



Field Performance of Large CVG GyroMWD Tools in Alaska's Arctic Drilling Conditions

Austin Pile



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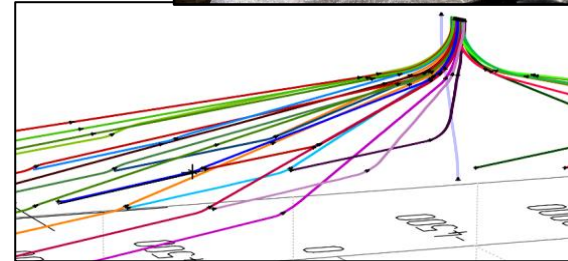
- Scientific Drilling International (SDI)
- 12 years' experience across Engineering, Product Support, and Field Operations
- Colorado School of Mines
 - B.S Petroleum Engineering
- Specialization:
 - Gyro Surveying
 - Prototype Tool Development



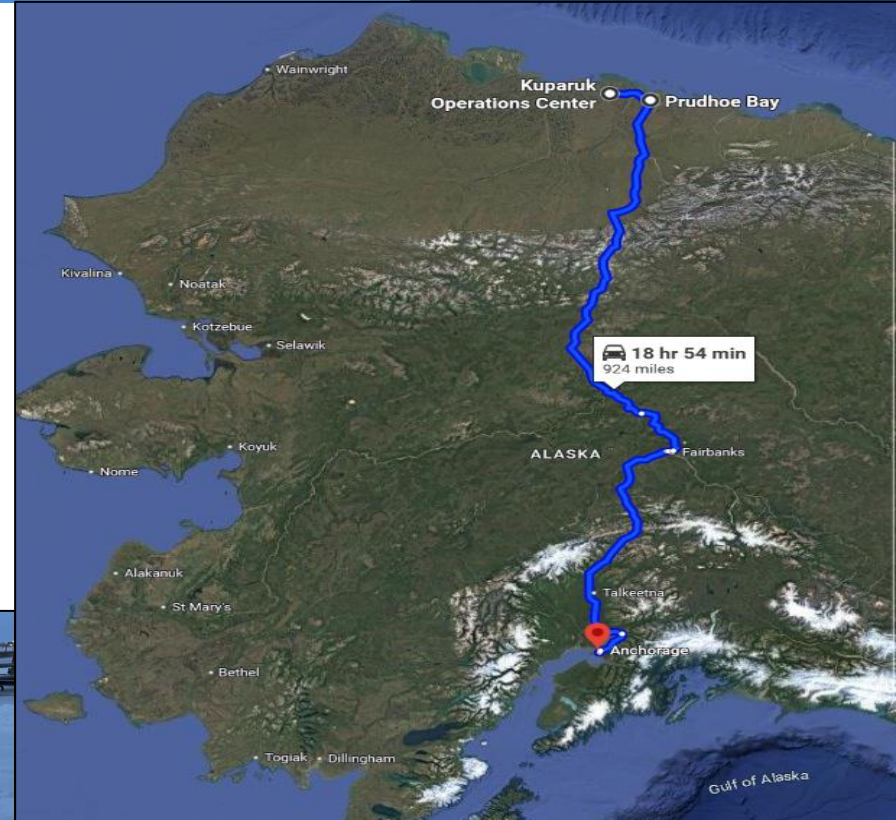


- Typical Alaska gyroMWD Operations
- Logistical and Environmental Challenges
- Overview of Large Coriolis Vibratory Gyroscope (CVG) System
- Field Performance of CVG Compared with Legacy Spinning Mass
- MWD and CVG Overlap Survey Observations

- Deployed to mitigate magnetic interference from offset wellbores
- Primarily used in surface hole section
- Motor BHAs (26"-13.5" bits)
- 20° - 80° inclination at surface section TD
- Cold mud temperatures to minimize permafrost disturbance

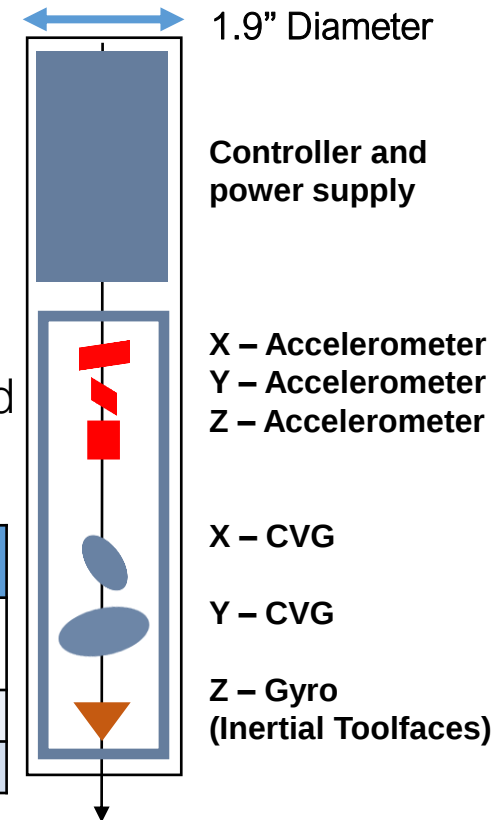


- Small earth rate horizontal signal
 $15.041 \times \cos(70^\circ) = 5.14^\circ/\text{hour}$
- Tools serviced in Prudhoe Bay and Anchorage
- Multi-run capacity required
 - Power consumption & calibration considerations
- Extreme temperatures $-40^\circ\text{C} / ^\circ\text{F}$ common



- XY large metal resonator CVG's
 - 0-150°C operating range
- Small and stable mass imbalance characteristics
 - Confirmed with highly accelerated life testing (HALT)
- X&Y sensor biases canceled using a proprietary indexing method

