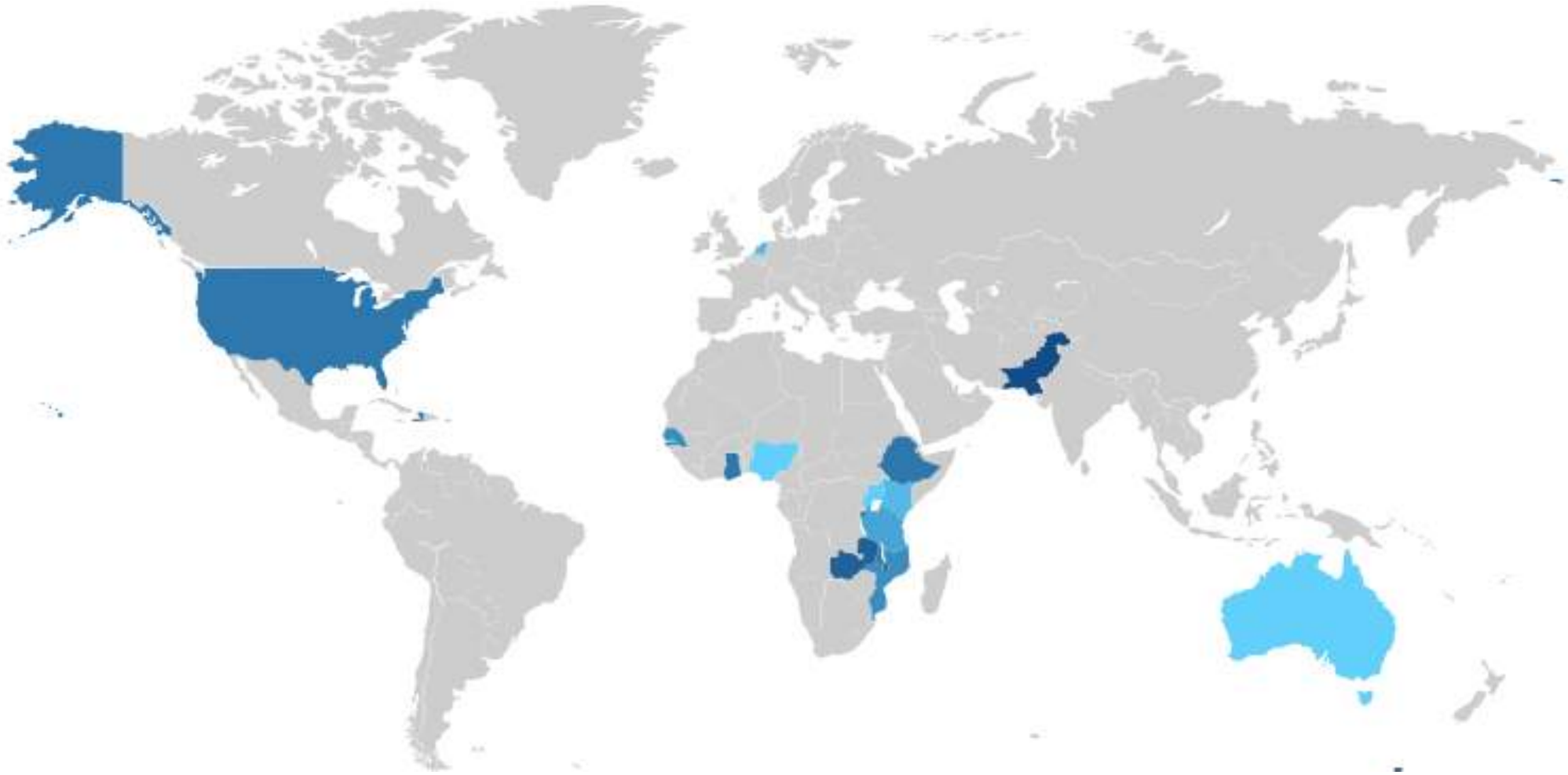
RTDX
real time diagnostics

https://www.surveymonkey.com/r/aflatoxin

Real-time Diagnostics Mobile Device Platform for food safety and human health diagnostics

Don Cooper Ph.D.
Co-Founder & Chief Science Officer
Real Time Diagnostics LTD
www.rtdx.io

"There are three phases to treatment: diagnosis, diagnosis and diagnosis." (1892) William Osler the father of modern medicine.



