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SPE Summit: AI – The Next Evolution of DDAA

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DIGITIZING SUBSURFACE EXPERTISE: MACHINE LEARNING FOR SMARTER WORKOVER DECISIONS IN A MATURE MULTI-LAYERED BROWN FIELD

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Mature Multi-Layered Reservoir

Discovered: **1971**

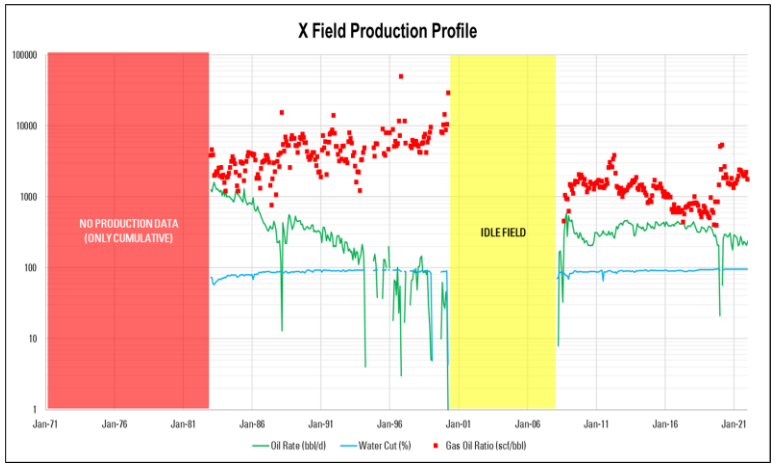
Production > **20 MMBO**

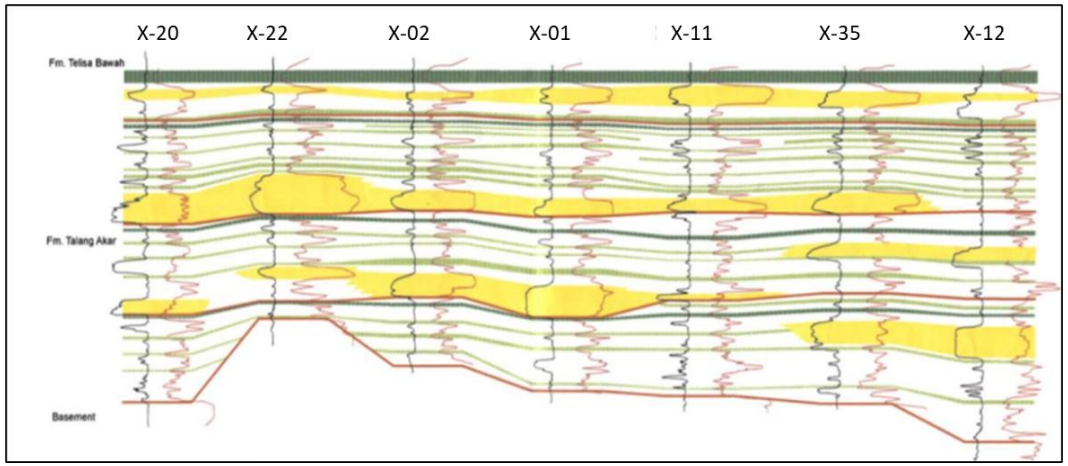
Peak production: **2000 BOPD @ 70's**

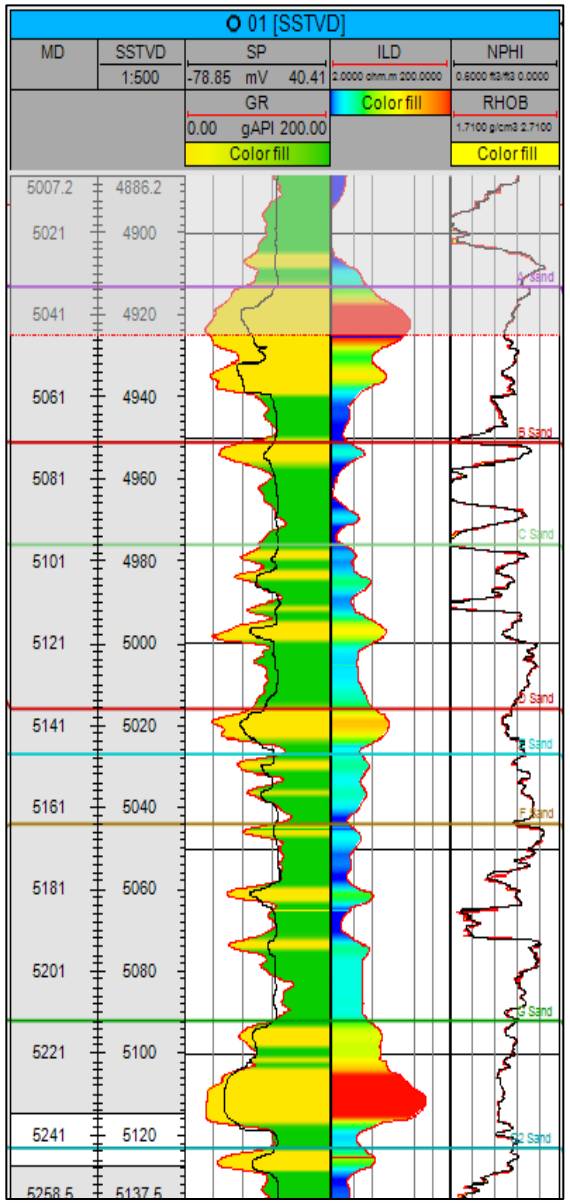
Current production: **~500 BOPD**

Wells: **55 wells**

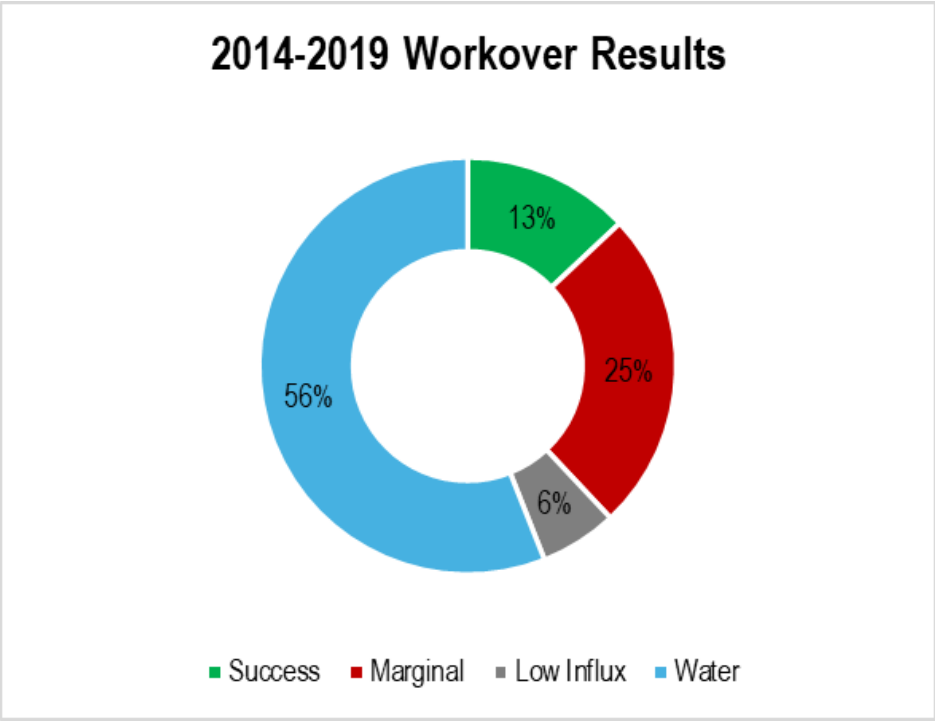
(9 Producing, 3 WIW, 29 Shut-in, 14 P&A)







