



KUWAIT 3RD FLOW MEASUREMENT TECHNOLOGY CONFERENCE

19 - 21 NOVEMBER 2017
HILTON KUWAIT RESORT , AL DORRA BALLROOM

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إحدى شركات مؤسسة البترول الكويتية
A Subsidiary of Kuwait Petroleum Corporation

SPEAKER BIOGRAPHY

Ahmed Hussein BSC, MBA

Expro Meters Product Line Manager

Strength and Presence:

MENA Region

Service Delivery, Multiple Geo-markets, Project Management



Ahmed Hussein is Expro Meters' Product Line Manager for MENA Region, he is in charge of Expro Meters Operations, service delivery and execution in MENA countries. Hussein's career within Expro passed through several steps of success between Operations and Business Development. He has achieved significant success for technology breakthrough in the Iraq, Algeria and KSA which in turn has had a profound influence on the Expro Meters' service delivery model worldwide.

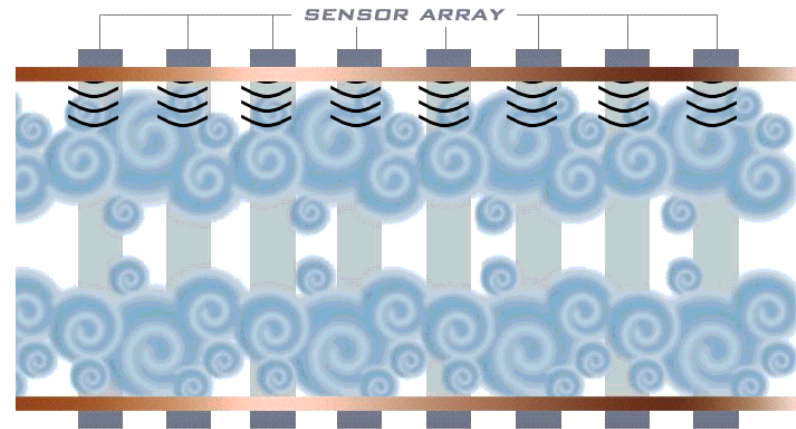
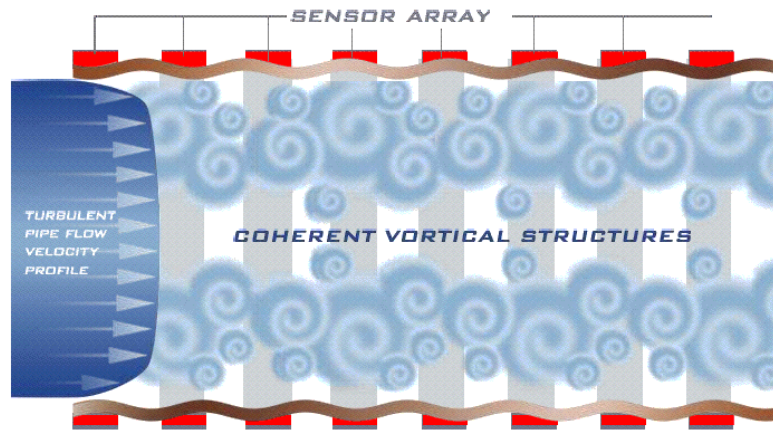
Multiphase Flow Surveillance Utilizing Clamp-on Sonar Metering

