2014 Gas and Coal Outburst Seminar

Concurrent *In-situ* Measurement of Flow Capacity & Gas Content

Peter Ramsay
pramsay@welldog.com
www.welldog.com

WellDog offices

Laramie - US
1482 Commerce Drive Suite S
Laramie, WY 82070
USA
T +1 307 742 6340
F +1 307 742 6342

Brisbane - AU
Level 23
127 Creek Street
Brisbane, 4000 QLD
Australia
T +61 (0)7 3218 2175
F +61 (0)7 3839 4649

Roma- AU
48 Spencer Street S.
Roma, 4455 QLD
Australia
T +61 (0)7 4622 5561
F +61 (0)7 4622 8550

www.welldog.com

Agenda

- Summary of Field Trial
- Equipment used for trial
- Mixed gas measurement
- Field trail results
- Conclusions

Field Trial

- Real Application
  - Measuring flow capacity
  - Measuring gas content
  - Testing in a PQ borehole

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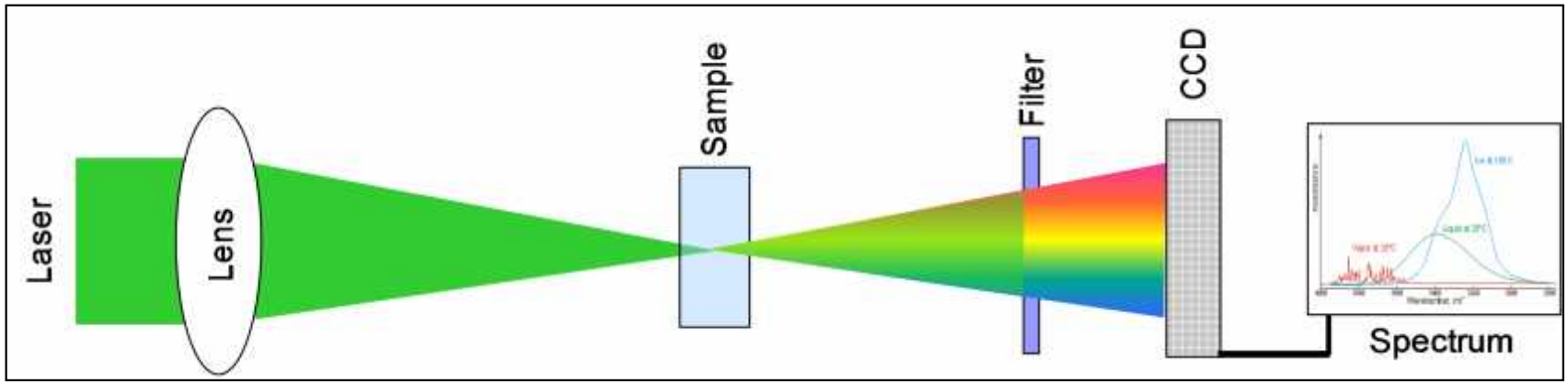
- Real Results
  - Blind trial