#Name	Vector	Tie-On	Unit	CVG Value	Legacy Spinning Mass Value	Formula
gxyran	a	r	d	0.05	0.07	$\frac{\sqrt{1-(\cos(\text{azt})^2 * (\sin(\text{inc})^2))}}{(\text{erot} * \cos(\text{inc}))}$
gxymu1	a	s	d	0.035	0.25	$\cos(\text{azt}) * \sin(\text{inc}) / \text{erot}$
gxymu4	a	s	d	0.035	0.33	$\sin(\text{azt}) * \tan(\text{inc}) / \text{erot}$



Large Coriolis Vibratory Gyroscope (CVG) System

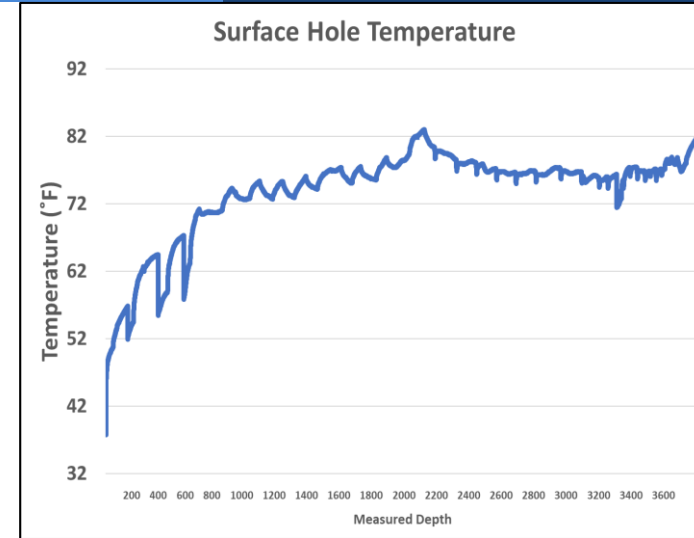
CVG Operations

Eliminates ✗

- Rig site field pre and post calibration checks
- HSE risks with simultaneous pipe shed operations
- Thermal flask requirements

Enables ✓

- Single-person and remote operations
- Flexible BHA configurations via feed through communications

