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Suitability of Geoscan-M elemental analyser for phosphate rock

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Suitability of Geoscan-M elemental analyser for phosphate rock

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1. Introduction

- * Real time, continuous, through belt, multi-elemental analysis of conveyed flows enables operators to measure & control feed & product quality
- * Advanced technology is proven
- * Applications – monitoring, bulk sorting, blending
- * Benefits and paybacks

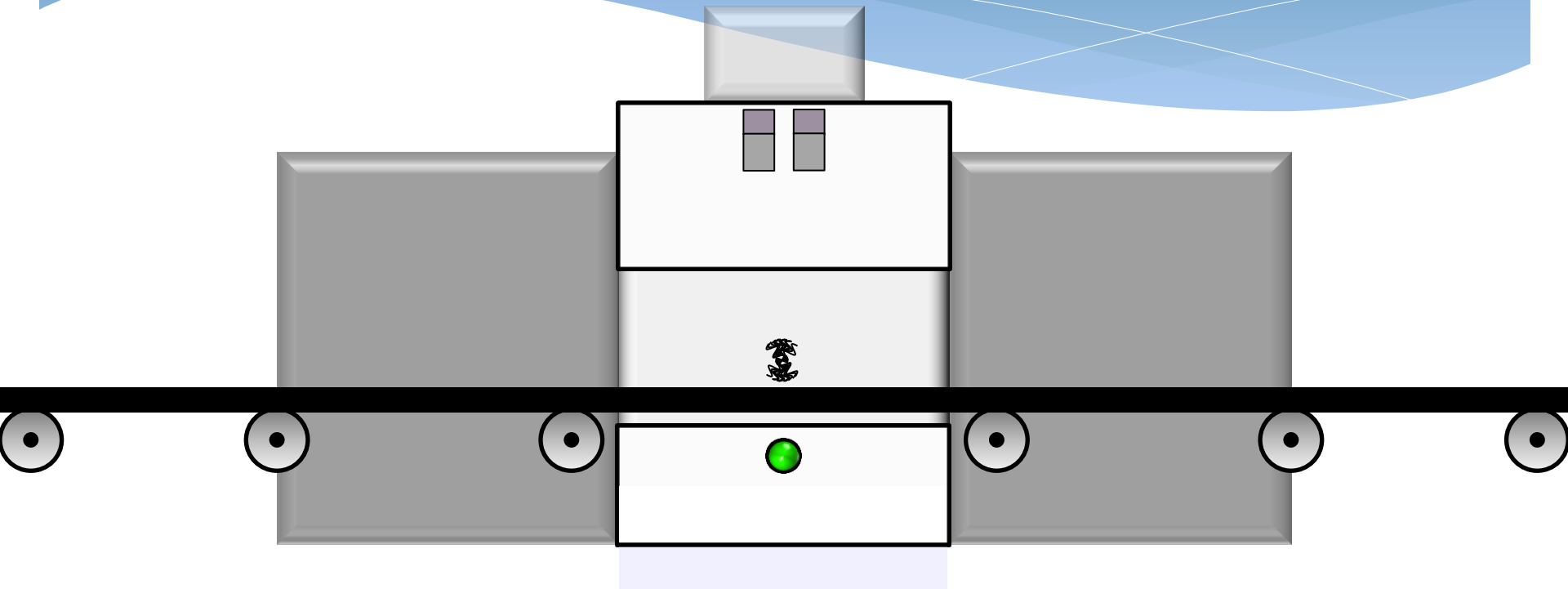
2. Geoscan-M using PGNAA

Prompt Gamma Neutron Activation analysis

- * Cf-252 source (under conveyor belt) emits neutrons
 - * Neutrons absorbed by elements in conveyed material
 - * Each element emits a unique gamma ray spectrum
 - * BGO detector array (over conveyor) measures gamma rays
-
- * Operating 10+ years in minerals sector (>50+ installations, incl. P)
 - * Combined with microwave moisture measurement
 - * Multi-elemental results reported every 2 – 5 minutes