Problem Statements

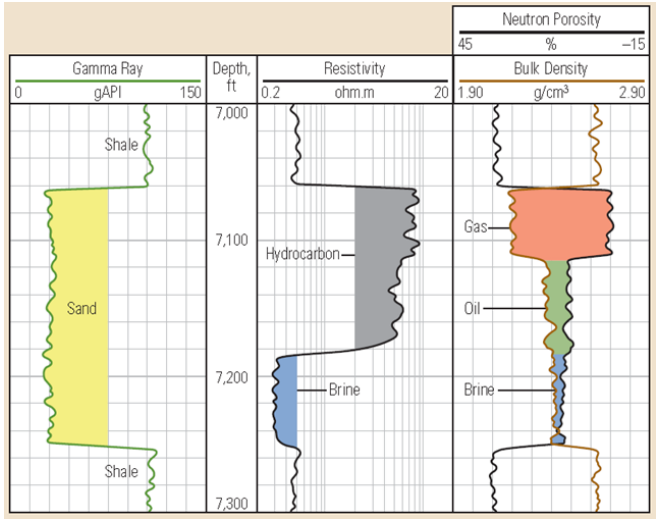


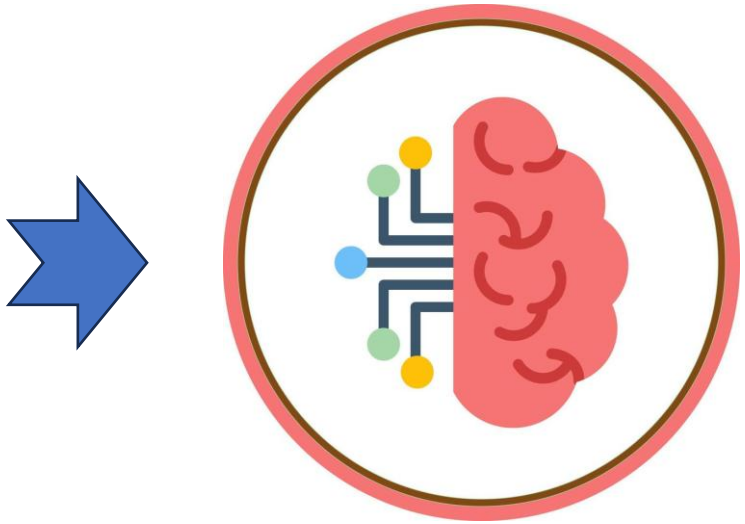
Identifying potential zones for workover

Challenges:

- Multi-layer reservoir complexity
- Bypassed oil potential
- Knowledge loss due to engineer turnover