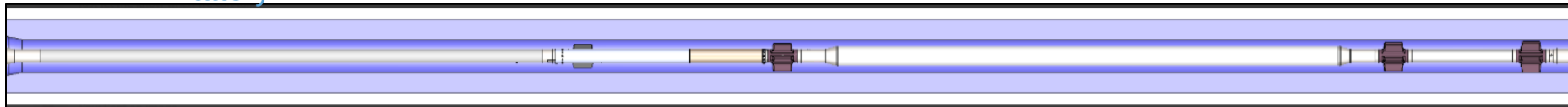


Battery

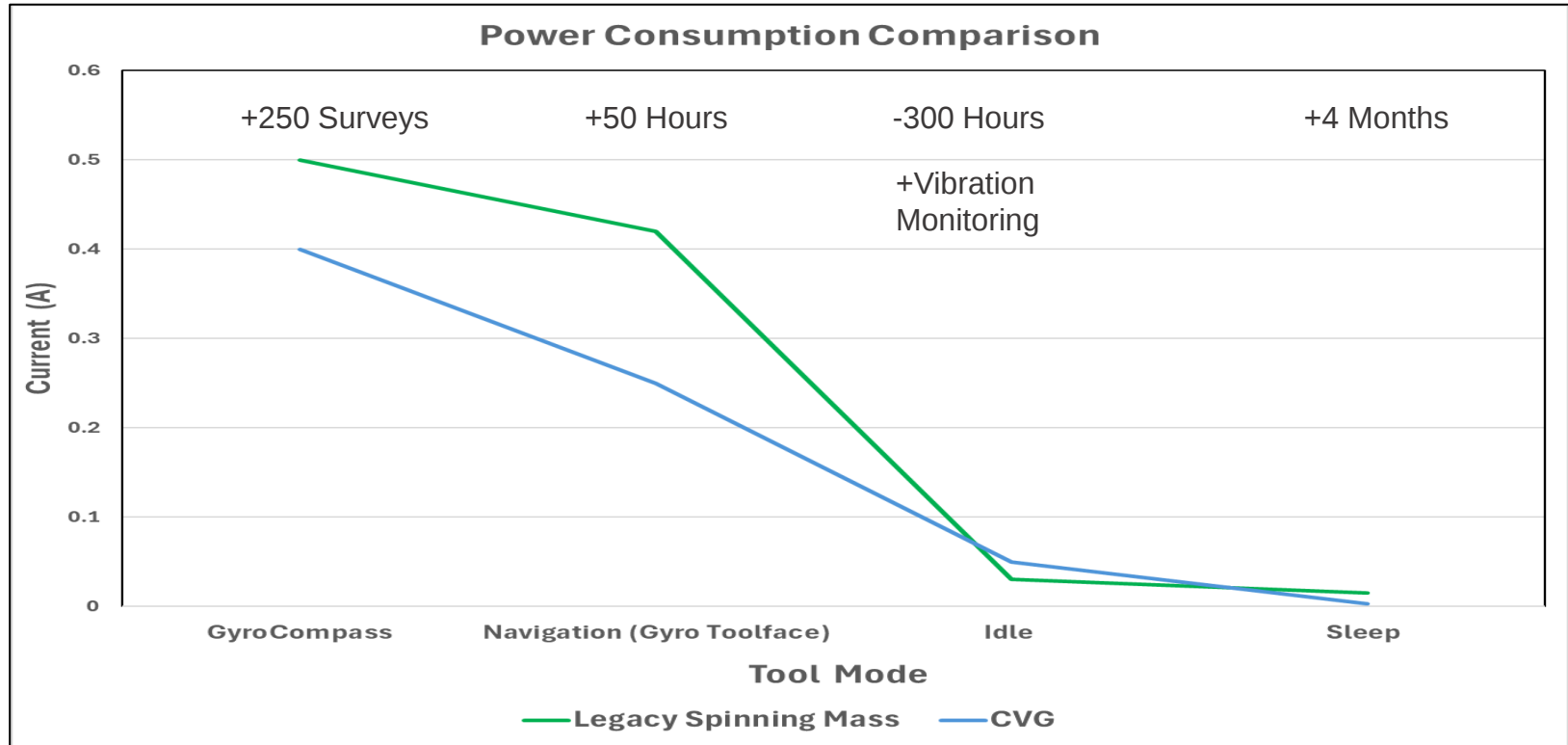
Controller

CVG

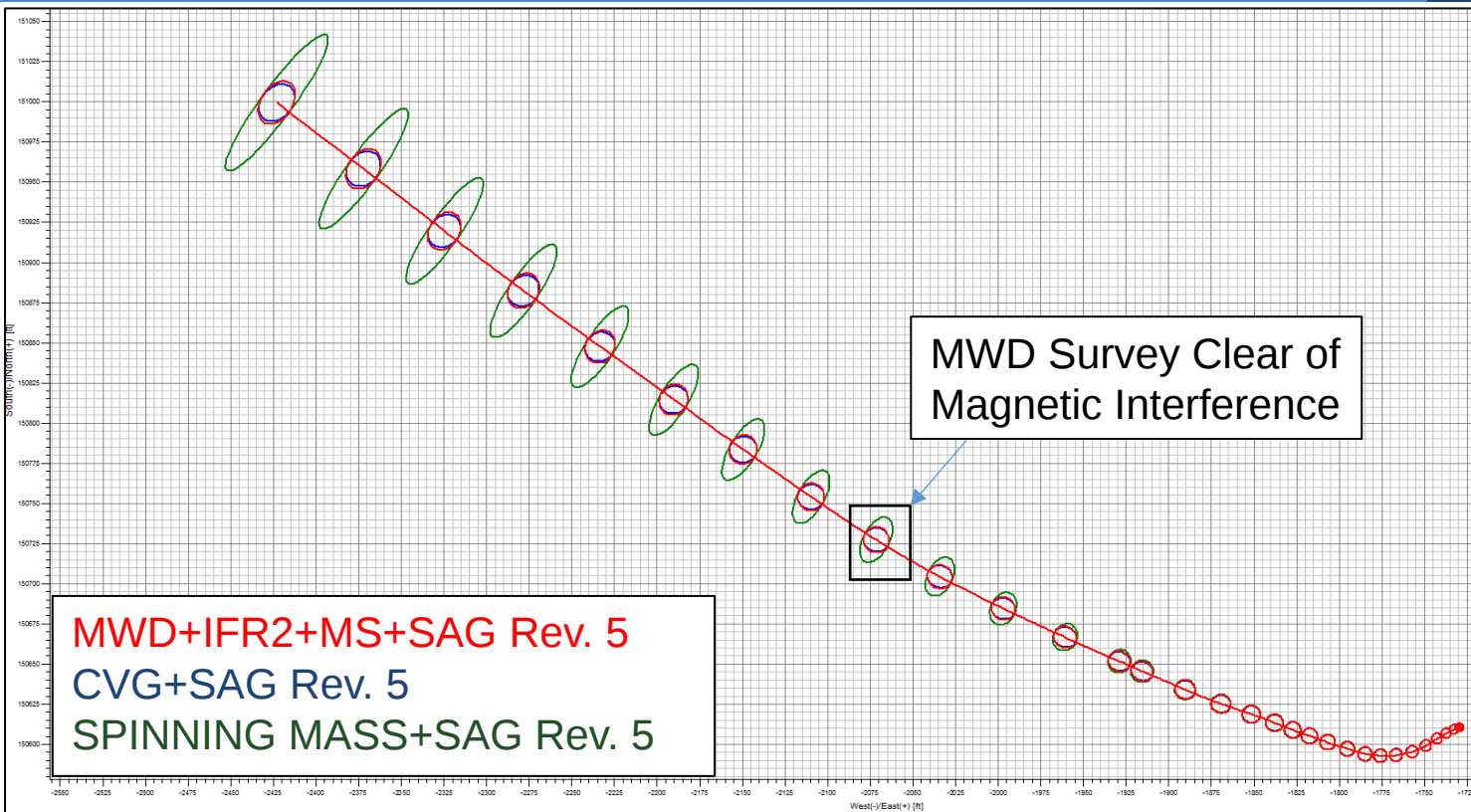
Extension



Large Coriolis Vibratory Gyroscope (CVG) System



Battery Life Improvement



MD	Inc	Azi
feet	deg	deg
0	0	0
159.88	0.43	58.72
312.06	1.29	266.18
502.61	3.33	244.44
692.13	4.99	238.94
881.21	6.03	265.46
1068.9	5.9	283.81
1257.59	7.21	290.61
1445.09	6.15	290.83
1633.41	10.05	288.99
1821.08	15.09	294.12
1959.54	20.32	295.22
2053.65	23.56	295.32
2244.23	26.83	299.42
2338.93	28.33	303.55
2529.48	31.96	306.97
2718.23	36.37	307.44
2907.47	39.55	309.44
3097.51	43.24	309.2

- Gravity Total Failures**

Occurred during initial winter deployments

- Root Cause**

Extreme cold cycling imparted calibration shifts on accelerometers

- Corrective Actions**

Return sensors to base for recalibration

Cold cycle future accelerometer assembly builds

Tagged	Time (Pacific Time)	Inc (deg)	Survey Atotal (mG)	Survey Inclination QA
✓	11/26/2023 07:16...	90.55	1002.44	Passed
✓	12/9/2023 16:21:50...	89.89	1003.69	Passed
✓	12/12/2023 11:58...	0.41	1004.33	Passed
✓	12/12/2023 11:58...	0.41	1004.33	Passed
✓	12/12/2023 19:25...	7.26	1004.82	Passed
✓	12/12/2023 21:26...	11.95	1004.85	Passed
✓	12/13/2023 04:30...	23.22	1004.91	Failed
✓	12/13/2023 05:19...	24.23	1005.28	Failed
✓	12/13/2023 15:22...	47.92	1005.13	Failed
✓	12/13/2023 19:30...	55.26	1004.53	Passed