Geoscan-M using PGNAA

How Geoscan Works

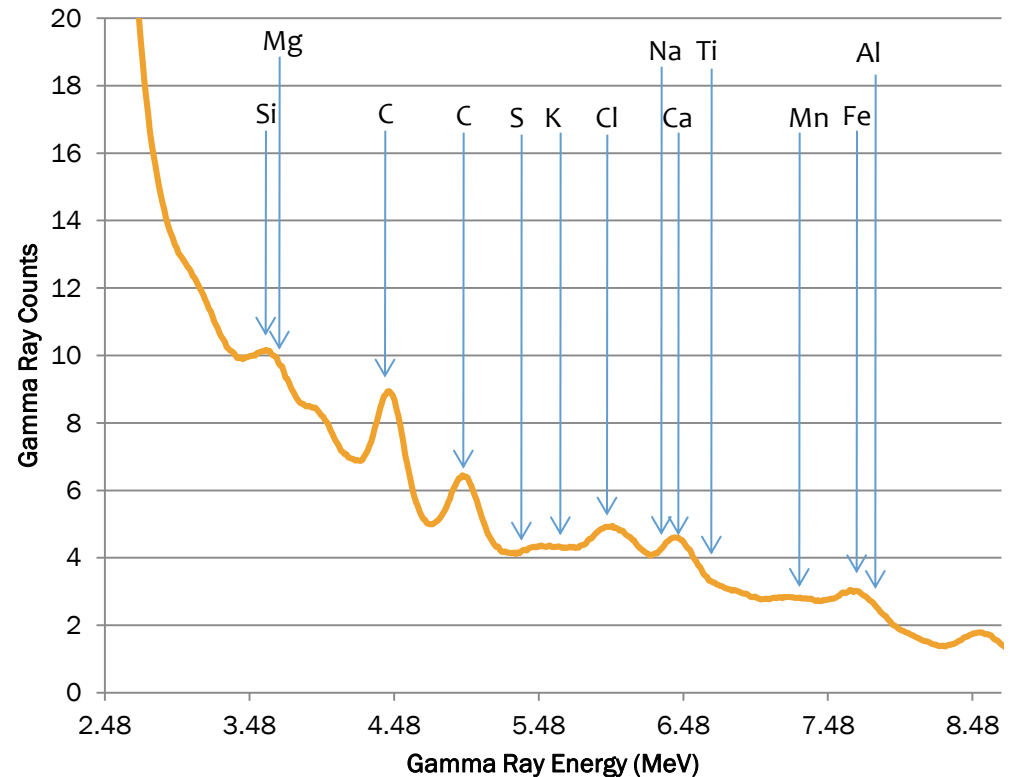


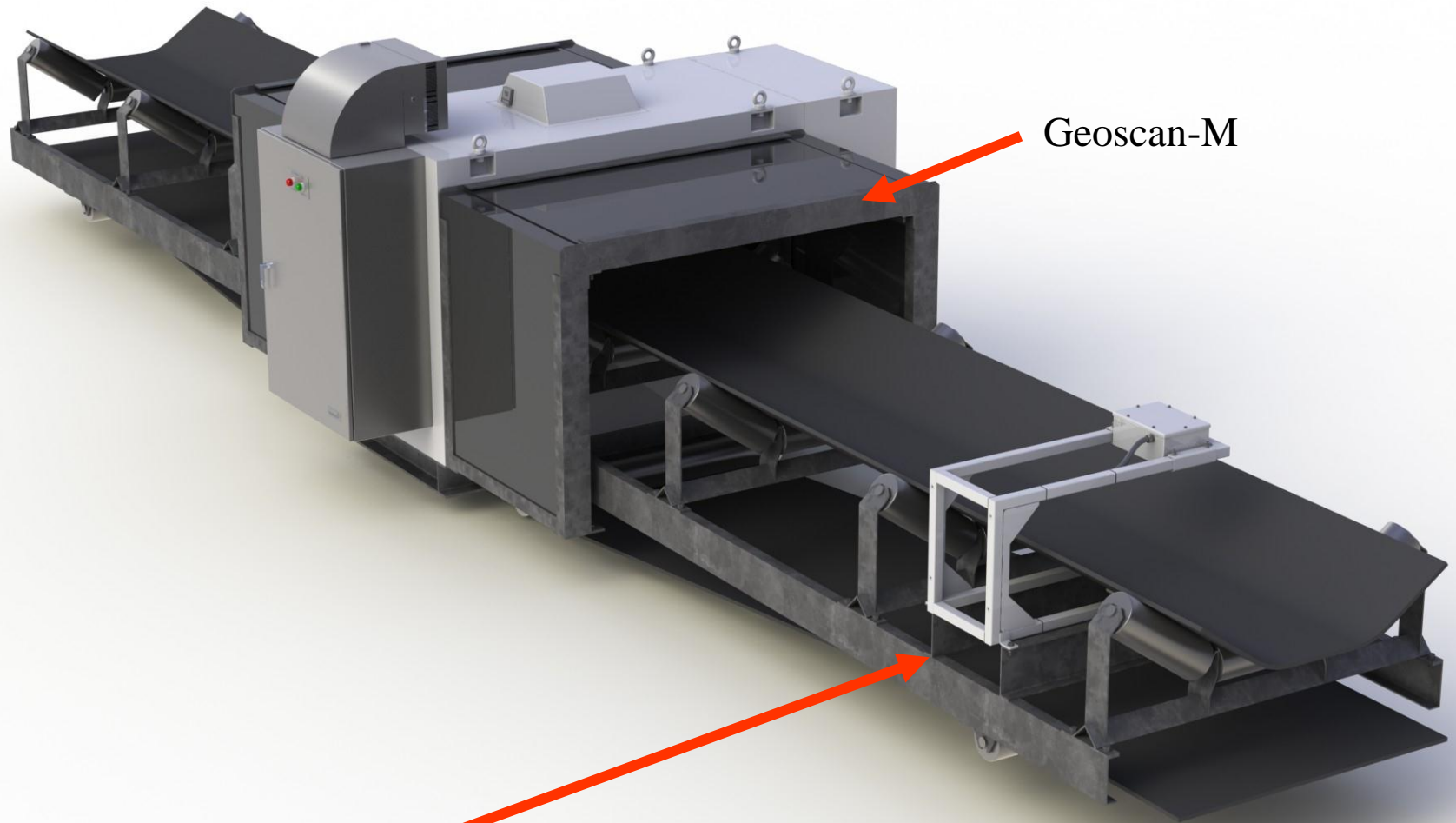
SiO_2 %	Al_2O_3 %	Fe %	TiO_2 %	K_2O %	Mn %
8.88	1.88	68.88	0.08	0.28	0.08

Geoscan-M using PGNAA

- * Fully transmissive
- * Continuous
- * Non-contact
- * Mineralogy, particle size, dust, moisture no effect
- * Belt scale input for tonnage weighted results
- * Moisture measured (TBM)
- * **Safe – can stand next to operating unit**

Typical analysis spectrum





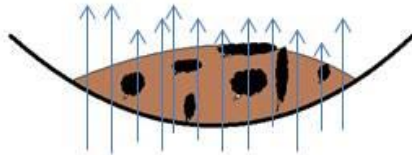
Geoscan-M

TBM Moisture Monitor

PGNAA vs XRF, LIBS, NMR

PGNAA

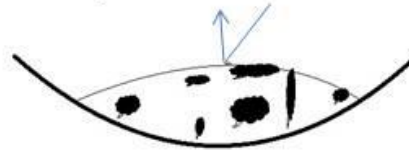
Measures full cross section continuously



- Penetration : 0.5m+
- Tonnage limited only by belt size & depth (approx 17kt/hr), min 20kg/m belt load
- No matrix effects, measures elements
- Unaffected by layering, particle size, belt speed, dust
- Representative for all profiles & mixtures
- Low maintenance

XRF/LIBS

Measures surface spots every few metres



- Penetration: sub-mm
- Measures spots only
- Very large sampling error
- Matrix effects: Ca, Fe.
- Layering gives biased analysis
- Dust is a problem
- ONLY representative if material is 100% homogeneous, unlikely
- High cost for amount measured
- High maintenance

NMR

Analysers a small sample periodically



- Very small sample
- Large sampling error
- Sampling system essential
- Off line measurement
- ONLY representative if material is 100% homogeneous, unlikely
- Very high cost for amount measured
- High maintenance

3. Applications and Benefits in Phosphate

- * Measure beneficiation feed quality for plant control
- * Sort phosphate rock onto stockpiles, remove waste
- * Blend to improve quality consistency
- * Blend into acid reactor feed
- * Control sulphuric acid addition to acid reactor based on feed rock chemistry to maximise P_2O_5 recovery & Ca to gypsum