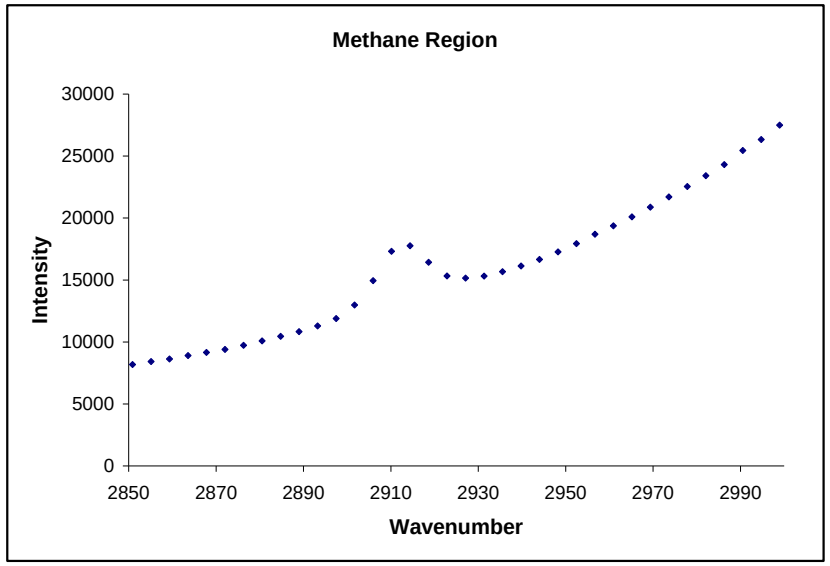
Technical Service #1 – Drill Stem Test

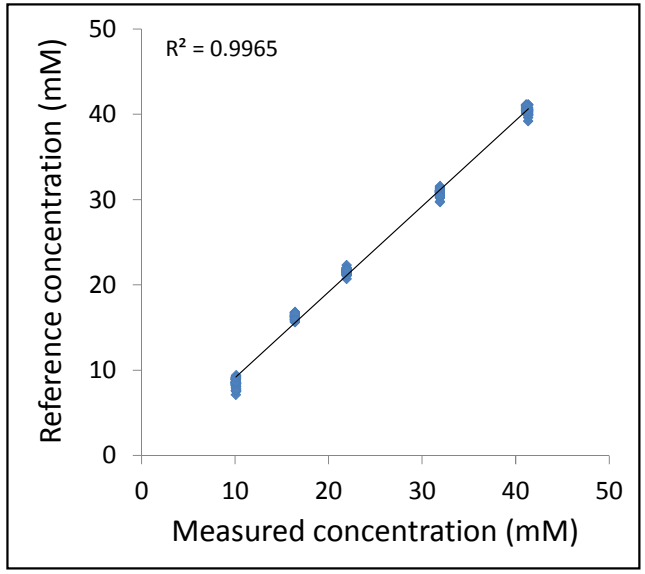
- DST technology established and widely used to measure flow capacity and other seam characteristics
- Straddle packers used to isolate the test interval
- System design allows integration of real time surface read out of coal seam pressure using wire-less E-M telemetry

Technical Service #2 – Raman Spectroscopy Gas Testing

- Raman spectroscopy used to detect and measure trace gases dissolved in coal seam fluids