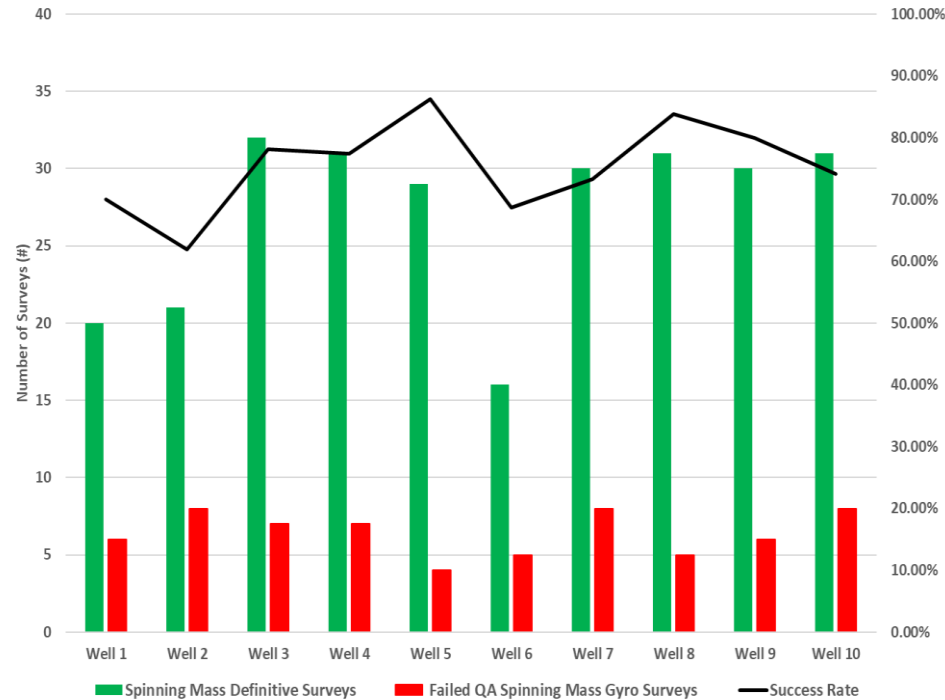
Post-Job Surface Test
Pre-Job Surface Test