4. Examples of performance

North African sedimentary phosphate rock

Elements	Min	Max	Expected Precision
P ₂ O ₅	17	45	0.42
MgO	0.5	6	0.44
SiO ₂	0.5	17	0.35
CaO	43	52	0.38

Examples of performance

North American sedimentary phosphate rock

Elements	Min	Max	Expected Precision
P ₂ O ₅	20	35	0.71
Al ₂ O ₃	0.5	2	0.25
Fe ₂ O ₃	0.5	2	0.09
CaO	40	50	0.38
MgO	0.2	1	0.15
SiO ₂	2	10	0.28

Examples of performance

Middle Eastern
sedimentary
phosphate rock

Elements	Min	Max	Expected Precision
P ₂ O ₅	17	25	0.42
MgO	0.5	6	0.44
SiO ₂	0.2	10	0.35
CaO	43	52	0.38

Conclusion

- * *“The Geoscan-M has shown excellent results on the phosphate ore as expected from Scantech products.*
- * *Scantech welcomes site to provide their laboratory report for these ore samples so that the Geoscan-M results can be regenerated and optimised with respect to site laboratory results.*
- * *The results demonstrate that the Geoscan-M is suitable for quality control at this site”.*

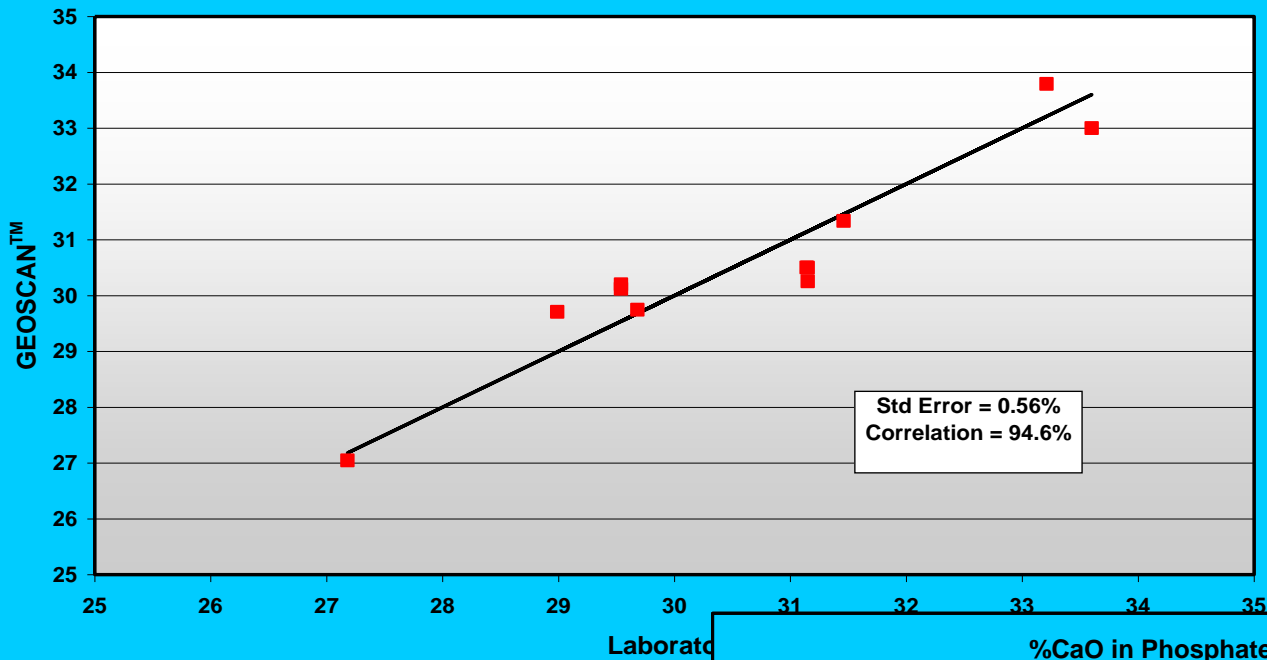
Examples of performance

Russian
igneous
phosphate
ore

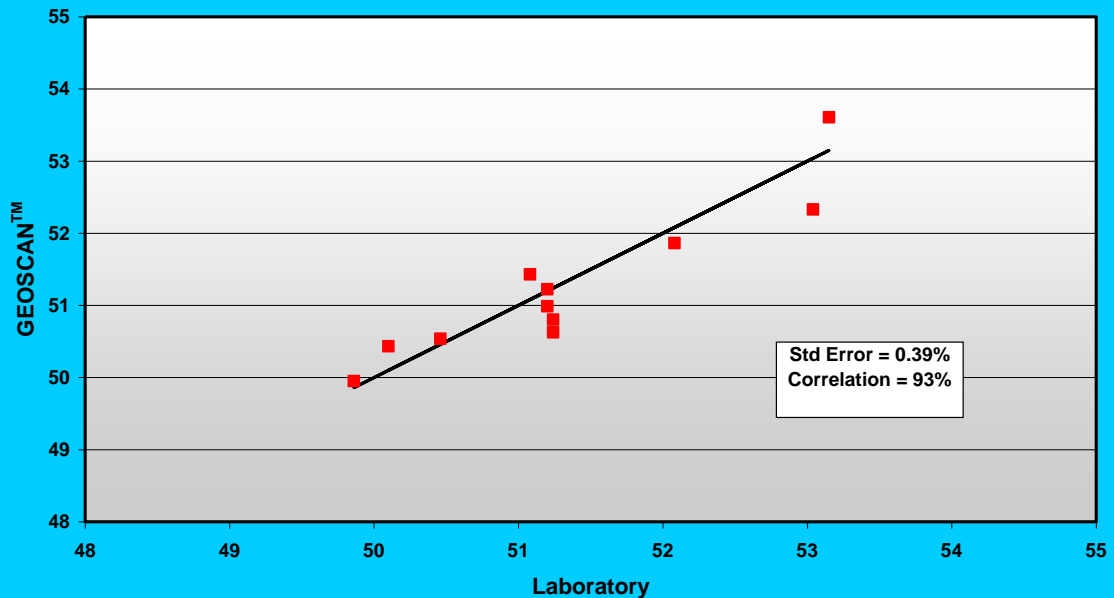
Elements	Min	Max	Expected Precision
P ₂ O ₅	3	10	0.38
SiO ₂	6	11	0.66
Al ₂ O ₃	1	3	0.45
Fe	15	35	0.80
CaO	14	24	0.95
MgO	11	14	0.60
S	0	1	0.10
TiO ₂	0	1	0.08

Examples by element

%P₂O₅ in Phosphate Rock (-6mm screening)

