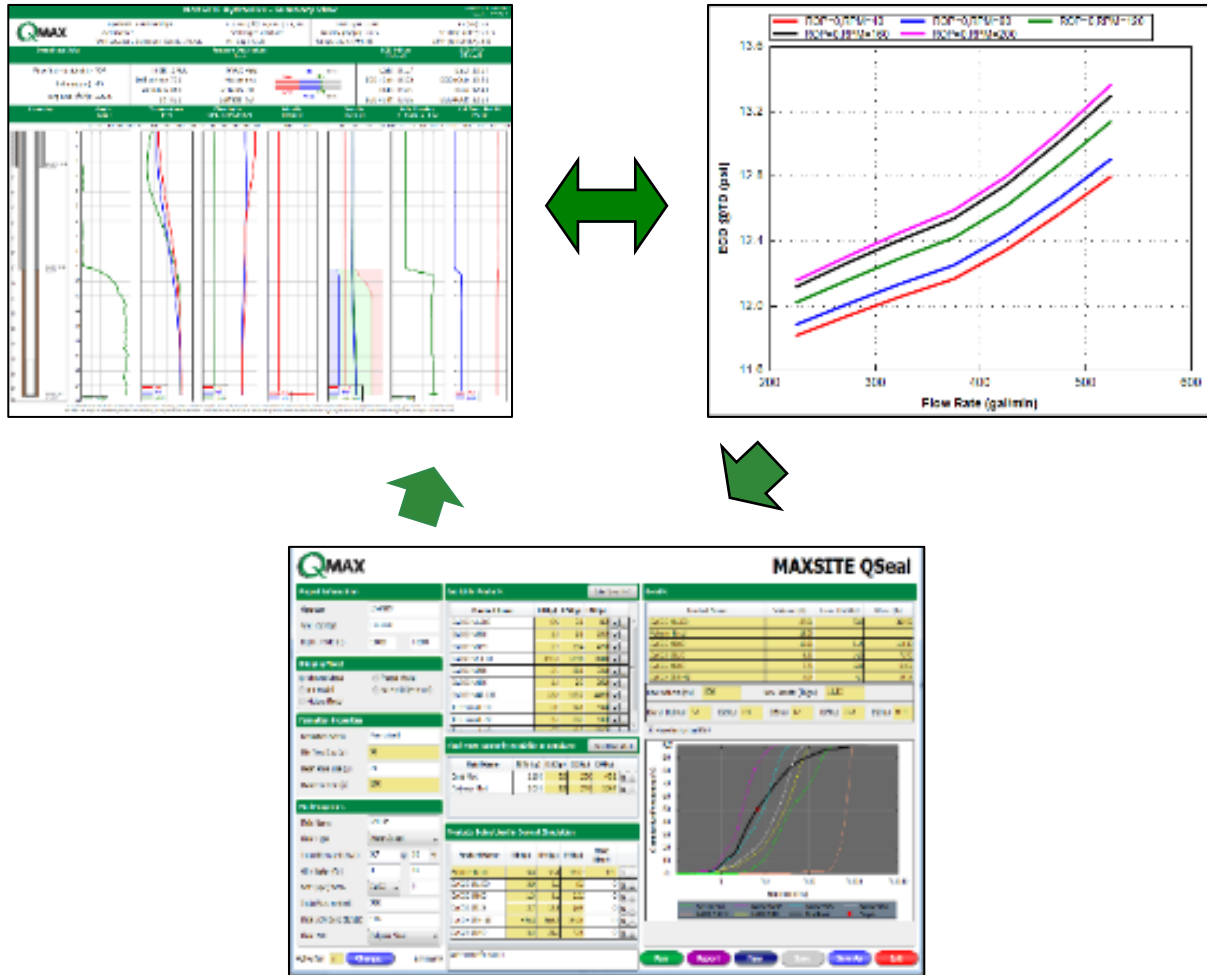
2ppb emulsifier and base oil to get back to 70/30 SWR

Impact:

Slightly better ECD response and LSYP response than before SW contamination

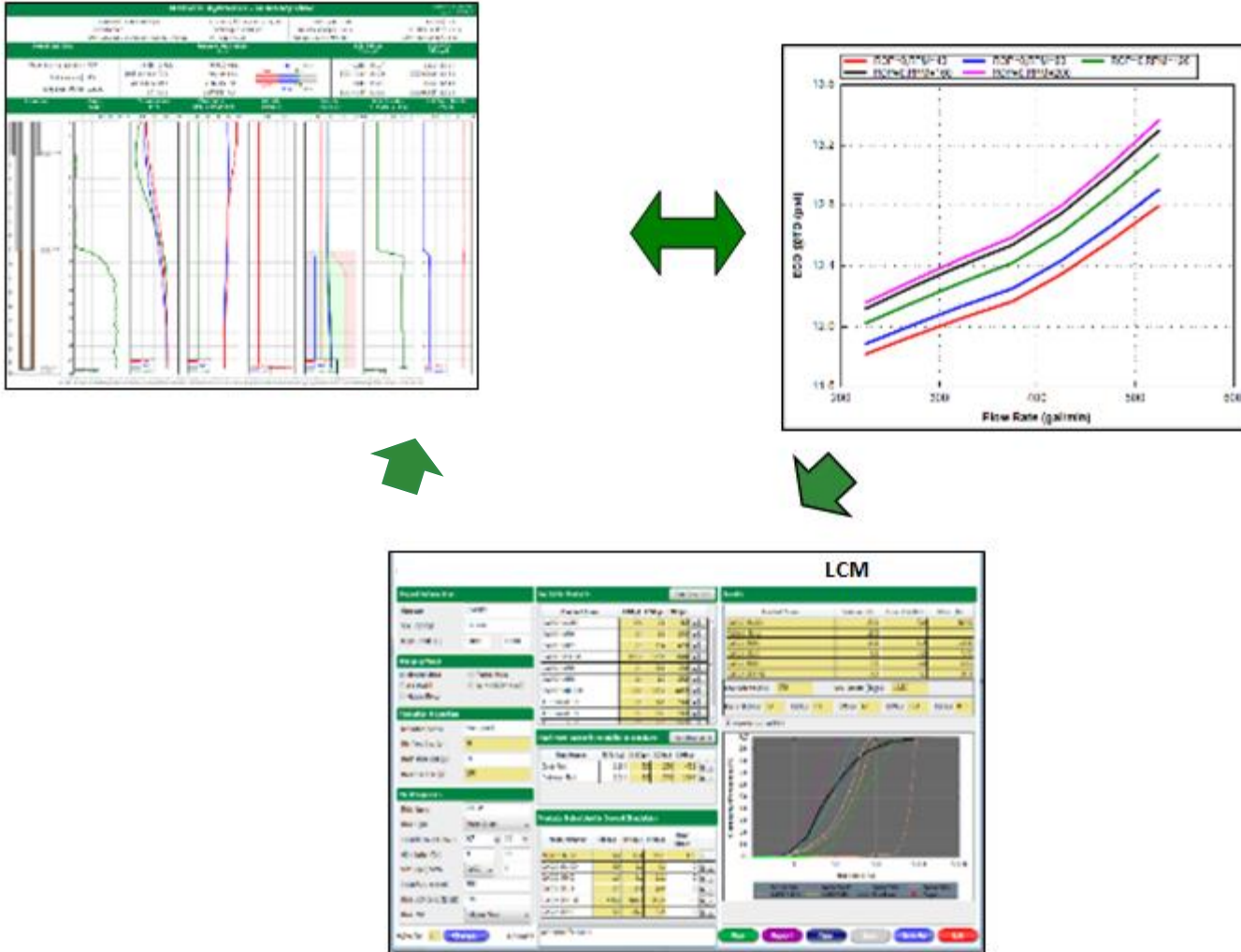


TRIMAX SYSTEM – SEEPAGE / LOSSES PLAN



- **Prevention and Control Plan of losses from seepage or major losses**
- Utilize **MaxSite Hydraulics** daily for drilling optimization and problem indications, tripping recommendations, sweep modelling, etc.
- Utilize low density **TriMAX SBM** where possible
- **QSEAL** Software for optimum LCM PSD range for seepage losses
- LCM Systems – if major losses occur:
 - **QMaxPlug** – cross-linked pill
 - **QMaxSqueeze** – high fluid loss pill

TRIMAX™ SYSTEM – SEEPAGE / LOSSES PLAN



- **Prevention and Control Plan of losses from seepage or major losses**
- Utilize **Hydraulics** daily for drilling optimization and problem indications, tripping recommendations, sweep modelling, etc.
- Utilize low density **TriMAX SBM** where possible
- **LCM** Software for optimum LCM PSD range for seepage losses
- LCM Systems – if major losses occur:
 - **ID-Plug** – cross-linked pill
 - **ID-Squeeze** – high fluid loss pill



*Thank
you*