ML Approach: Digitizing Expert Interpretation







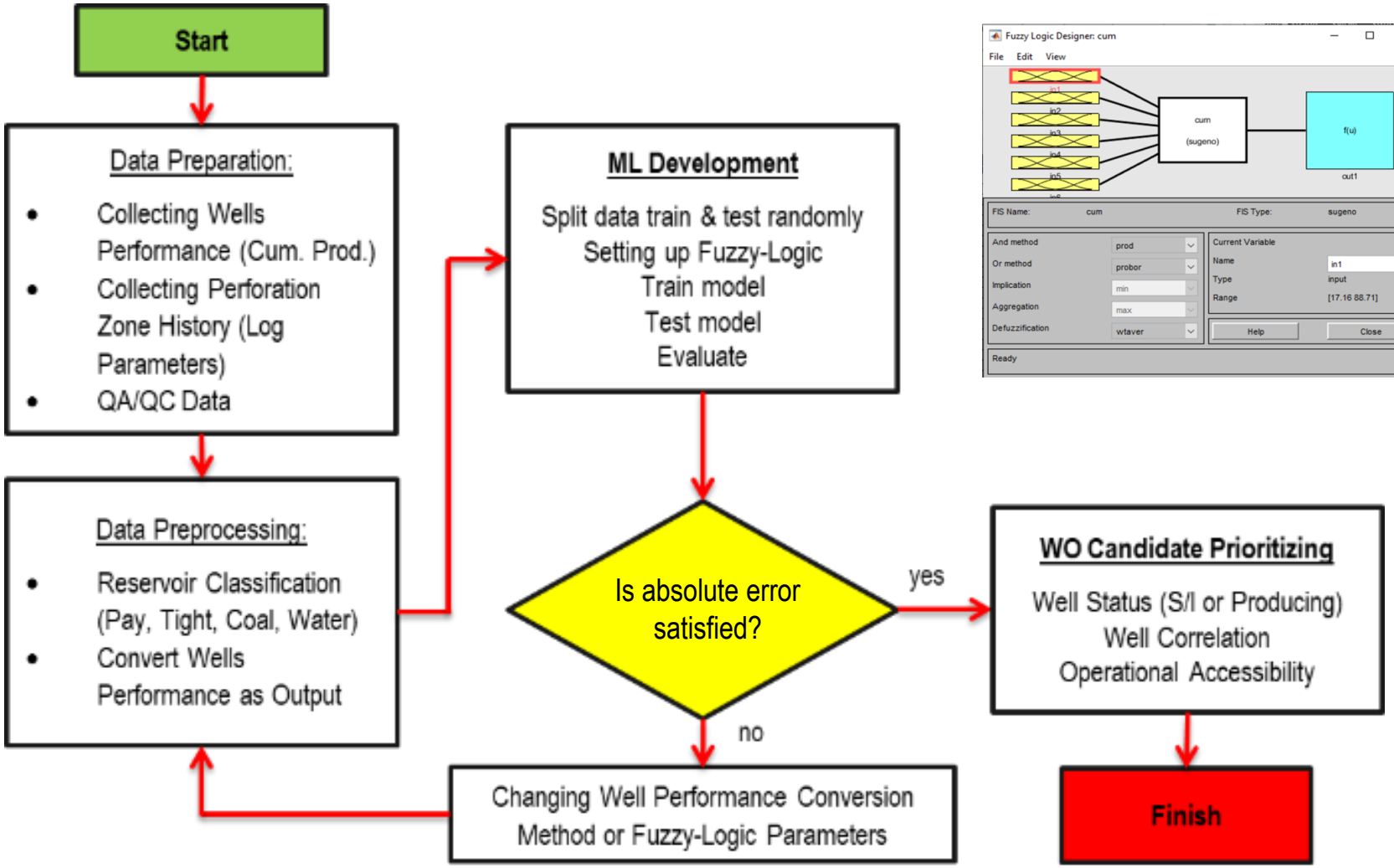
- 88 Perforation history OH log data + Production data
- Additional 30 OH log data for tight, water and coal zone

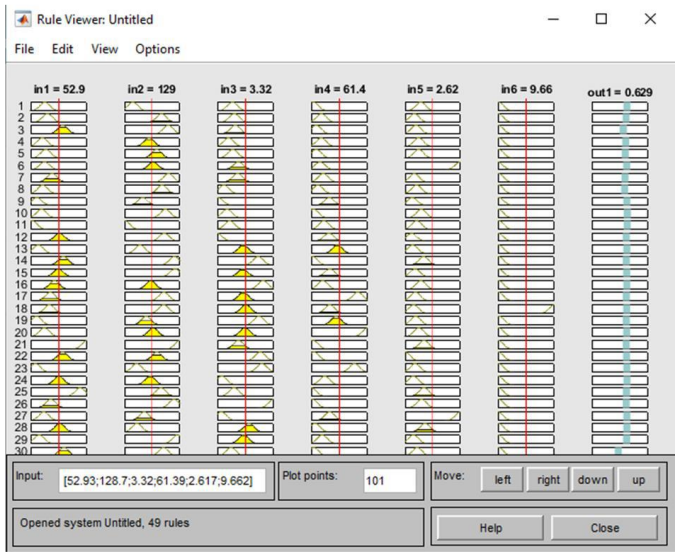
- Feature engineering
- Fuzzy logic model