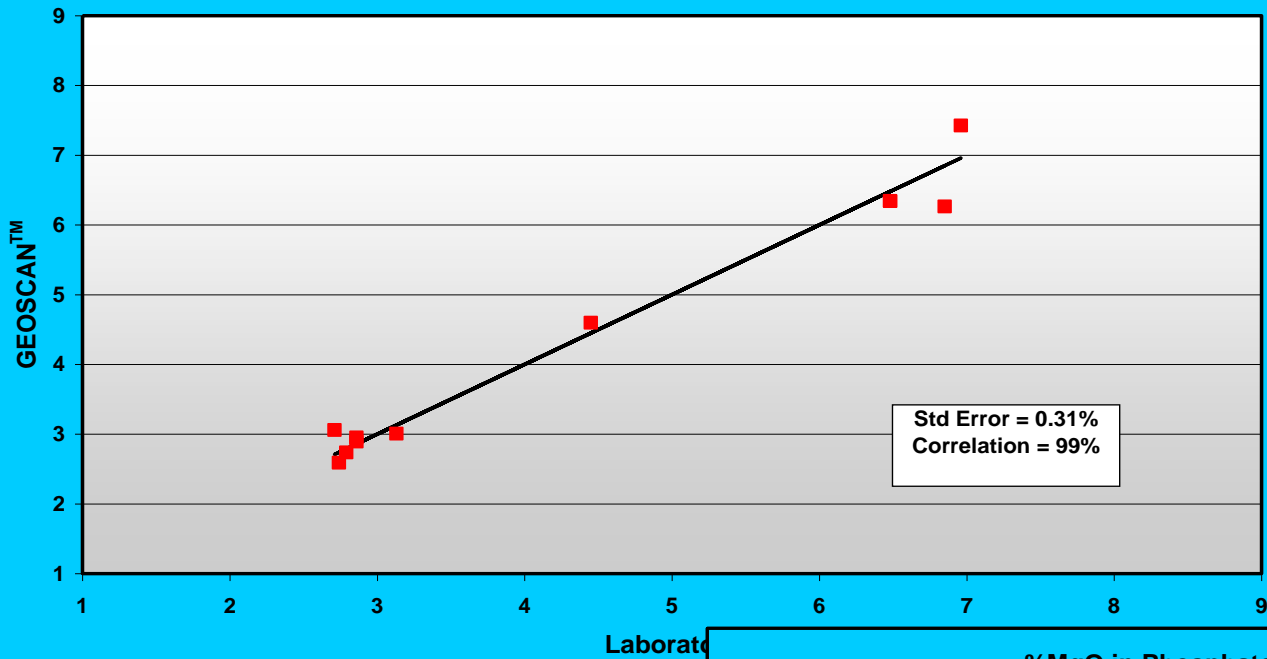


%CaO in Phosphate Rock (-6mm screening)