☒ Reference Atotal

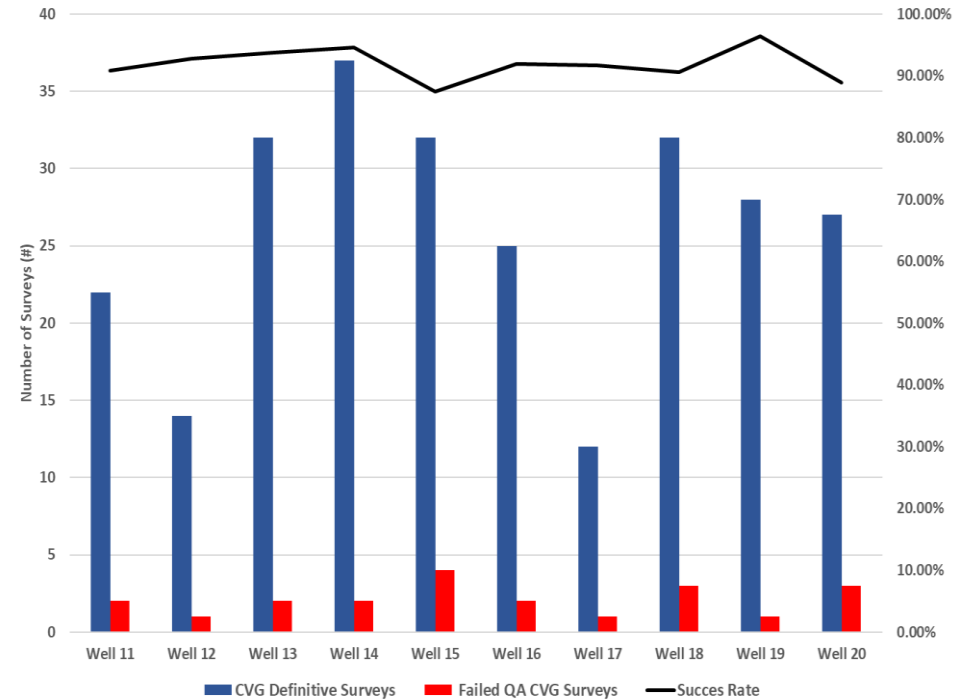
☒ Calculate mG



Spinning Mass Survey Success Rate



CVG Survey Success Rate

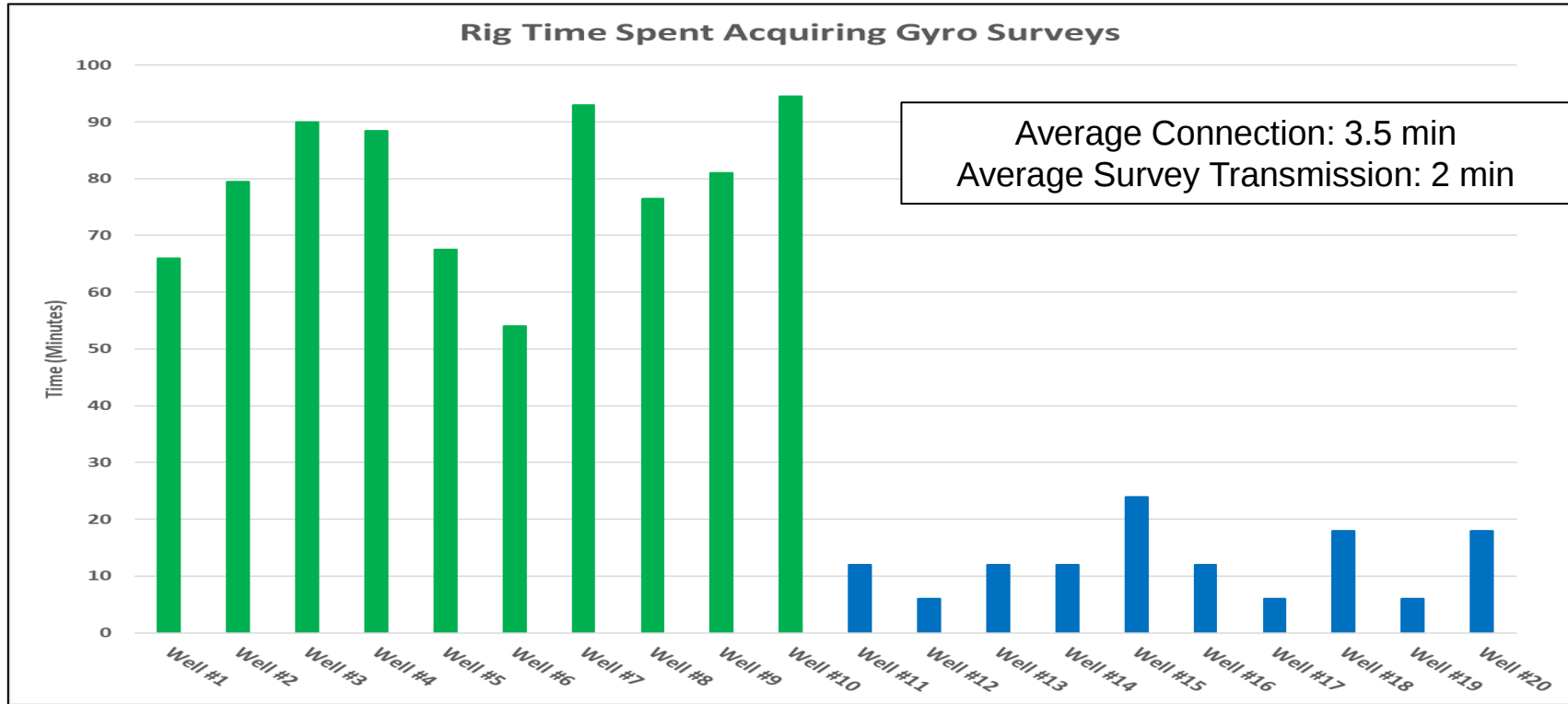




Wellbore Positioning Technical Section



The Industry Steering Committee on
Wellbore Survey Accuracy (ISCWSA)