RTDX
real time diagnostics

The use of mobile technology to managing mycotoxins

6 Oct 2014 last update:13 Nov 2014 1671

A mobile device in combination with rapid diagnostic test strips, geographical tagging and cloud computing could help f… and track common crop pathogens and h…

data, and lack of laboratory services put th…
At the same time, the farmers' incomes and…
consume the food they grow and store. If th…
they face a terrible economic loss and the r…
serious risk. In Kenya and Tanzania (totallir…
staple food for much of the population and…
smallholder farmers is estimated to be abo…

BBC | Sign in | News | Sport | Weather | Shop | Earth | Travel | More | Search

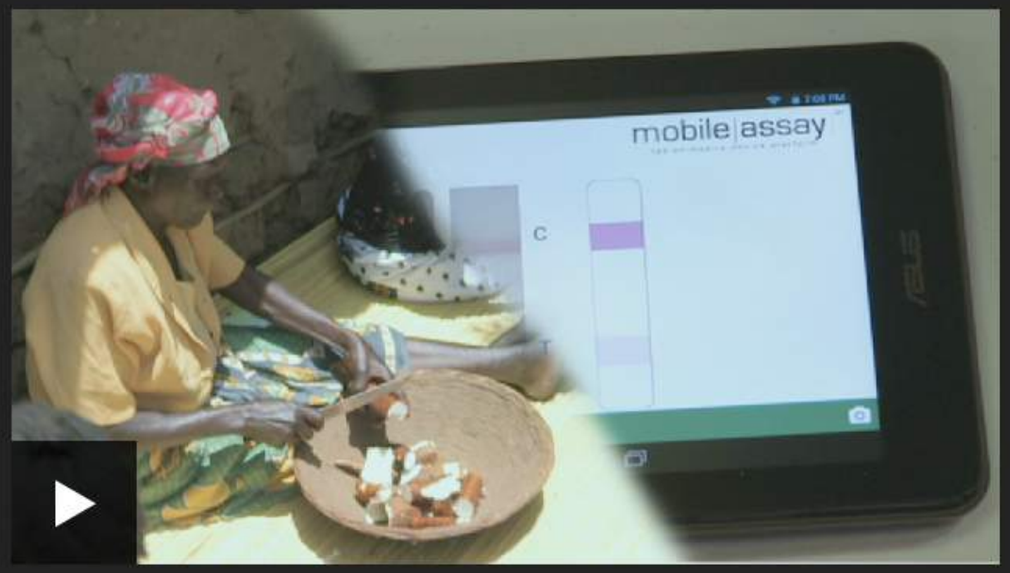
WORLD NEWS

HORIZONS — AN INSIGHT INTO THE FUTURE OF GLOBAL BUSINESS

Home | Food | Energy | Protection | Episodes | Clips Library | About Horizons

Pocket protector

Pocket toxin detectors



Brief Report — technology

Mobile Image Ratiometry: A New Method for Instantaneous Analysis of Rapid Test Strips

Donald C. Cooper[1,2], Bryan Callahan[2], Phil Callahan[2] & Lee Burnett[2]

Here we describe Mobile Image Ratiometry (MIR), a new method for the automated quantification of standardized rapid immunoassay strips using consumer-based mobile smartphone and tablet cameras. To demonstrate MIR we developed a standardized method using rapid immunotest strips directed against cocaine (COC) and its major metabolite, benzoylecgonine (BE). We performed image analysis of three brands of commercially available dye-conjugated anti-COC/BE antibody test strips in response to three different series of cocaine concentrations ranging from 0.1 to 300 ng/ml and BE concentrations ranging from 0.003 to 0.1 ng/ml. These data were then used to create standard curves to allow quantification of COC/BE in biological samples. MIR quantification of COC and BE proved to be a sensitive, economical, and faster alternative to more costly methods, such as gas chromatography-mass spectrometry, tandem mass spectrometry, or high pressure liquid chromatography. MIR is a valuable tool that provides instant data acquisition, tracking and analysis for the emerging field of mobile platform informatics (MPI) and smartphone informatics (SPI).

RESULTS

Cocaine and benzylecgonine standard curves

Each COC and BE standard provided colored signal bands that were quantified and used to create a standard curve. For the test strips obtained from Craig Medical, an exponential function provided the best fitting curve for both the COC and BE data. Sensitivity for COC ranged from 3 to 30 ng/ml, whereas sensitivity for BE ranged from 0.003 to 0.1 ng/ml. Thus, the Craig Medical test strips were 250 times more sensitive towards BE than COC. Cocaine sensitivity for Medimpex test strips ranged from 0.1 to 2 ng/ml, whereas sensitivity for Q Test strips ranged from 5 to 100 ng/ml. Thus, the Medimpex test strips were approximately 10 times more sensitive to cocaine compared to those from Craig Medical and the Q Test strips approximately 3 times less sensitive to cocaine compared to those from Craig Medical. MIR analysis produced fast, repeatable and highly sensitive detection of COC and BE.

DISCUSSION

In this paper, we describe MIR, which uses low cost immunoassay strips, a smart phone or tablet computer camera, and automated image analysis to detect and quantify cocaine and benzoylecgonine. MIR has many possible applications when and can be used for almost any number of immunoassay test strips. Many immunoassay test strips exist which test for anything from drugs of abuse to water contaminants and infectious agents, such as bacteria or parasites. Foremost, MIR represents a powerful tool for use in developing countries where resources and trained personnel are limited and immunoassay test strips and cell phones are relatively inexpensive and require little training. Results can be photographed by individuals, transmitted to a central server for archiving and analysis, and the results sent back within minutes. Smart phones and tablet computers can automatically tag photos with coordinates, allowing end-users to track results geographically. The development of MIR (Mobile Assay Inc., www.mobileassay.com) is one example that reflects the advancement in the field of Mobile Platform Informatics (MPI), which includes tablets and smart phones. New smart tools for MPI are advancing as mobile devices develop new capability to capture and quantify information previously acquired through costly specialized equipment. In the future it is anticipated that these tools will allow low-cost consumer-based devices to serve as multifunctional data testing, tracking and analyzing devices with applications in a variety of industries.