AGENDA

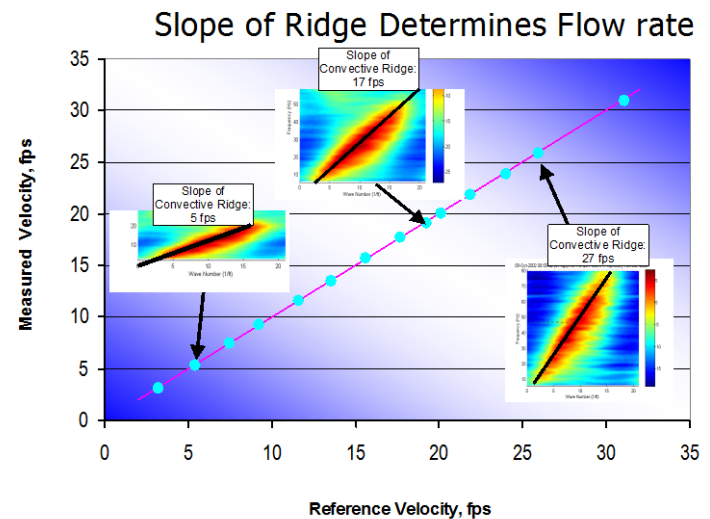
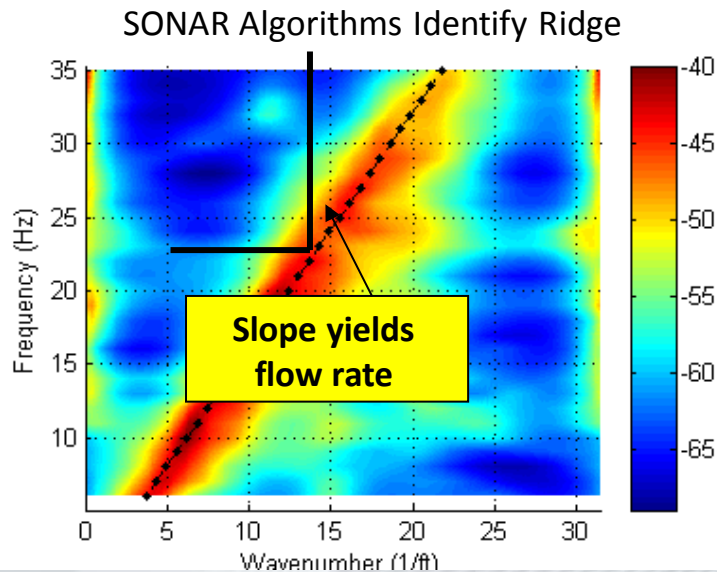
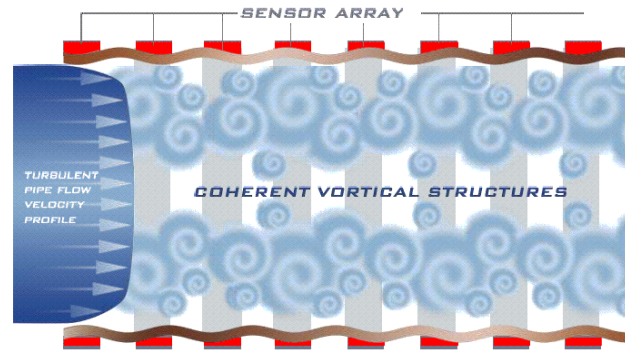
- **SONAR Technology Description**
- **Core Applications – Multiphase Flow**
- **Multiphase Flow Processing – Black Oil**
- **Multiphase Flow Processing – Wet Gas**
- **Case Studies**
- **Conclusions**

SONAR TECHNOLOGY

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SONAR TECHNOLOGY



CORE APPLICATIONS

- Oil and Gas wells production surveillance
- ESP Surveillance & Optimisation
- Gas lift optimisation
- Gas and water injection surveillance
- Production facilities - Flow surveillance for instrument verification and de-bottlenecking

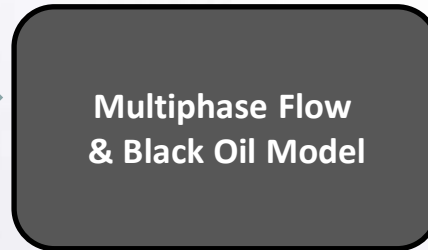
MULTIPHASE FLOW PROCESSING – BLACK OIL

Compositional Data (from PVT report)

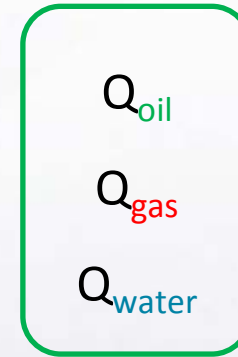
Formation GOR
Gas SG
Oil SG
Bubble Point Pressure
Reservoir Pressure
Reservoir Temperature

(Client Provided)

Pressure &
Temperature



Watercut
sampling



MULTIPHASE FLOW PROCESSING – WET GAS

PVT Engine + Wet Gas Algorithm (includes the OR correlation)

