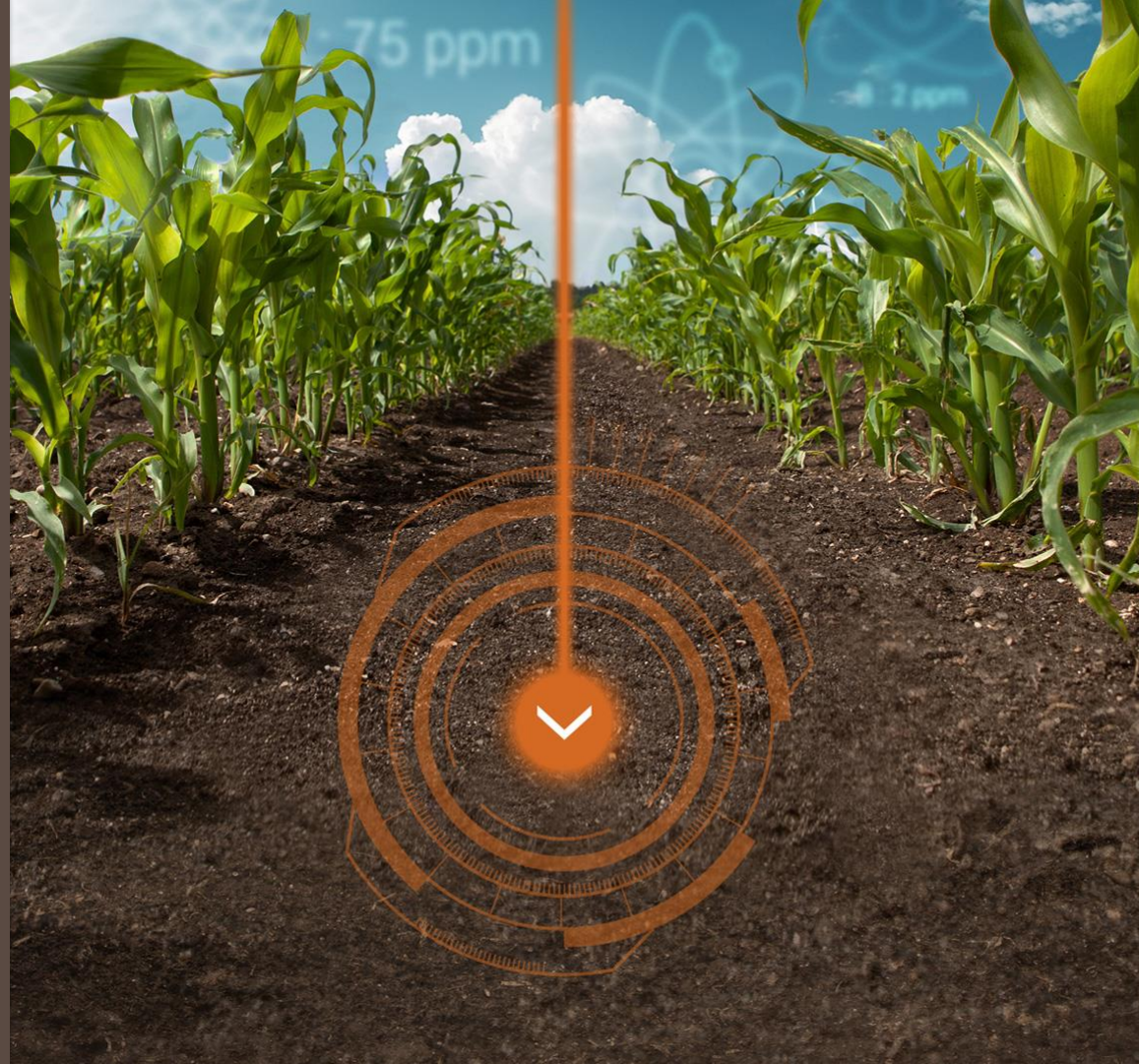


*LASER*AG

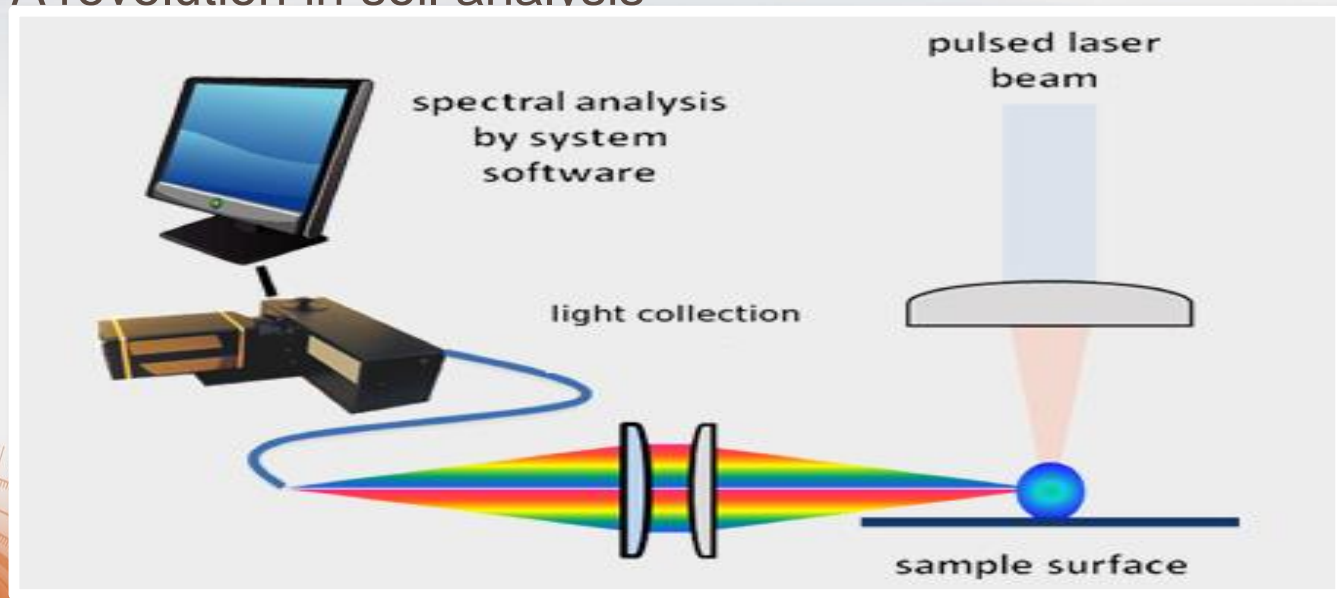
Laser-precise

An innovation by LOGIAG



Laserag

A revolution in soil analysis



Jacques Nault, agr. MSc

- BSc (1984) and Msc. (1990) from Macdonald campus of McGill university
- Co-founded Logiag in 1999.
- Director of agronomy services at Logiag.
- From 2004 to 2014 general manager of FCS, a NY based corporation specialized in NMP – sold to the US employees in 2014
- Laserag business development

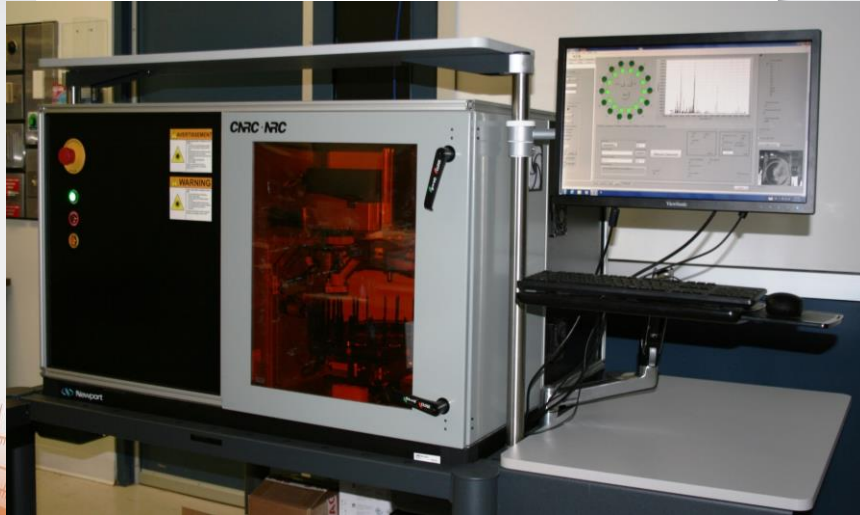
LOGIAG

- > Founded in 1999
- > 35 employees
- > NMP,
- > drainage and erosion control,
- > biosolids (NASM),
- > Strong software and technology development
- > Network of service and input providers serving 4000 farmer clients in Quebec, Ontario and Northeastern US



LASER INDUCED BREAKDOWN SPECTROSCOPY (LIBS)

Where it is used:



LIBS is currently used:

- Mining industry
- Metallurgical analysis
- Pharmaceutical quality control
- International atomic energy agency
- NASA

LASER INDUCED BREAKDOWN SPECTROSCOPY (LIBS)

Working with top canadian scientists:

Canadian Nuclear Safety Commission / Commission canadienne de sûreté nucléaire

IAEA Symposium on International Safeguards:
Linking Strategy, Implementation and People
Vienna, October 20-24, 2014

Development of Laser-Induced Breakdown Spectroscopy Technologies for Nuclear Safeguards and Forensic Applications