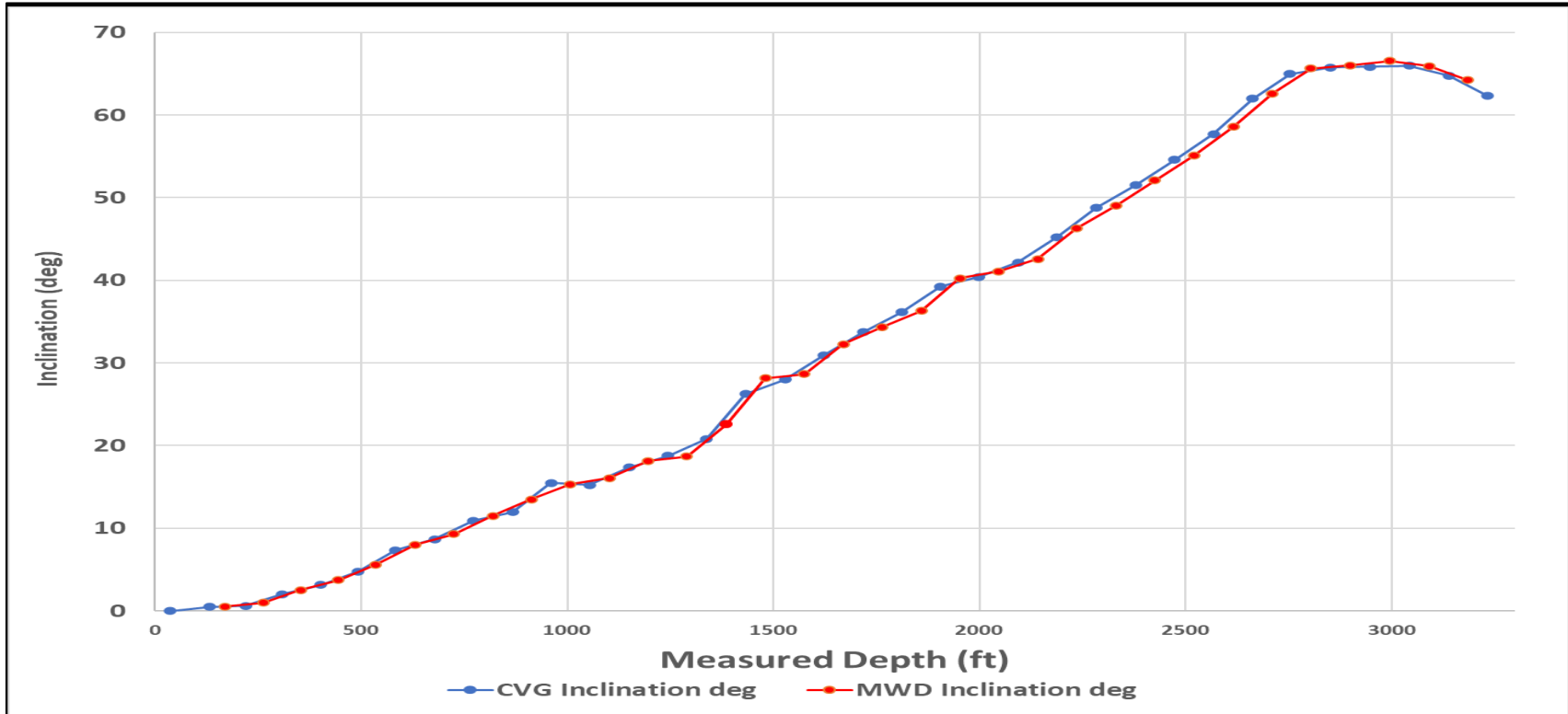


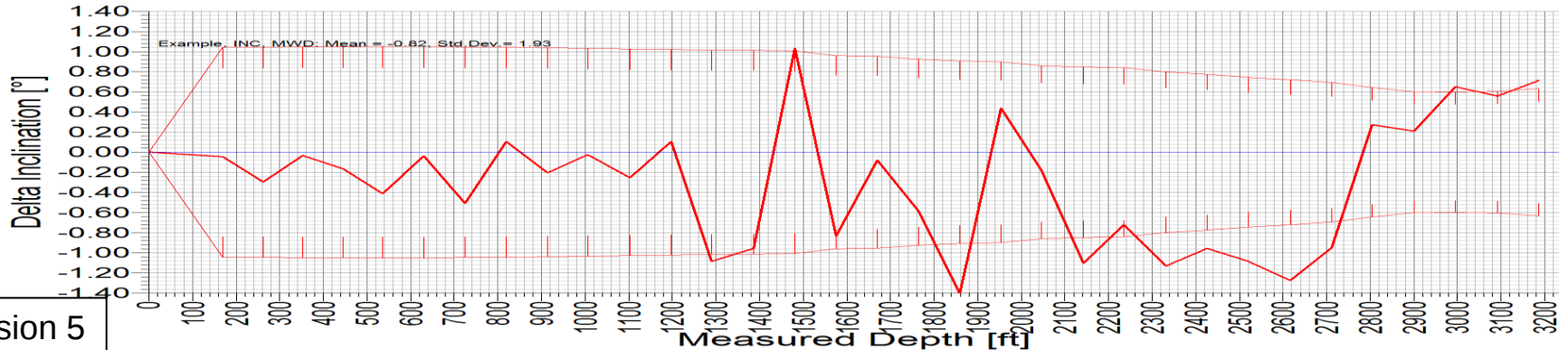
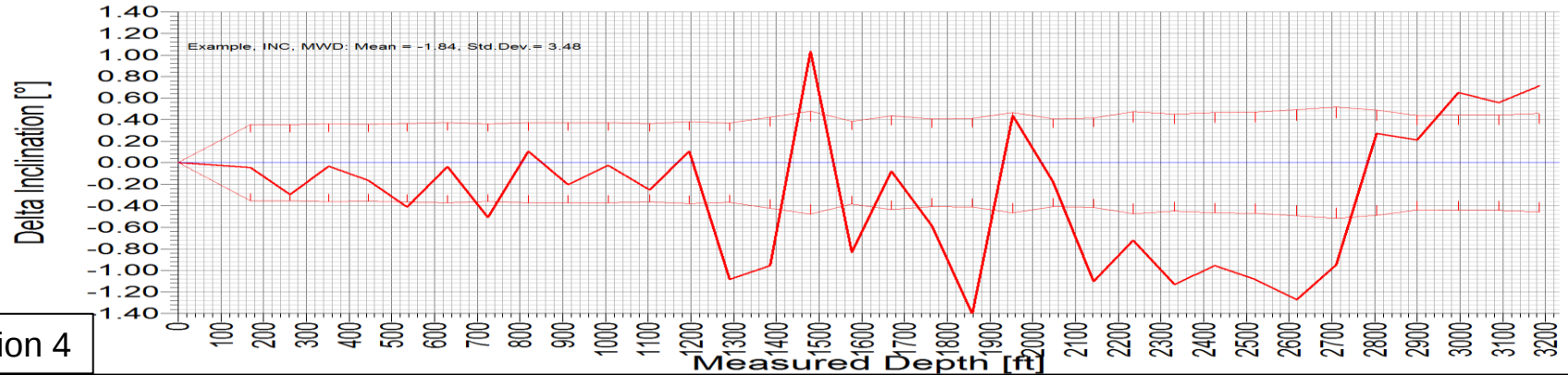