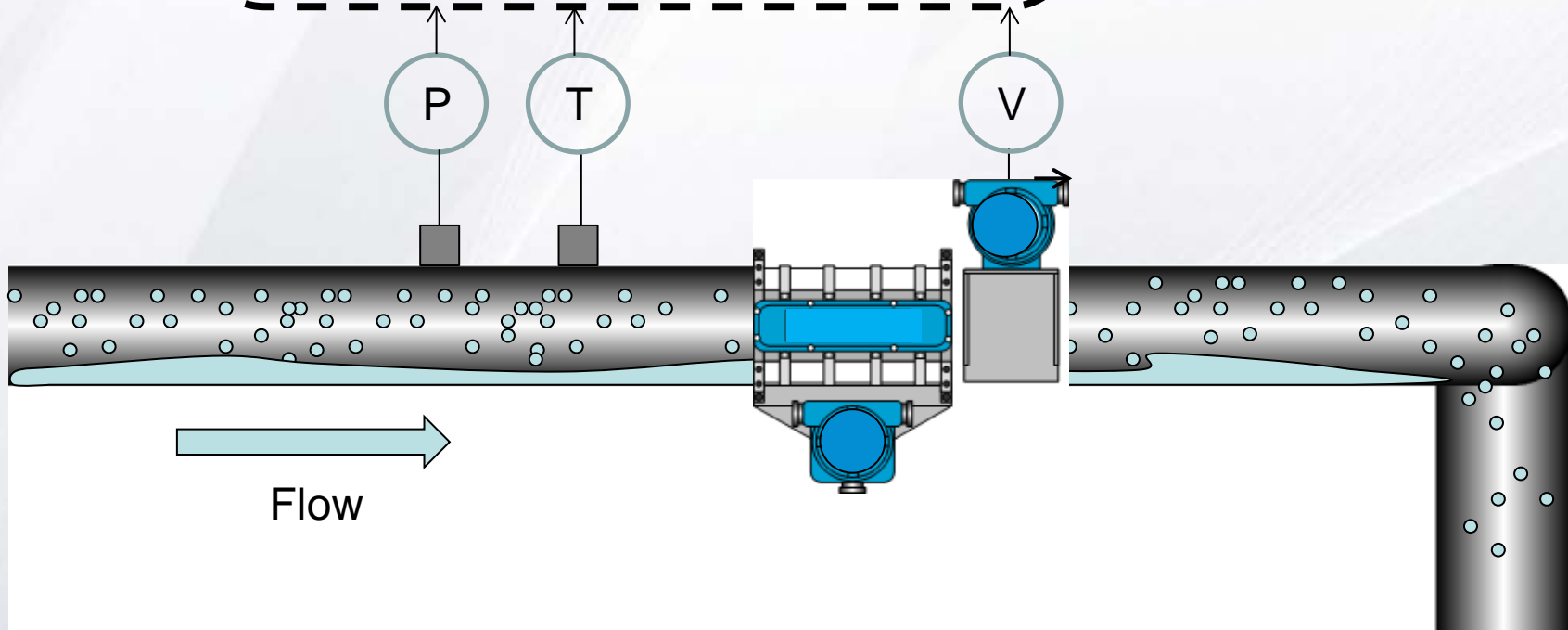
Inputs

C7+ Wellstream
Composition or
GOR/CGR
WGR/Water Cut



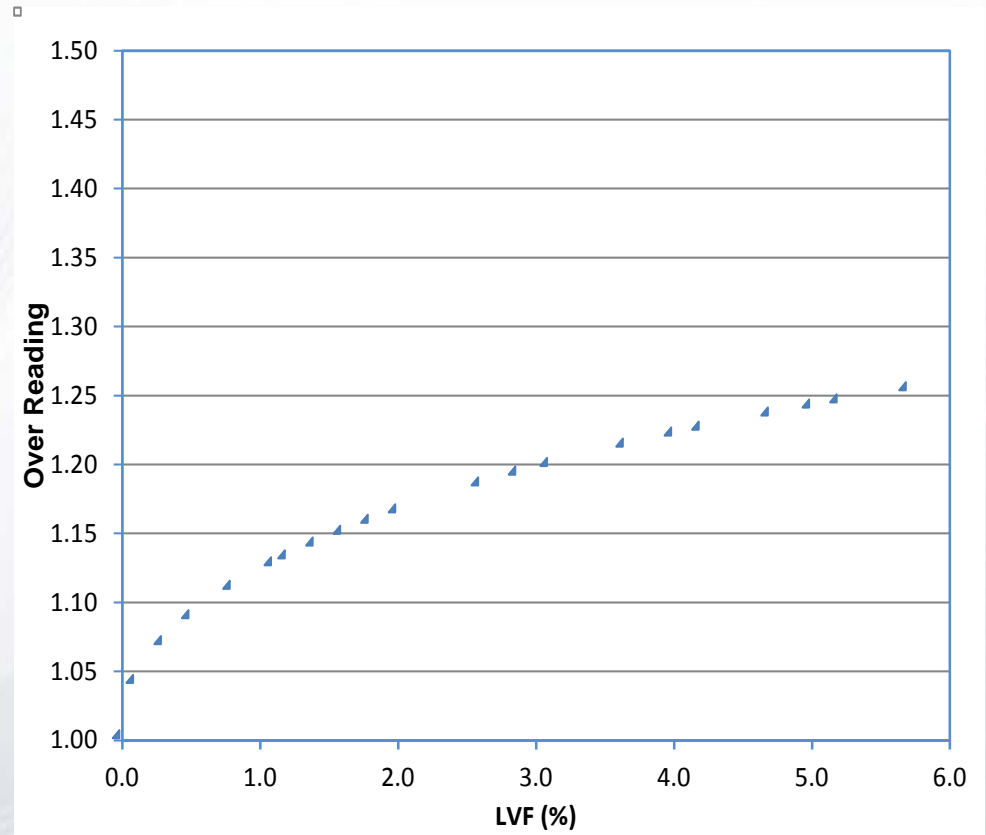
Outputs

Gas Rate @ Act, STD
Oil Rate @ Act, STD
Water Rate @ Act, STD



WET GAS OVER-READING (OR CORRELATION)

- SONAR OR Correlation is pipe size dependent
- OR correlation is a function of the LVF and Froude No. $OR = f(LVF, Fr)$
- Developed after extensive flow loop testing on multiple pipe sizes



CASE STUDY – BLACK OIL WELLHEAD SURVEILLANCE

- Systematic well testing production allocation and optimization
- ESP Surveillance / Optimisation
- Pre / post work over testing
- Surface rates during production logging