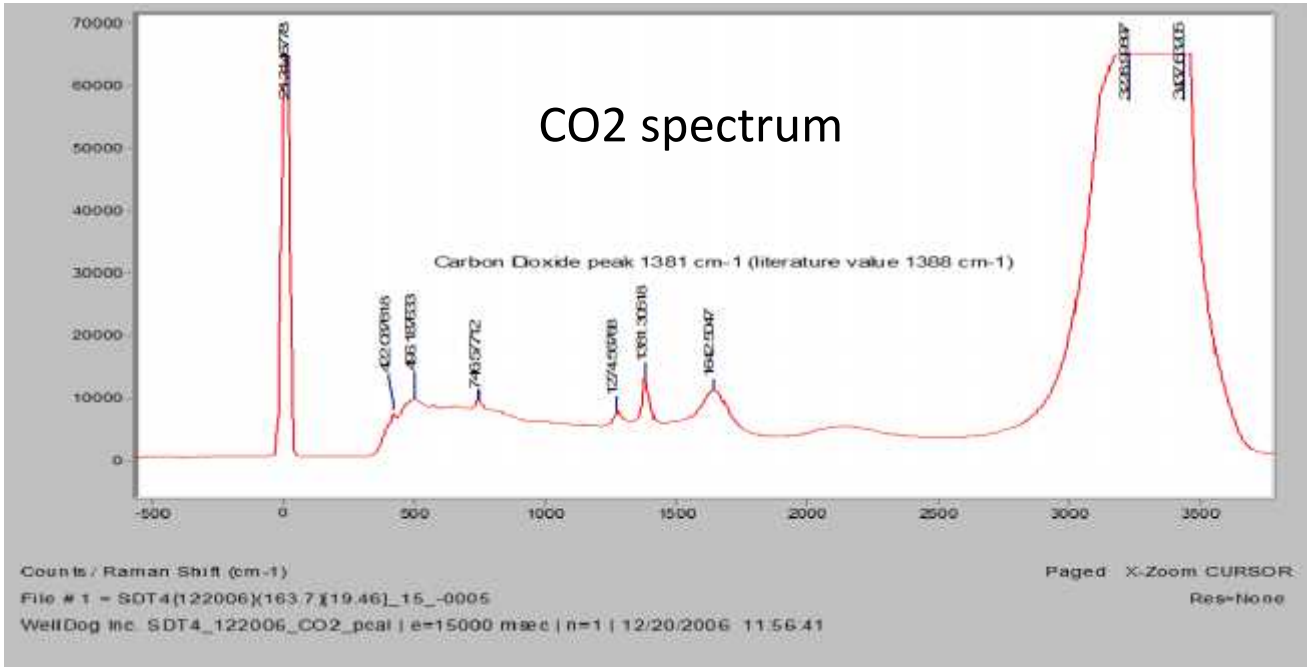






Gas Testing Mixed Gases

- RS has the ability to detect the concentration of different gases like CO2
- During dewatering, bicarbonate can revert to CO2 resulting in a higher % of CO2
- Create a mixed gas isotherm based on borehole concentrations



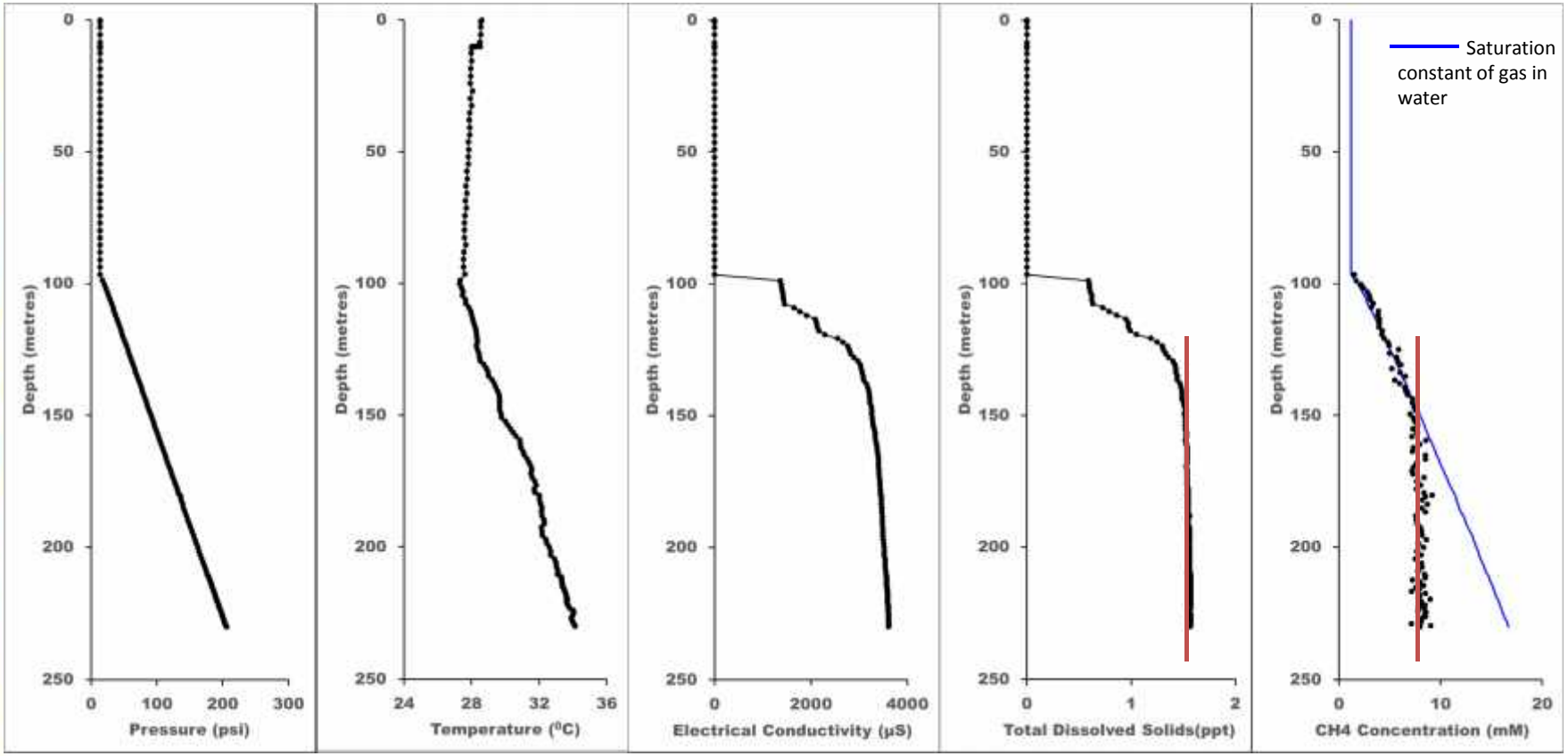
Technologies - RS

- Result are related to gas content in coal seam
  - Gas concentration → gas partial pressure = critical desorption pressure (CDP) → gas content G_c
- For example:

$[CH_4]$ → $P(CH_4)=CDP$ → $\Gamma(CH_4)$

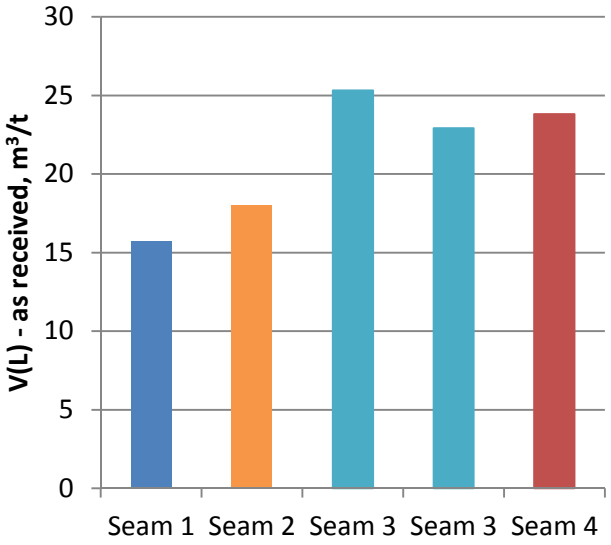
- An adsorption isotherm is needed to calculate gas content from CDP

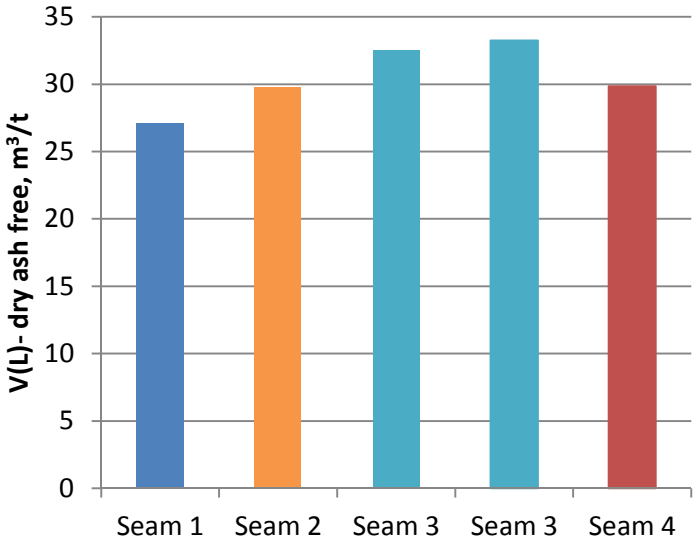
RS Log

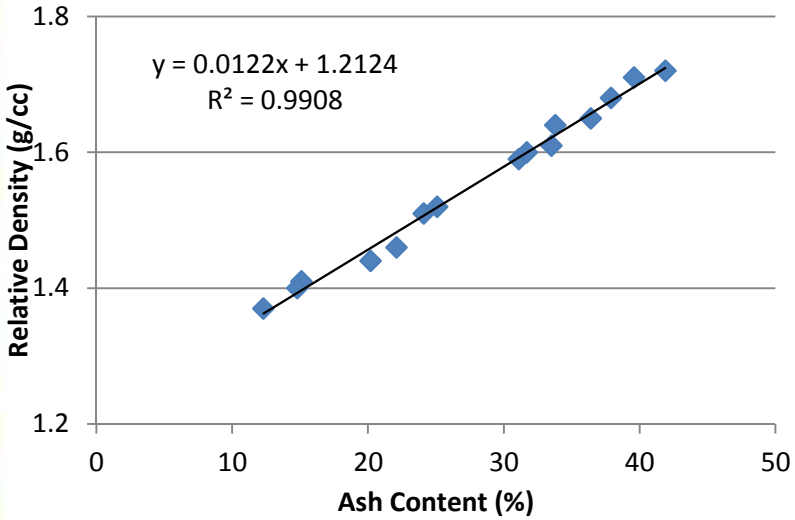


Pressure, temperature and conductivity used to calculate solubility relationship for Henry's constant	Total Dissolved Solids indicates self-consistent fluid	Methane log shows under-saturated fluid, maximum gas content has been measured