Presented by Suzhen Chen
Canadian Nuclear Safety Commission


October 24, 2014
e-Docs # 4526209

nuclearsafety.gc.ca



Canada

Portable LIBS system



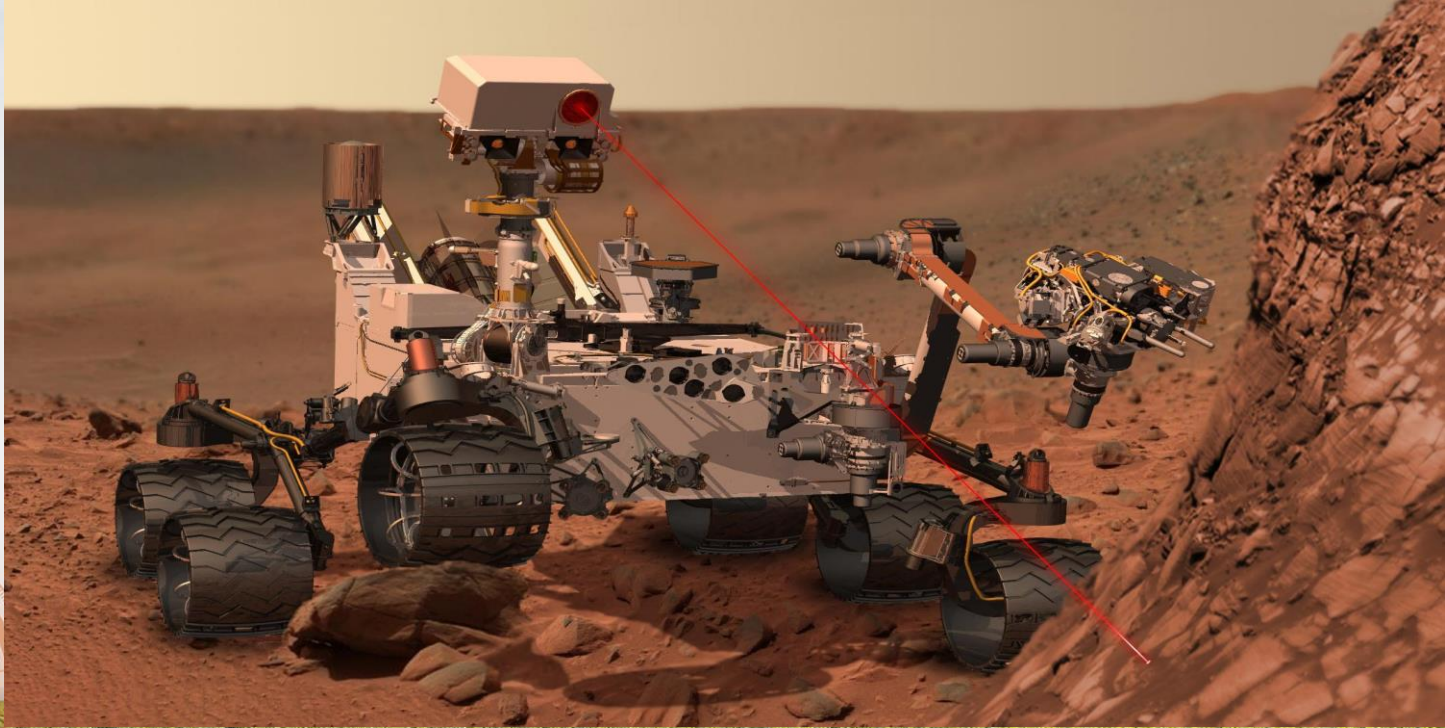
Probe

Control box

Canadian Nuclear Safety Commission

6

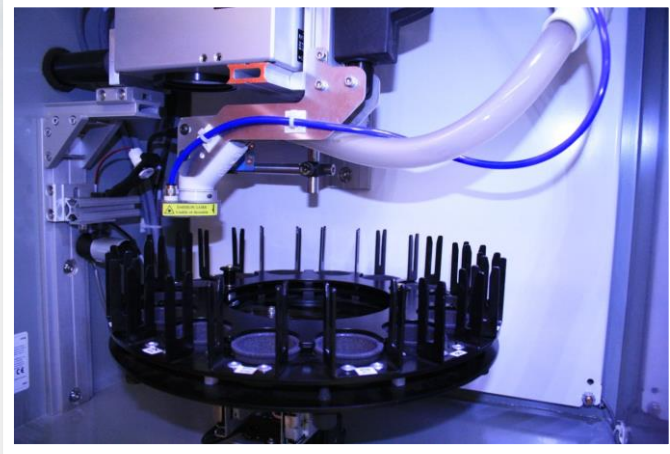
NASA's curiosity MARS Rover using the LIBS technology