CASE STUDY – BLACK OIL WELLHEAD SURVEILLANCE

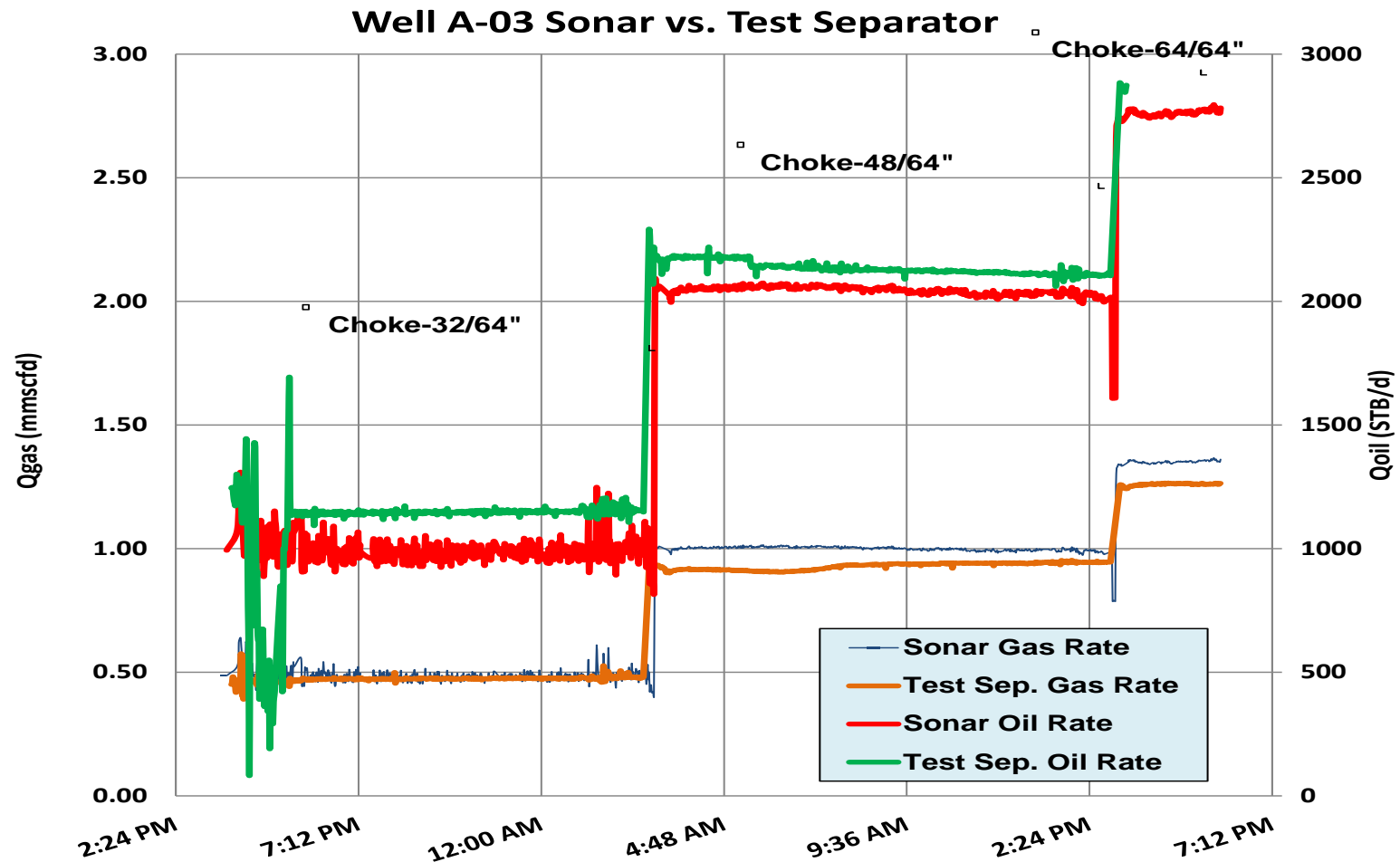
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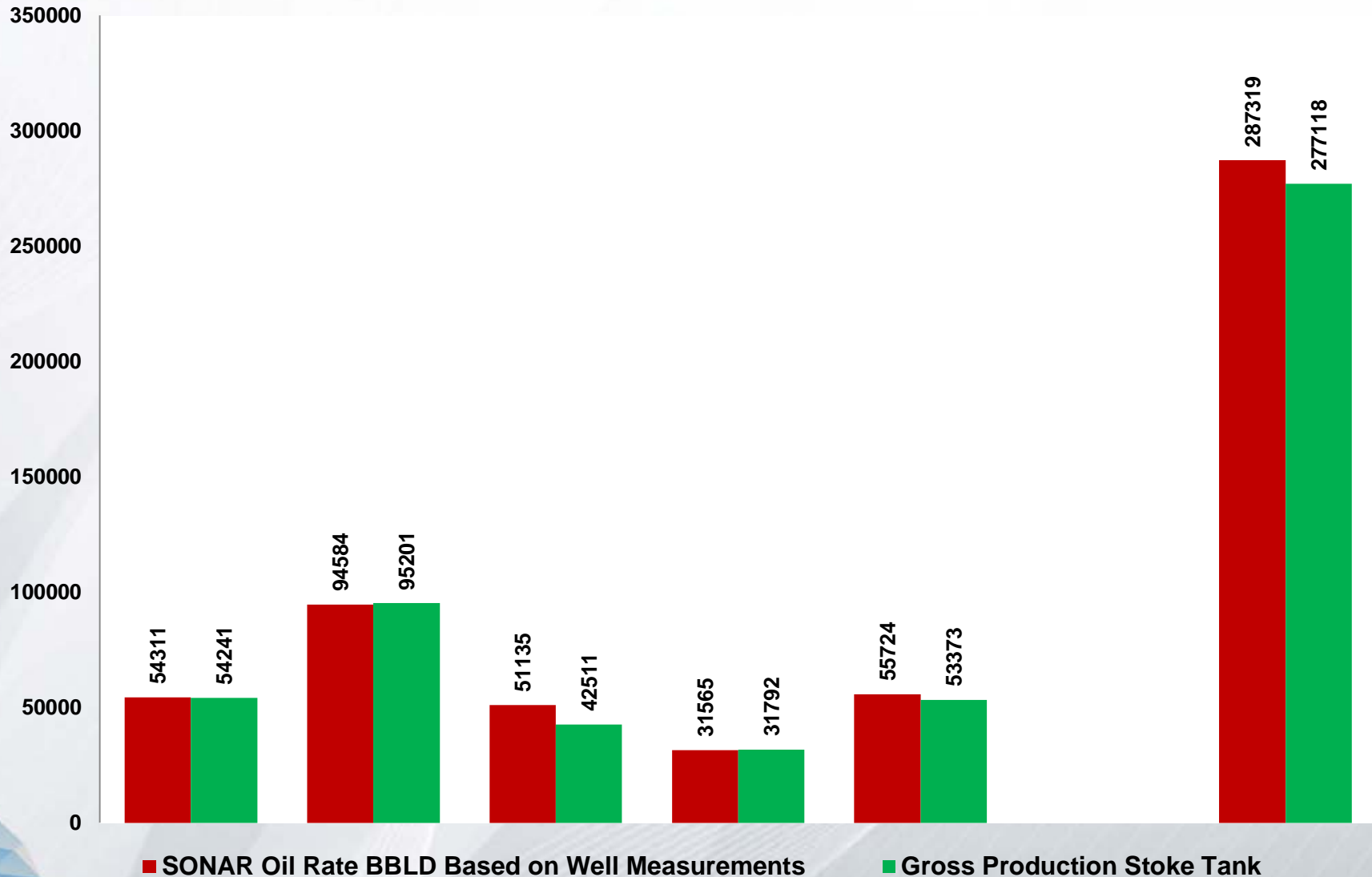
- Initial verification testing performed in conjunction with a test separator for multiple wells
- Historic PVT for reservoir zones provided by client (under-saturated reservoir)
- The offset between SONAR and reference 3-phase rates ranged from $\pm 0.1\%$ -15% across various operating conditions (choke sizes, process pressures)
- Verification testing deemed to be successful
- Subsequent field wide surveillance campaigns have been performed over the years