Derivation of Gas Content

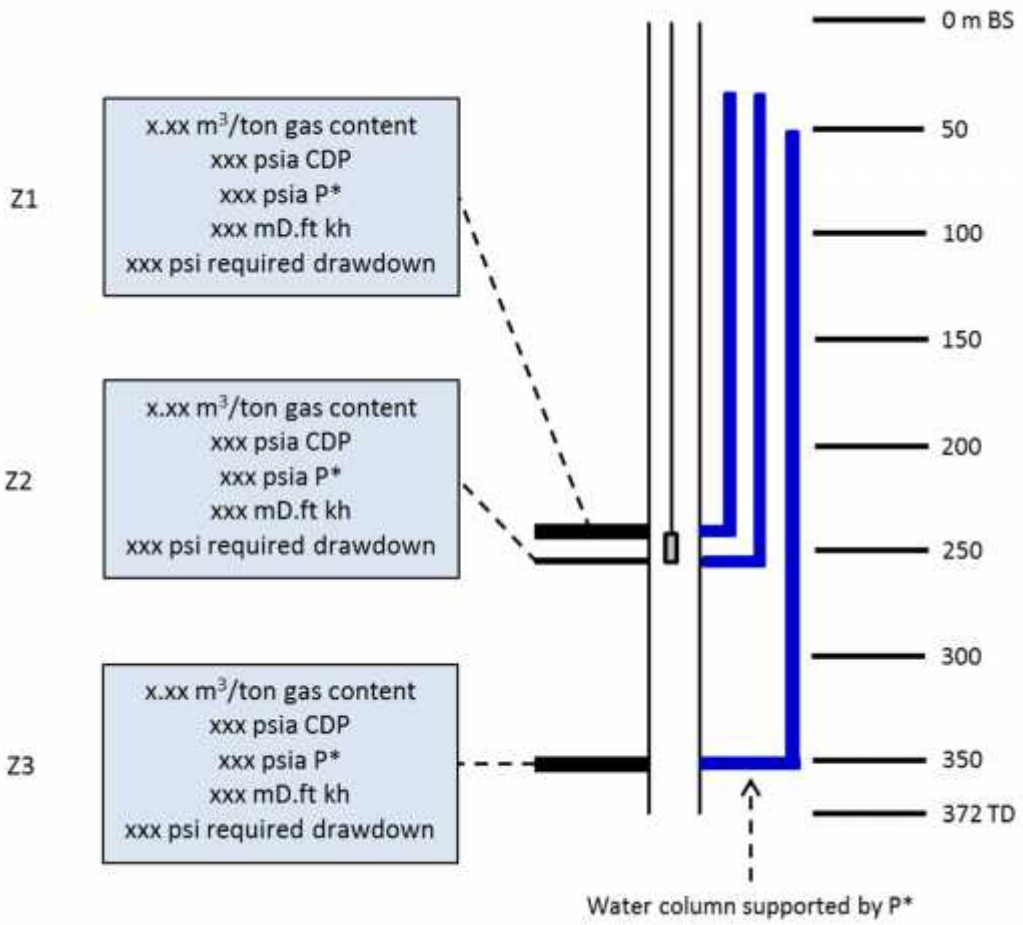






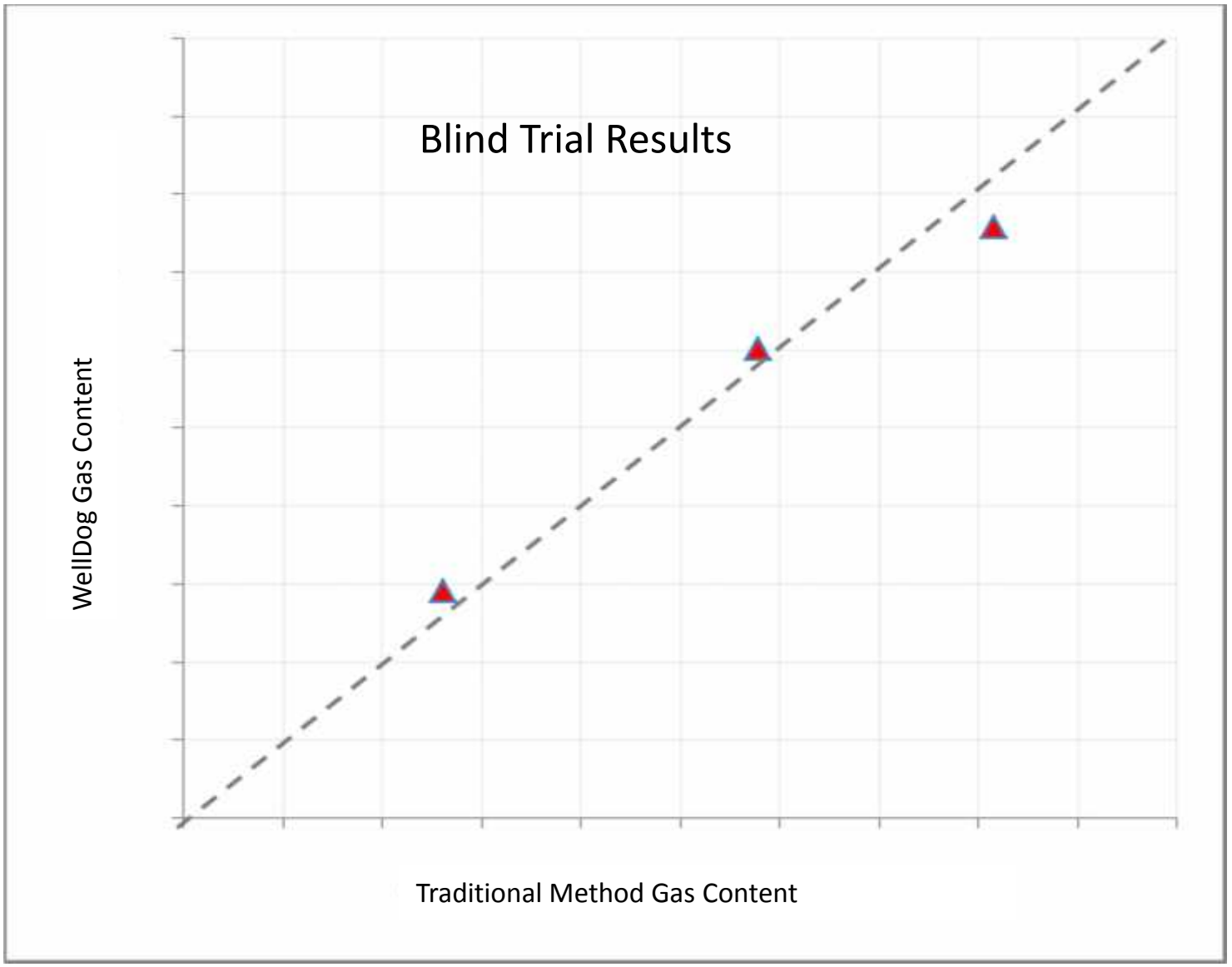
Seam no.	Average density (g/cc)	Average ash (%)	V(L)—DAF (psi)	Synthetic V(L)—AR (psi)
Seam 1	1.57	29	27.06	19.21
Seam 2	1.63	34	29.74	19.65
Seam 3	1.50	23	32.87	25.17
Seam 4	1.62	33	29.84	19.93

Test Results



DST no.	1
Interval name	Seam 1
Interval (m BS)	114.6–118.2
Flow capacity (mD-ft)	950
Skin	3.8
Pressure (psia)	90
CDP (psia)	20
Std. Dev (%) spectra (no.)	12.5/25
V_L (m³/ton) / L_p (psia)	23.11/289.0
G_C (m³/ton)	1.5
G_S (m³/ton)	5.49
G_C/G_S (%)	27
Drainage dP (psi)	70
$P_{abandon}$ (psia)	10
Recovery (m³/ton)	0.72
R.F. (%)	48

WellDog vs Traditional Gas Content



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  - Increase available hole for gas content testing
- ✓ Immediate Results
  - Results available while testing

References

Concurrent *In Situ* Measurement for Measuring Permeability, Gas Content and Saturation, Quentin Morgan, John Pope and Peter Ramsay, 2014 Coal Operators Conference, The University of Wollongong

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