LOGIAG using the LIBS technology

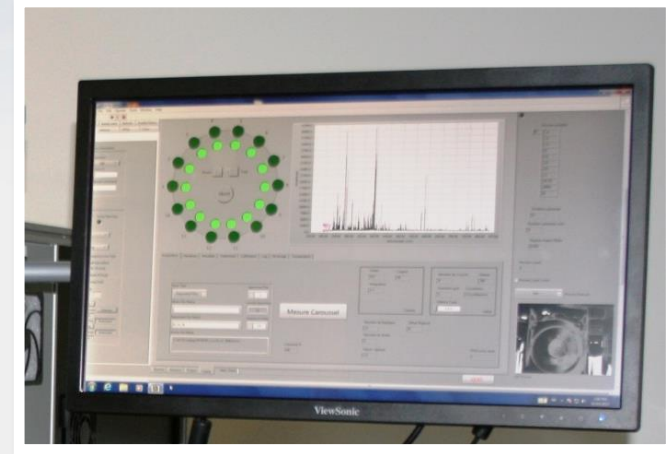


LIBS SOIL ANALYSIS PROTOTYPE BUILT AT NRC



2000 acquisitions/sample

The measurement time for 12 samples is 6 minutes: 30 seconds/sample

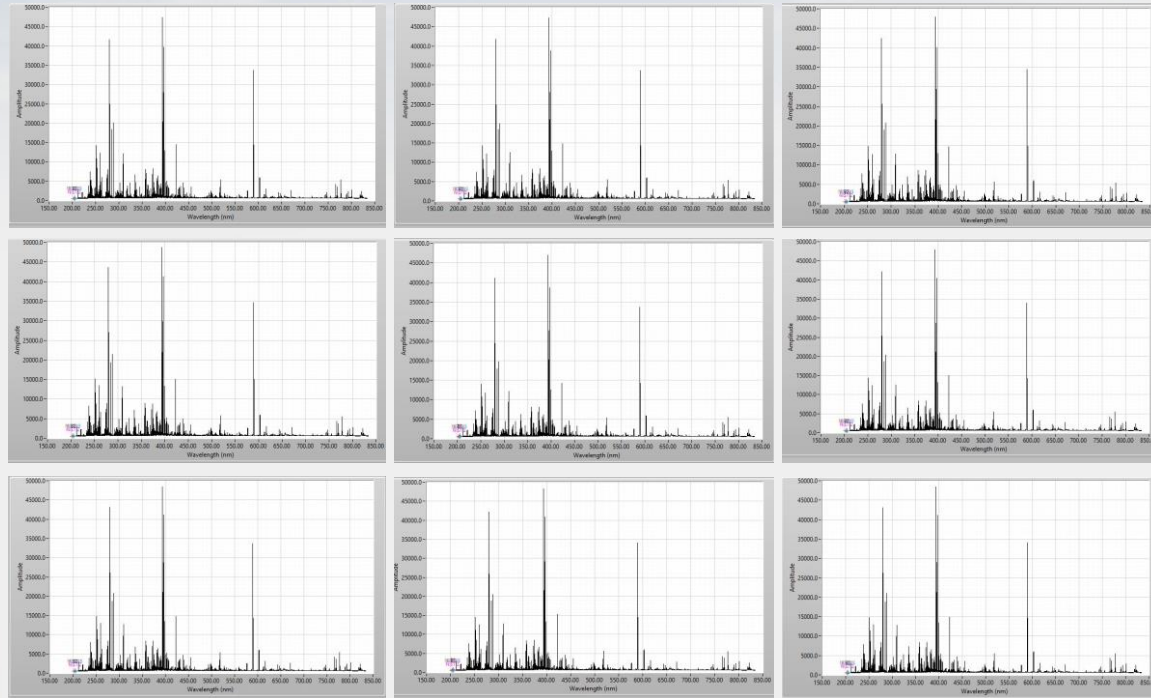


Instrument precision:

The relative standard deviation is < 5 (%)

DOES IT WORK LASERAG SYSTEM STABILITY

9 independent replicates of the same loamy soil



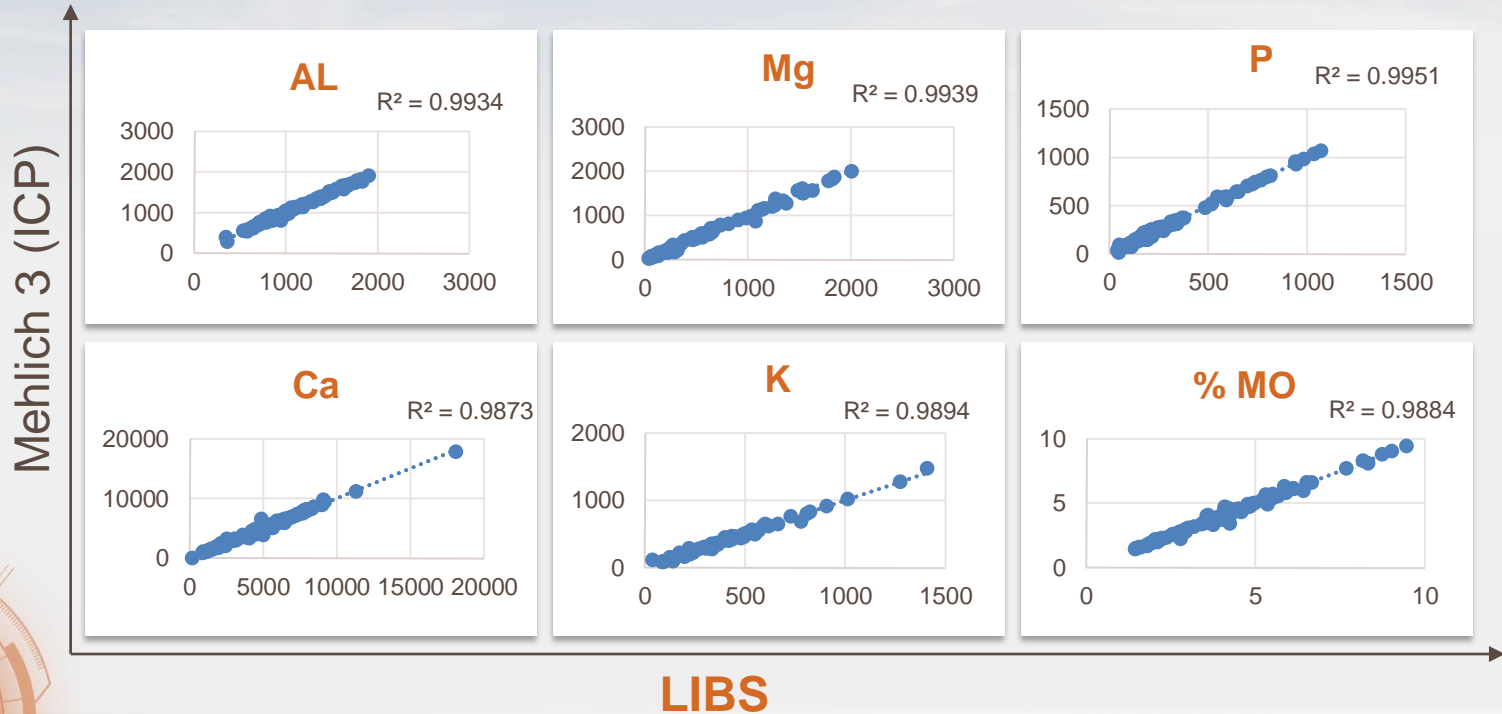
LASERAG SPECTRAL ANALYSIS SOFTWARE

Efficient on prepared as well as unprepared soils
Can cover a wide range of matrix simultaneously

- › From rock to organic matter such as leaves, including all type of soils (sand, clay, loam, silt and all their possible mixtures)
- › Doesn't required recalibration or transfer function to adjust daily system variation
- › New materials or parameters can be added to the system without having to repeat and re-analysed the entire calibration set