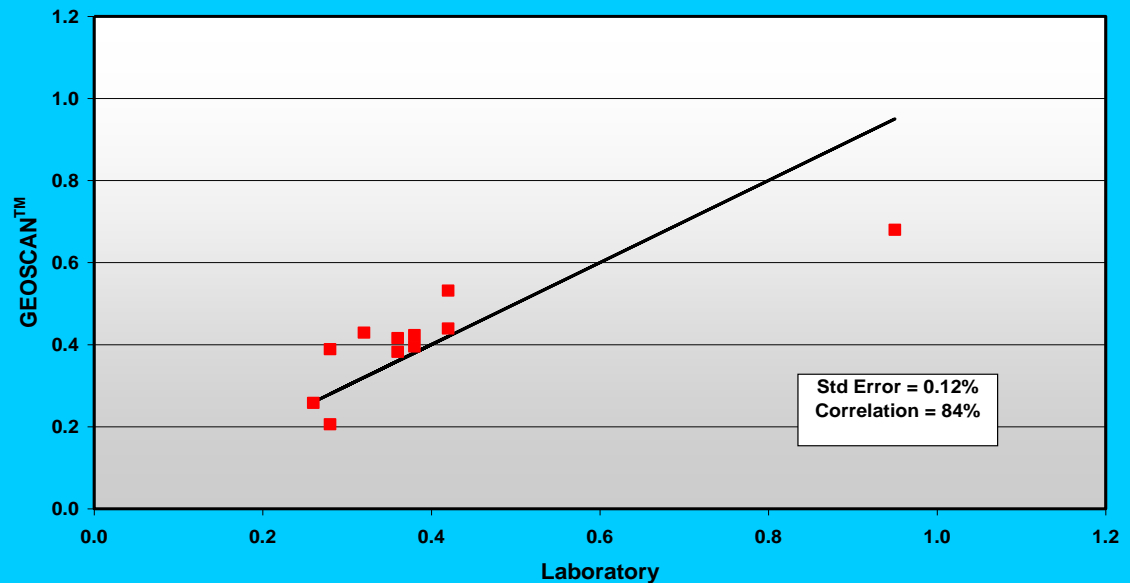


Examples by element

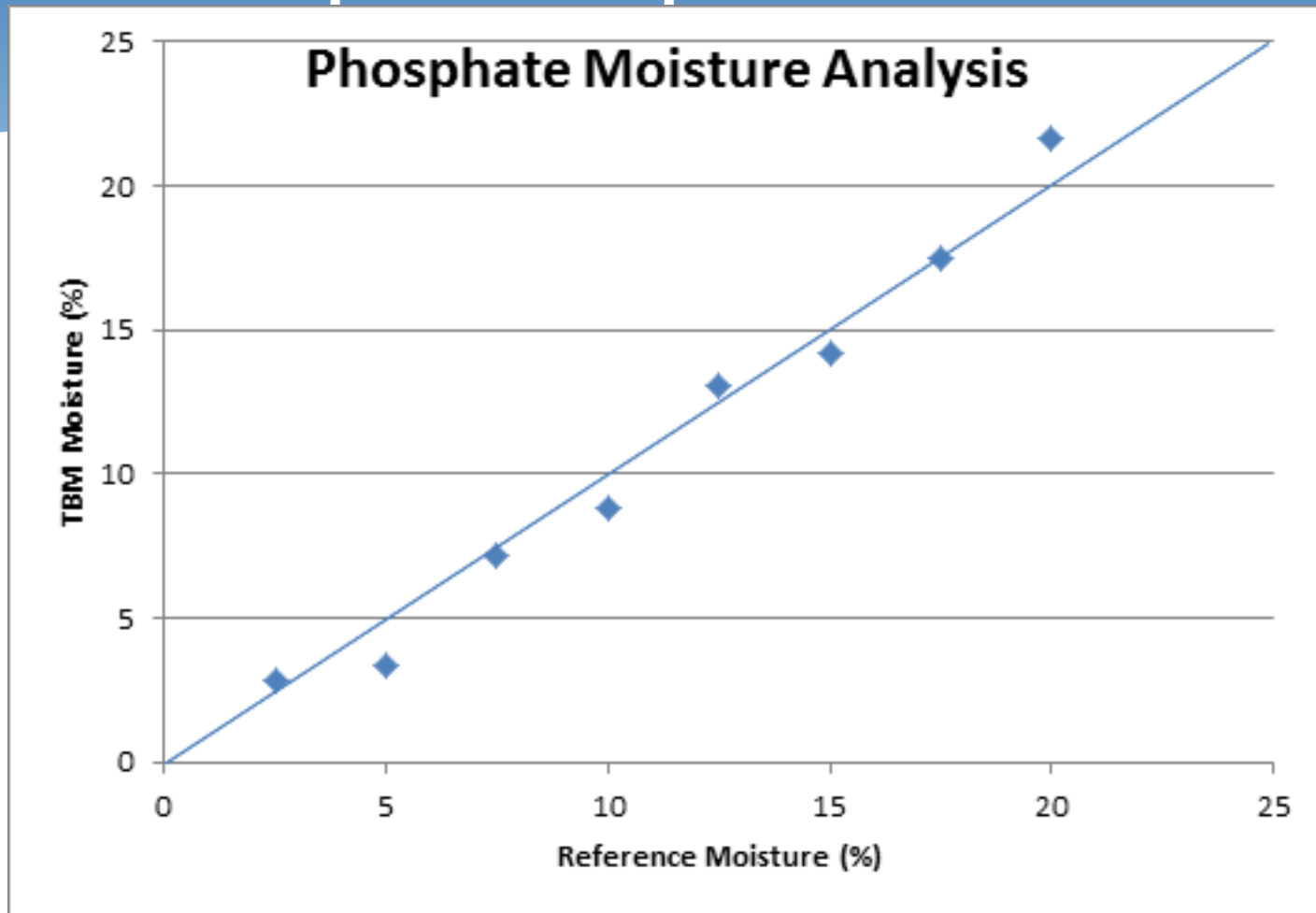
%SiO₂ in Phosphate Rock (-6mm screening)



%MgO in Phosphate Rock (-6mm screening)



Examples of performance



Examples of performance

- Analysers installed in North America & North Africa
- Applications: phosphate rock feed to beneficiation for ore blending, bulk sorting to stockpiles & acid reactor feed
- Performance guarantees (elements) reduce customer risk
- Pay back <6 months on acid digest application
- YR1 technical support included to optimise performance, service engineers located in key regions

Examples of performance - compelling evidence of benefits

- * On-line spectrometry has been one particularly fruitful technology that has helped the US phosphate industry to innovate, cut costs, improve efficiency and reduce environmental impact.
- * “FIPR has also long championed the potential for on-line chemical analysis for improving the performance of phosphate beneficiation plants.”
- * A US fertilizer company uses “analysers for quality control purposes at one of their beneficiation plants and is saving several million dollars annually as a result.”
- * quotes from **Patrick Zhang**, beneficiation and mining research director, FIPR, in Fertilizer International 465: March-April 2015 issue.

4. Summary

- * Technology is proven - safe, reliable, accurate
- * Representative system measures real time on-belt
- * Remove waste increments from feed
- * Bulk sort & blend phosphate rock → consistent feed
- * Improve process control & efficiency – proven benefits
- * Reduces operating costs, short payback (<6 months)
- * Maximise P₂O₅ recovery, acid consumption & Ca removal

Further information:

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