- Production prediction
- Candidate ranking

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ML-driven Workover Candidate Identification Workflow





Parameter	Value	Function
Influence	0.4	Controls rule contribution
Squash	1.25	Non-linear output scaling
Accept Ratio	0.5	Rule activation threshold
Tolerance	0.15	Prediction deviation allowance

Training error : 0.24
Testing error : 0.42

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ML-driven Workover Candidate Identification Results

Well	Interval	GR Res	GR Base	ILD Water	ILD Res	Rhob	Nphi	CUM	Output	Error
X-1	5038-5048	33.99	113.56	1.82	42.97	3.21	0.00	1.00	0.980	0.02
X-1	5214-5228	36.81	131.80	3.00	37.72	3.16	0.00	1.00	0.990	0.01
X-1	5276-5286	35.00	130.76	2.88	24.77	3.20	0.00	1.00	0.960	0.04
X-3	5152-5160	34.37	85.46	2.23	8.93	2.39	0.22	1.00	0.950	0.05
X-3	5227-5230	35.33	91.68	2.51	12.07	2.36	0.24	1.00	0.970	0.03
X-3	5265-5274	54.04	99.46	3.53	15.36	2.45	0.21	0.96	0.901	0.06
X-4	5152-5160	52.96	124.86	1.85	33.60	2.20	0.18	0.99	0.878	0.11
X-4	5228-5242	35.14	136.36	2.63	44.96	2.32	0.28	1.00	0.970	0.03
X-4	5294-5304	33.34	138.43	3.29	58.60	2.34	0.23	0.12	0.167	0.42
X-4	5331-5341	34.66	130.29	3.29	114.78	2.32	0.23	1.00	0.930	0.07
X-5	5228-5234	56.84	145.80	2.42	13.00	2.28	0.24	0.29	0.232	0.20
X-5	5216-5234	59.25	150.30	2.42	13.00	2.28	0.24	1.00	0.970	0.03
X-5	5313-5323	53.31	168.45	3.07	17.10	2.22	0.23	0.59	0.405	0.31
X-6	5281-5287	47.16	134.04	2.90	34.22	2.23	0.23	0.27	0.326	0.19
X-6	5420-5423	29.71	155.63	2.65	11.88	2.24	0.23	1.00	0.910	0.09
X-7	5170-5178	48.53	153.01	2.27	26.28	2.22	0.24	0.20	0.256	0.26
X-7	5240-5262	66.37	149.33	3.28	13.95	2.28	0.24	0.05	0.041	0.20
X-8	5208-5218	31.18	143.11	2.74	26.72	2.30	0.25	0.24	0.194	0.18
X-8	5438-5448	48.13	152.31	2.55	43.28	2.27	0.26	0.39	0.279	0.28
X-9	5137-5148	25.17	110.83	1.62	42.50	2.18	0.37	1.00	0.870	0.13
X-9	5299-5314	24.75	117.10	4.15	55.17	2.25	0.45	0.27	0.386	0.41

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ML-driven Workover Candidate Identification Results