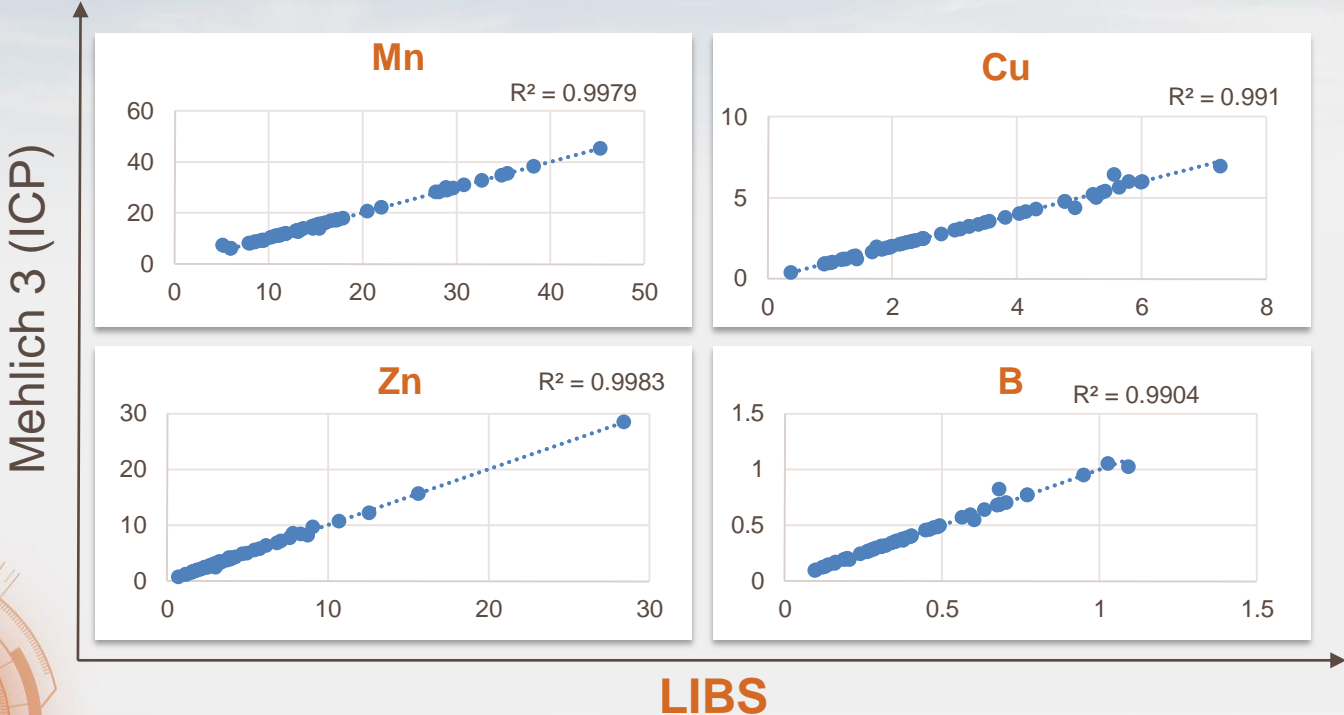
DOES IT WORK LASERAG CALIBRATION MODEL

(correlation curves with Mehlich 3 standard on main soil parameters)



DOES IT WORK LASERAG CALIBRATION MODEL

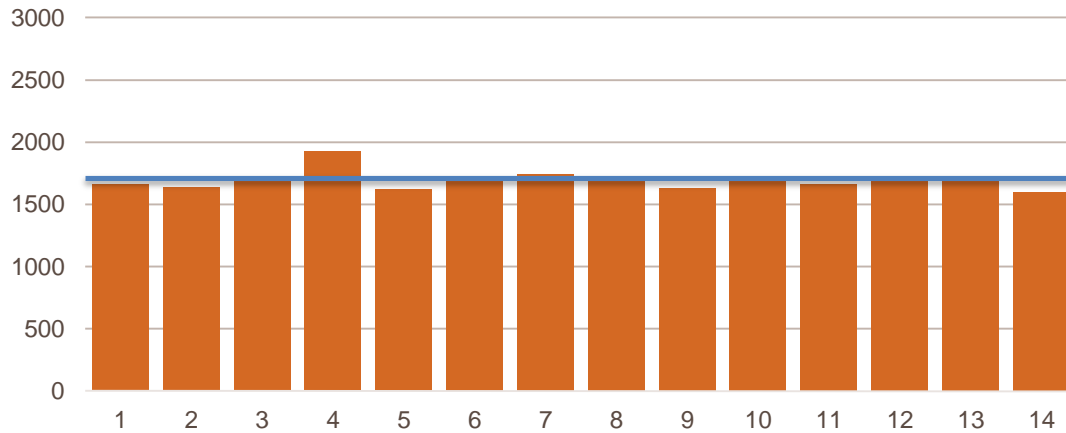
(correlation curves with Mehlich 3 standard on minor elements (mg/kg))



PRECISION / REPLICABILITY:

AI results on same sample analysed 14 times

Aluminum (loamy soil)



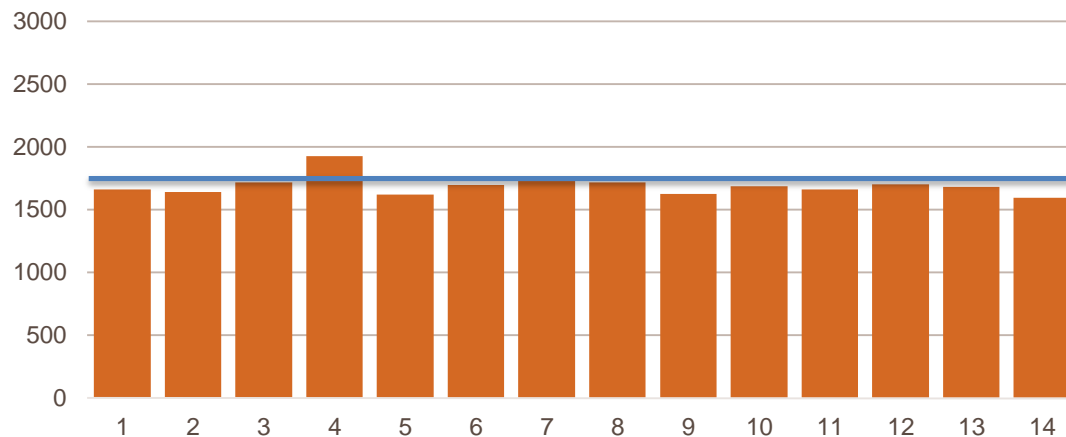
Mean:
1689.45 ppm

Standard deviation:
80.04 ppm

Coefficient of variation:
4.73%

ACCURACY: All results for the same sample analysed 14 times by 4 different certified labs and compared with Laserag results