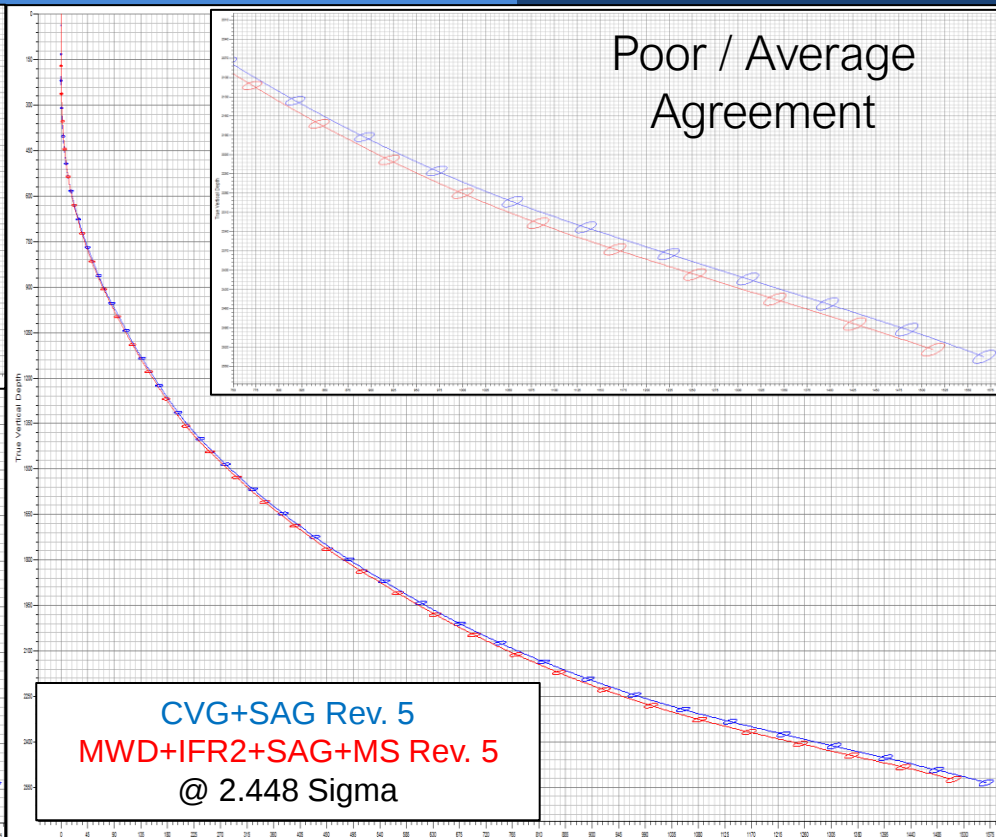
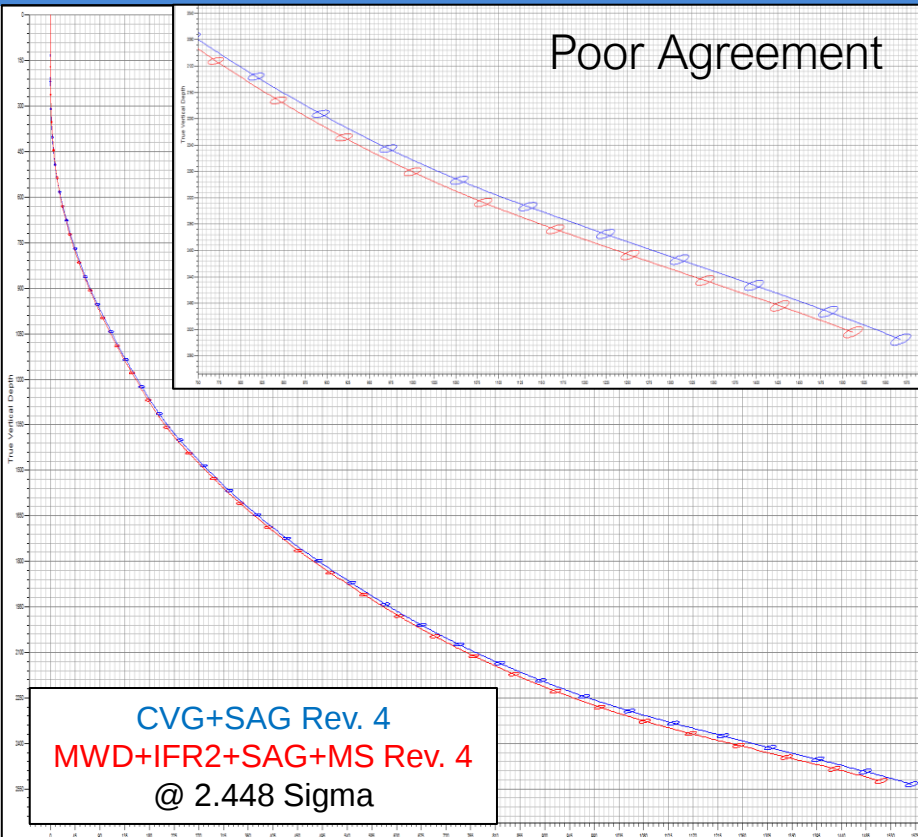
Wellbore Positioning Technical Section



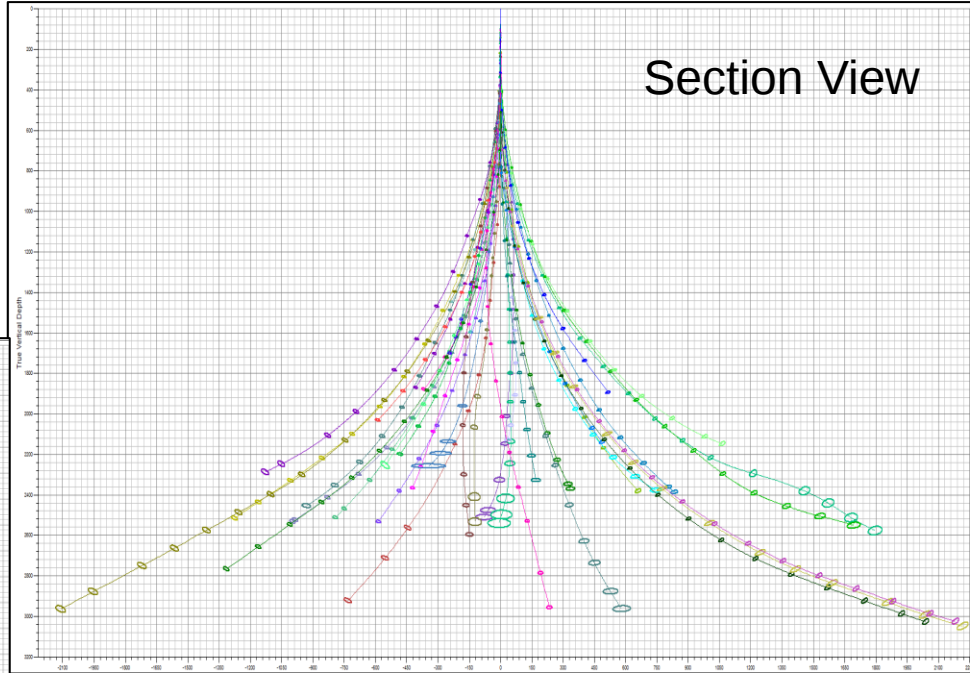
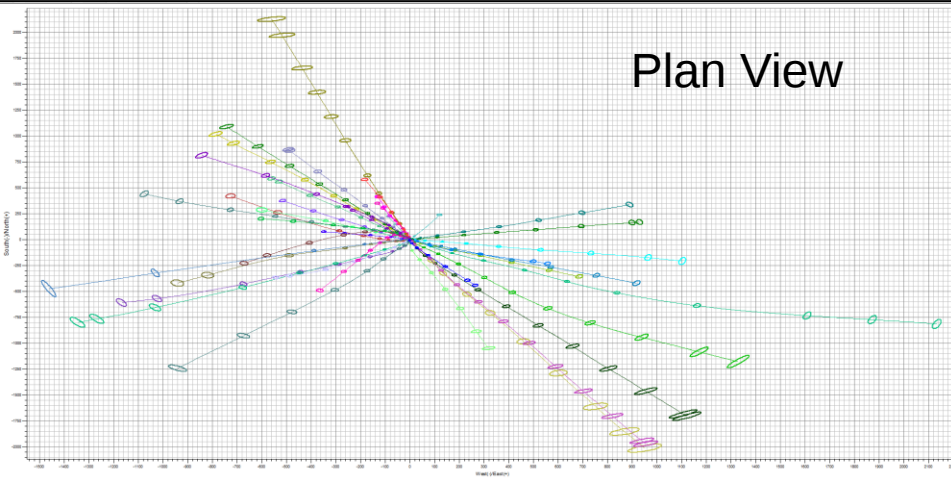
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- 38 wells compared
- 500 ft of valid survey overlap required
- Nominal declination $\approx 13.5^\circ$
- Assumed fully corrected MWD (conservative)
- .1 low angle misalignment magnitudes
- $E/W \text{ Score} = \text{Avg}(\sin(\text{inc}) * \sin(\text{azi}))$