Well	Interval		GR Res	GR Base	ILD Wate	ILD Res	Rhob	Nphi	Output	Cum
	top	botto								
X-01	5138	5145	36.86	138.94	3.00	19.23	3.17	0.00	1.00	30.18
X-01	5317	5319	35.00	126.53	2.67	7.27	3.34	0.00	0.98	29.56
X-03	5351	5357	51.35	103.24	3.52	14.50	2.52	0.12	0.98	29.27
X-03	5402	5409	58.29	97.51	5.03	12.27	2.35	0.11	0.82	23.57
X-08	5398	5402	86.63	152.31	2.41	8.44	2.17	0.25	0.52	12.66
X-10	5068	5074	59.52	105.73	2.27	7.19	2.44	0.20	0.44	9.81
X-10	5108	5110	49.82	94.14	4.91	7.45	2.37	0.22	0.79	22.52
X-10	5204	5223	30.23	101.34	3.17	57.43	2.19	0.23	0.98	29.34
X-11	5301	5303	38.19	101.11	3.09	8.76	2.45	0.18	1.00	30.18
X-15	5486	5495	28.49	83.76	2.77	6.34	2.52	0.21	0.78	22.00
X-16	5450	5475	30.26	146.01	3.33	95.59	2.25	0.22	0.46	10.47
X-17	5371	5374	56.17	120.50	3.65	13.58	2.47	0.16	1.00	30.18
X-17	5405	5415	35.60	118.04	3.65	9.09	2.58	0.11	1.00	30.18
X-21	5127	5130	39.74	112.37	2.49	10.52	2.44	0.12	0.51	12.33
X-21	5227	5230	80.78	140.06	3.20	8.99	2.43	0.11	0.42	8.83
X-34	5149	5155	69.08	157.13	2.78	6.19	2.11	0.12	1.00	30.18
X-34	5183	5197	74.65	151.04	2.80	9.19	2.01	0.21	1.00	30.18
X-34	5214	5224	69.65	158.64	3.88	8.13	2.03	0.21	0.52	12.62
X-35	5306	5334	47.01	139.37	3.42	38.66	2.30	0.22	0.58	14.70
X-39	5406	5452	43.44	171.25	2.48	11.22	2.47	0.20	0.80	22.70
X-41	5043	5049	74.81	163.70	2.54	7.27	2.51	0.21	0.69	18.72
X-46	5525	5576	30.05	156.13	2.24	8.29	2.56	0.15	0.57	14.56

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Field Implementation Results

Well	Total	ExpCum (MBO)	Curent Status
X-01	7	209.5	Producing
X-03	7	190.1	Shut In
X-04	1	20.6	Producing
X-05	1	30.2	Shut In
X-08	1	12.7	WIW
X-09	5	143	Producing
X-10	9	240.1	Producing
X-11	2	58.1	Shut In
X-12	3	89.2	Shut In
X-14	1	30.2	Shut In
X-15	6	170.4	Shut In
X-16	1	10.5	WIW
X-20	1	24	WIW
X-22	5	99.4	Shut In
X-31	2	49.7	Shut In
X-34	5	133.3	Producing
X-41	3	79.1	Producing
X-44	1	30.2	Shut In
X-46	2	44.7	Shut In
X-48	1	30.2	Shut In
X-49	3	74.4	Shut In
X-51	1	27.2	Shut In
X-52	5	76.3	Shut In
X-54	1	28.9	Shut In
24	**74**	**1902**	**Total**

Well	Before WO			After WO			
	Oil Rate	Liquid Rate	WC	Oil Rate	Liquid Rate	WC	Est EUR
	bopd	blpd	%	bopd	blpd	%	MBO
X-22	-	-	-	32	400	92	20
X-01	33.4	836	96	141	832	83	40
X-04	17	456	96	87	484	82	20
X-03	-	-	-	65	662	90	45
X-31	-	-	-	67	140	52	50

- Identifying **~2 MMBO** potential across 74 untapped zones in 24 wells
- Establishing strong foundation for scaling **success rate to 100%** of first 5 WO programs
- Increased field production by ~**350 BOPD**
- Enhanced economic efficiency by **avoiding up to USD 800K** (if still 13% success ratio) in failed workover costs via improved subsurface analysis and candidate selection

Conclusion

- ML successfully digitizes expert log interpretation
- Improves workover decision reliability
- Significant production and cost impact
- Scalable for mature multilayer reservoirs

“What was once overlooked can now be identified, quantified, and monetized.”

Acknowledgements / Thank You / Questions

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Medco E&P Indonesia

Resources Development Area 2 – Subsurface Onshore Team

Base Management Area 2 – Subsurface Onshore Team

Resources Development Belut – Subsurface Offshore Team