Aluminum (loamy soil)



Mean:
1689.45 ppm (LIBS/LASERAG)

Standard deviation:
80.04 ppm

Means certified Labs:
1745 ppm

Mean relative error (%):
4.65862079

LASERAG IS



FAST



FLUID



ACCURATE



GREEN

THE PROCESS

The soil never leaves the plastic cup



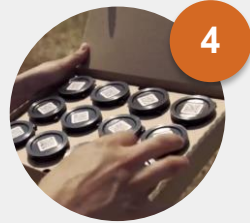
Collection of samples



Identification of samples
with the QR code



Simultaneous
geopositioning using
Sampler app and QR code



Shipment to the lab in
prepaid boxes



Drying of samples



Pressing of samples
under 23T

SOLID™ SAMPLER MOBILE APP

1. Select farm, then field to sample

2. Locate sampling point and get as close as possible

3. Collect a few cores of soil at the location of the point and fill the plastic cup

Use this button to allow the map to rotate according to your direction (makes reaching sampling points easier)

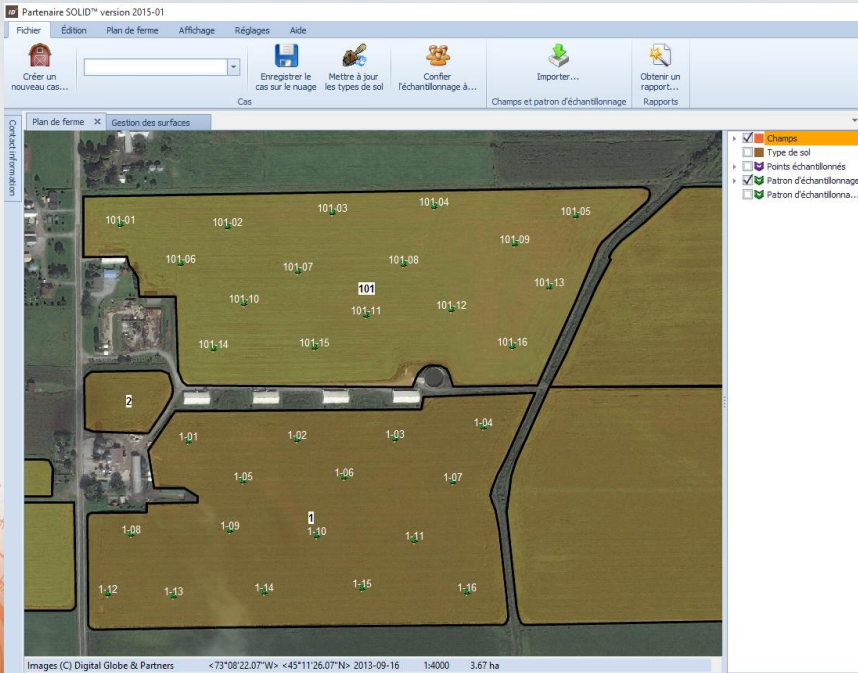
4. Scan the QR code at the location of the point

5. Upload scans to cloud

Sampling points are green; points that have been scanned are purple



LASERAG SOFTWARE



PARTNER SOFTWARE

SOLID Partner™ version 2015-01 [Ferme Sandstone]

File Edit Farm plan View Settings Help

Nault, Jacques , (Logiag) Ferme Sandstone

Save to cloud Update soil types Assign sampling to... Import Fields and sampling pattern Obtain report...

File

Field information

Farm plan X

Images (C) DigitalGlobe and Partners <72°36'29.97\"W> <45°35'2.44\"N> 5/28/2013 1:8000 22.99 ha

Fields

- Soil type
- Sampled points
- Sampling pattern
- 1100-1
- 1100-2
- 1100-3
- 1100-4
- 1100-5
- 1100-6
- 1100-7
- 1100-8
- 1100-9
- 1100-10
- 1100-11
- 1100-12
- 1100-13
- 1100-14
- 1100-15
- 1100-16
- 1100-17
- 1100-18
- 1100-19
- 1100-20
- 1100-21
- 1100-22
- 1100-23
- Champ 1-1
- Champ 1-2
- Champ 1-3
- Champ 1-4
- Champ 1-5
- Champ 1-7
- Champ 1-8
- Champ 1-9
- Champ 1-10
- Champ 1-11
- Champ 1-12
- Champ 1-13