SONAR Production Well Testing Accuracy



SONAR Production Well Testing Accuracy



■ SONAR Oil Rate BBLD Based on Well Measurements

■ Gross Production Stoke Tank

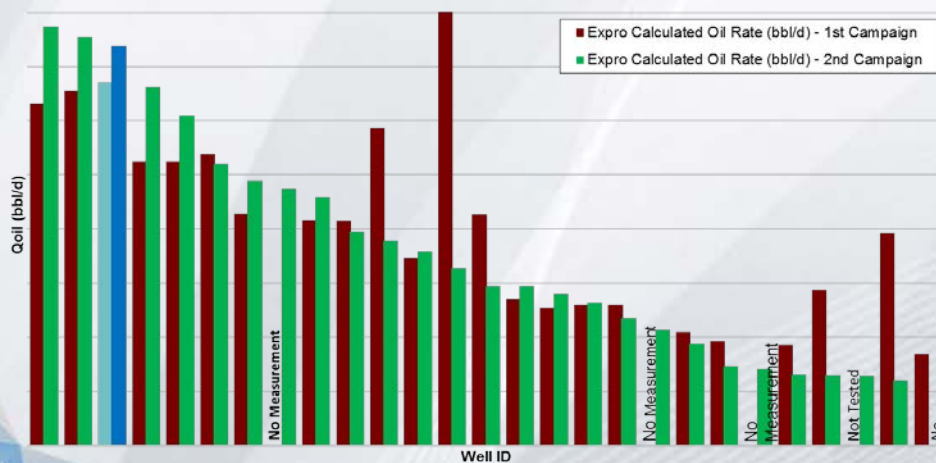
Expro SONAR Surveillance – Production Optimization

Company optimization team identifying wells performance using SONAR Surveillance Technology in a time lapse campaign mode

8 Wells proved Stable Production •
Wells oil rate within +/- 10%

9 Wells proved Declining Production •
Wells oil rate <-10%.

8 Wells proved Optimized Production •
Wells oil rate > +10%



Oil Flow Rate Comparison Per Group of Wells			
ID	Production Increased	Production Decreased	Production Status
XX-	22%	-	Production Optimized
XX-	15%	-	Production Optimized
XX-	26%	-	Production Optimized
XX-	16%	-	Production Optimized
XX-	-	3%	Stable
XX-	14%	-	Production Optimized
XX-	-	-	Production Optimized
XX-	10%	-	Stable
XX-	-	5%	Stable
XX-	-	35%	Decreased
XX-	3%	-	Stable
XX-	-	59%	Decreased
XX-	-	31%	Decreased
XX-	9%	-	Stable
XX-	10%	-	Stable
XX-	1%	-	Stable
XX-	-	10%	Stable
XX-	-	-	Production Optimized
XX-	-	11%	Decreased
XX-	-	24%	Decreased
XX-	-	-	Production Optimized
XX-	-	29%	Decreased
XX-	-	55%	Decreased
XX-	-	-	Tested Once
XX-	-	70%	Decreased
XX-	-	36%	Decreased



Thanks for Attention

QUESTIONS?