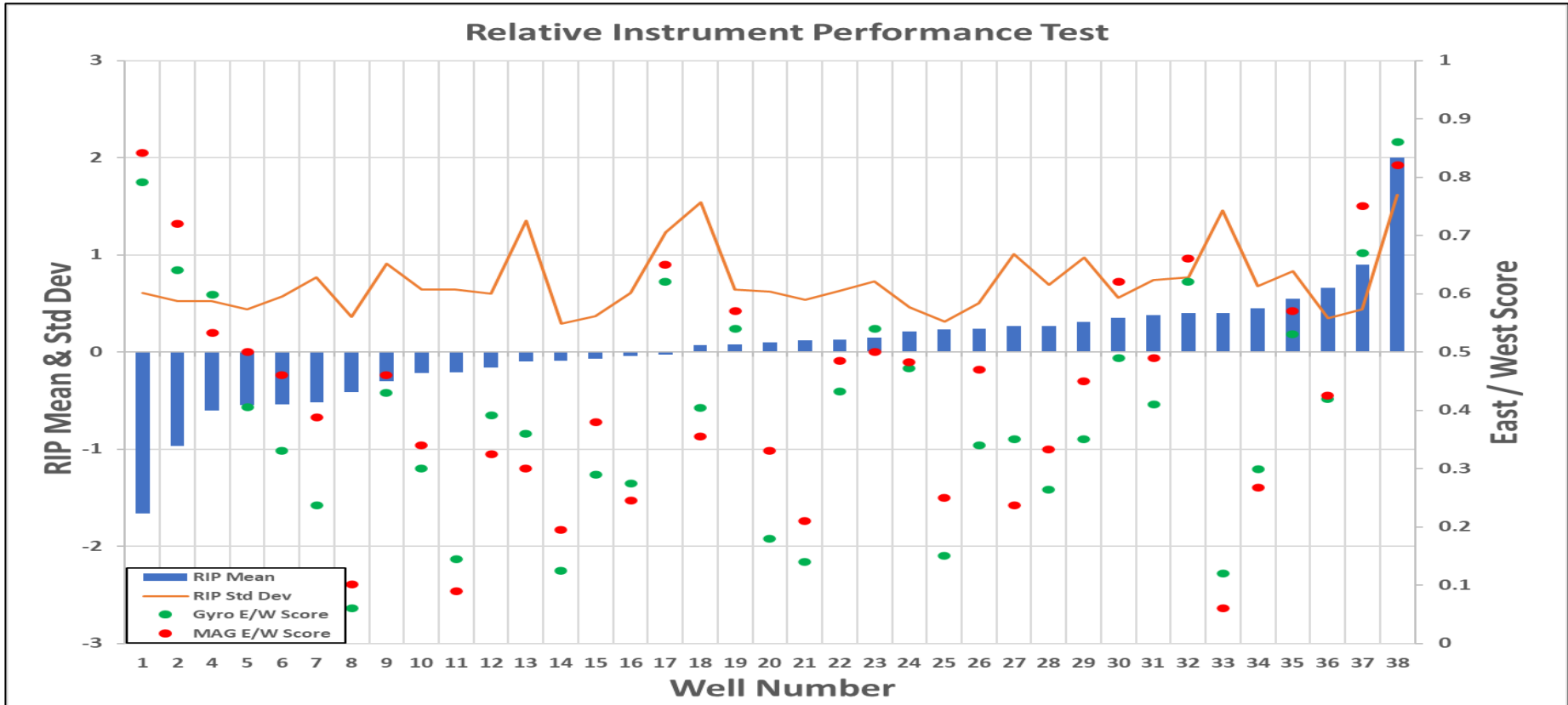




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- CVG GyroMWD tools demonstrate significant improvements in accuracy, efficiency, and safety over conventional systems.
- Adoption of the Revision 5 ISCWSA model provides improved uncertainty estimates, however current XCL magnitudes may not be sufficient for certain applications.
- High-accuracy survey methods (CVG and MWD+IFR2+MS) show excellent azimuthal agreement under Alaska North Slope drilling conditions.
- Near-horizontal east–west trajectories remain challenging; independent surveys provide value in validating worst-case survey orientations.

62nd General Meeting
24th & 25th of September 2025
Anchorage, Alaska



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Questions?