Analysis results X Soil type Manage surfaces

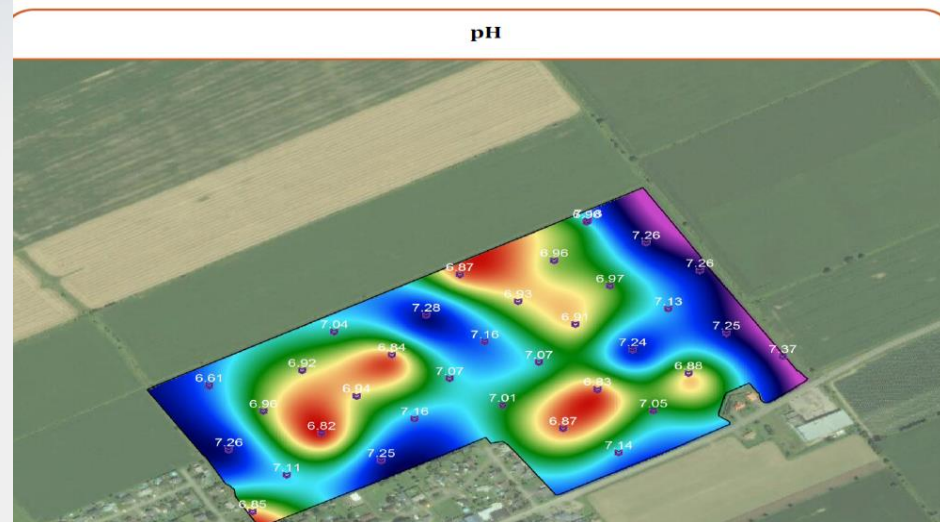
Sampled points	Sample date	Sampler	Analysis date	pH	Buffer pH	CEC	Organic matt
A-1	6/10/2015	Iké Nault	8/27/2015	6.9169621474	7.178621076	20.9	7.123183
A-2	6/10/2015	Iké Nault	8/26/2015	7.640528731	7.6701815754	19.9	5.803710
A-3	6/10/2015	Iké Nault	8/27/2015	6.990802834	7.1575651799	18.8	4.85022
A-4	6/10/2015	Iké Nault	8/27/2015	7.7012917008	7.7350065304	17.9	5.695951
A-5	6/10/2015	Iké Nault	8/26/2015	7.5885232586	7.5267178422	20.8	7.095811
A-11	6/10/2015	Iké Nault	8/27/2015	6.9215835826	7.0862642683	12.1	4.438578
A-12	6/10/2015	Iké Nault	8/26/2015	6.779387414	6.9470712821	15.7	4.753494
A-13	6/10/2015	Iké Nault	8/26/2015	6.2871032134	6.8047119448	13.6	4.166965
A-14	6/10/2015	Iké Nault	8/27/2015	6.8856322959	6.9936780494	17.3	4.935233
A-15	6/10/2015	Iké Nault	8/27/2015	6.2893800675	6.8006875696	14.1	4.14660
A-16	6/10/2015	Iké Nault	8/27/2015	6.6658768228	6.9575685262	13	4.172763
A-17	6/10/2015	Iké Nault	8/26/2015	6.4452830028	6.9037501415	12.1	3.670102
A-18	6/10/2015	Iké Nault	8/26/2015	6.3595667496	6.8153099421	14.4	4.331873
A-19	6/10/2015	Iké Nault	8/26/2015	6.6755143613	7.0219709424	10.3	3.777337
A-20	6/10/2015	Iké Nault	8/26/2015	6.5147822156	6.8520297483	18.5	5.90385
A-21	6/10/2015	Iké Nault	8/27/2015	6.4693406373	6.9169944693	10.9	3.458352
A-28	8/23/2015	Jacques Nault	8/27/2015	6.8957483682	7.0918765831	11.1	2.495968
A-29	8/23/2015	Jacques Nault	8/27/2015	7.9337877849	7.3193789499	13	4.473869
A-30	8/23/2015	Jacques Nault	8/27/2015	5.7346021953	6.5034923252	13.4	3.218957
A-31	8/23/2015	Jacques Nault	8/27/2015	6.7344352979	6.9635143171	15.2	2.58546
A-32	8/23/2015	Jacques Nault	8/27/2015	6.1462134197	6.8343349941	13	2.419401
A-33	8/23/2015	Jacques Nault	8/27/2015	6.3741116792	6.8982681265	12.1	3.436088
A-34	8/23/2015	Jacques Nault	8/27/2015	6.3183741549	6.8798533349	11.9	3.499532
A-35	8/23/2015	Jacques Nault	8/27/2015	6.8959576213	7.0447396847	13	3.743251
A-36	8/23/2015	Jacques Nault	8/27/2015	5.9220715931	6.7450910454	11.6	2.954293

Analysis results cannot supersede results of an accredited laboratory; there are obtained in the context of a research and development project, and thus are provided only for informational purposes.

PARTNER SOFTWARE

Analysis Results - Ratios and Base Saturations

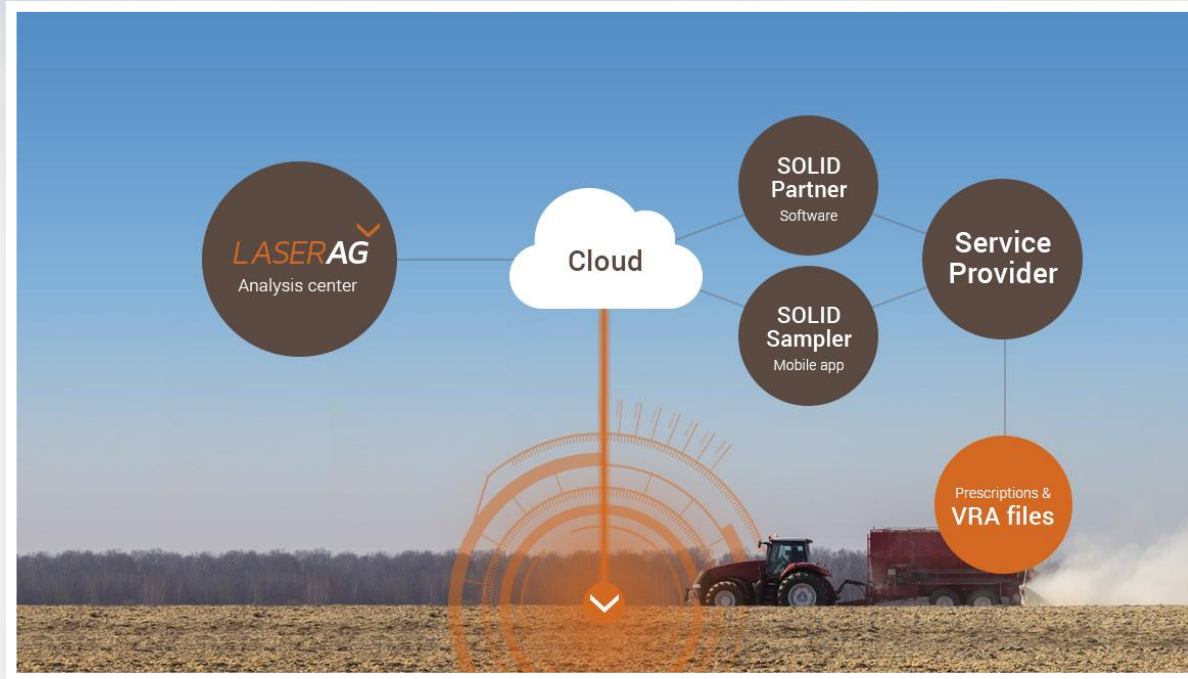
Sampling point	P Sat (%)	K Sat (%)	Mg Sat (%)	Ca Sat (%)	K/Mg	K/Ca	Mg/Ca
A-25	12.92	2.83	19.94	71.02	0.14	0.04	0.28
A-26	8.21	2.60	20.41	70.95	0.13	0.04	0.29
A-27	9.50	2.89	14.58	67.43	0.20	0.04	0.22
A-28	5.19	2.48	20.83	73.62	0.12	0.03	0.28
A-29	4.53	2.73	20.56	75.77	0.13	0.04	0.27
A-30	3.90	2.83	18.29	74.42	0.16	0.04	0.25
A-31	5.57	3.48	24.47	69.45	0.14	0.05	0.35
A-32	5.43	2.97	15.06	73.55	0.20	0.04	0.20
A-33	5.08	2.69	15.52	66.38	0.17	0.04	0.23
A-34	4.62	2.91	16.24	66.97	0.18	0.04	0.24
A-35	5.06	2.53	19.38	68.65	0.13	0.04	0.28
A-36	5.51	3.09	19.50	69.28	0.16	0.04	0.28
A-37	6.91	2.56	17.18	66.91	0.15	0.04	0.26
A-38	7.88	2.43	21.39	69.04	0.11	0.04	0.31



WHO SHOULD PAY ATTENTION?

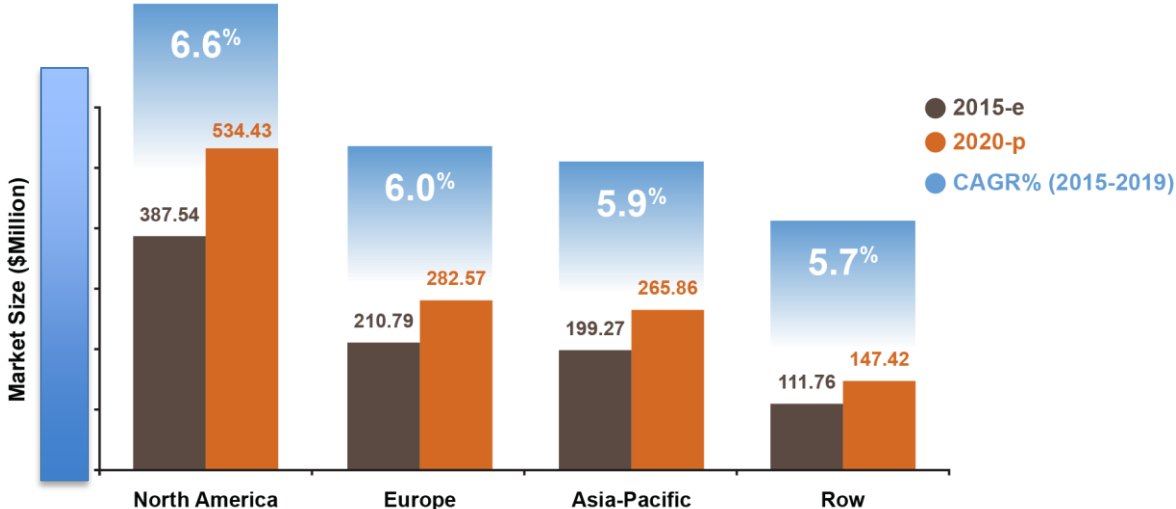
- Agronomy groups, who want to bring value to their members;
- Service providers who offer soil sampling, VRA files, and are involved in precision agriculture
- Organizations who are interested in big data and who need precise GPS soil test results to feed into their prescription algorithms

AN INTEGRATED SYSTEM



WHY YOU SHOULD CARE

Overview: Soil Type Agricultural Testing Market



Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Primary Interviews, Company Publications, MarketsandMarkets Analysis, in *Agricultural Testing Market – Global Trends and Forecast to 2020*, MarketsandMarkets, 2015.

CERTIFICATION

- **Currently in the process of becoming ISO 17025 certified:**

ISO/IEC 17025 is the standard for which most labs must hold accreditation in order to be deemed technically competent. The method has been named *Laserag-1*

- **Centre d'expertise en analyse environnementale du Québec (CEAEQ):**

A Quebec specific certification administered by the ministry of environment

Conclusion

- > **Come and see me at my booth!**