Fig 1. MIR acquisition and analysis of rapid test strips on the Android and iOS platforms.

1.Institute for Behavioral Genetics/Department of Psychology and Neuroscience, University of Colorado, Boulder. 1480 30th St. Boulder, Co 80303.
2.Mobile Assay Inc., www.mobileassay.com1
*dcooper@colorado.edu

Sci Dev Net — Bringing science and development together through news and analysis

CU professor to use new mobile technology to test for agricultural pathogens in Africa

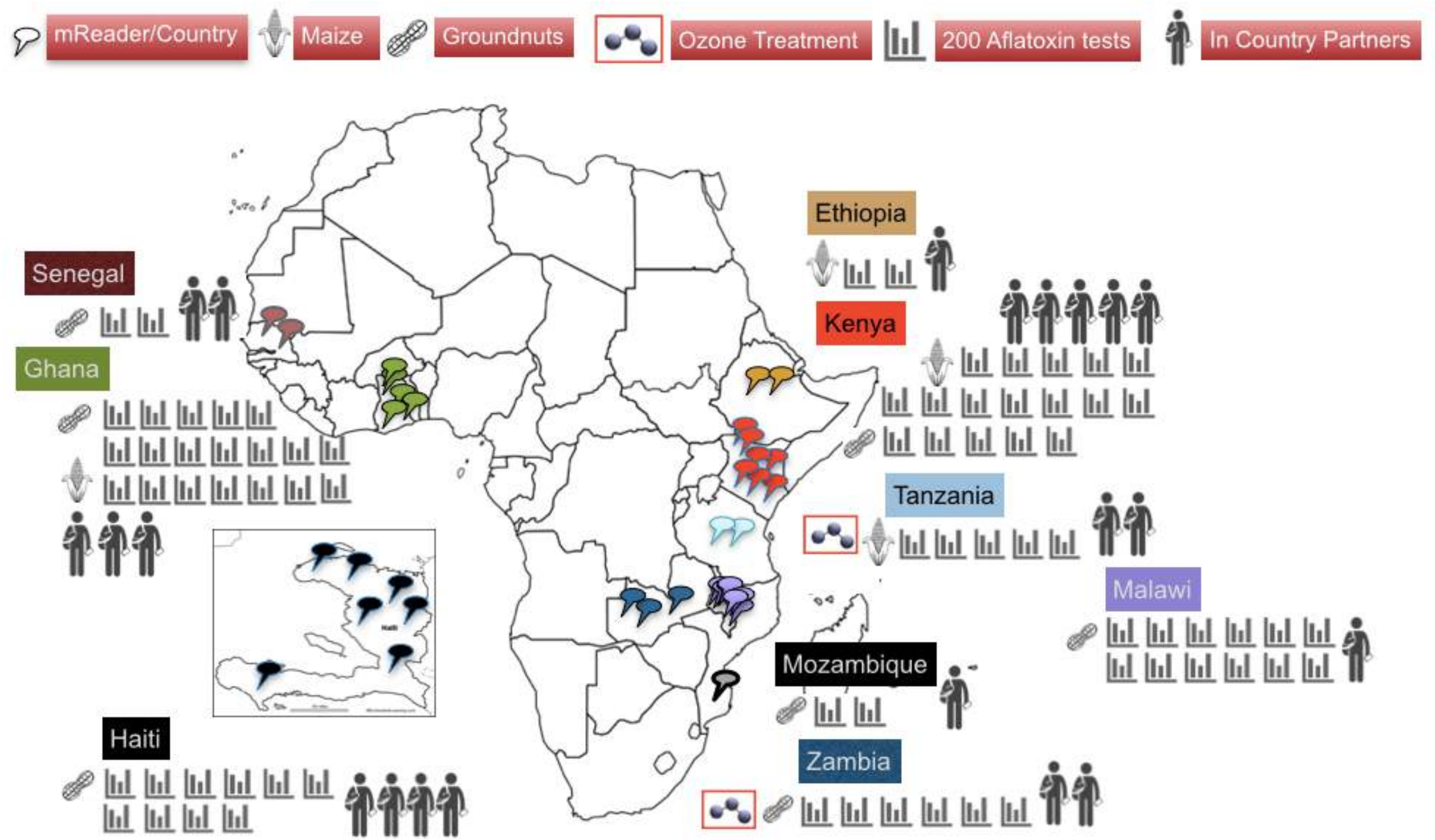
August 20, 2013 •
Social Sciences, Research, Outreach, Global Engagement, Institutes

A University of Colorado Boulder faculty member will travel to Africa later this month to test a mobile smartphone technology developed by his team to rapidly detect and track natural carcinogens, including aflatoxin, which is estimated to contaminate up to 25 percent of the global food supply and cause severe illnesses in humans and animals.

RTDX
real time diagnostics

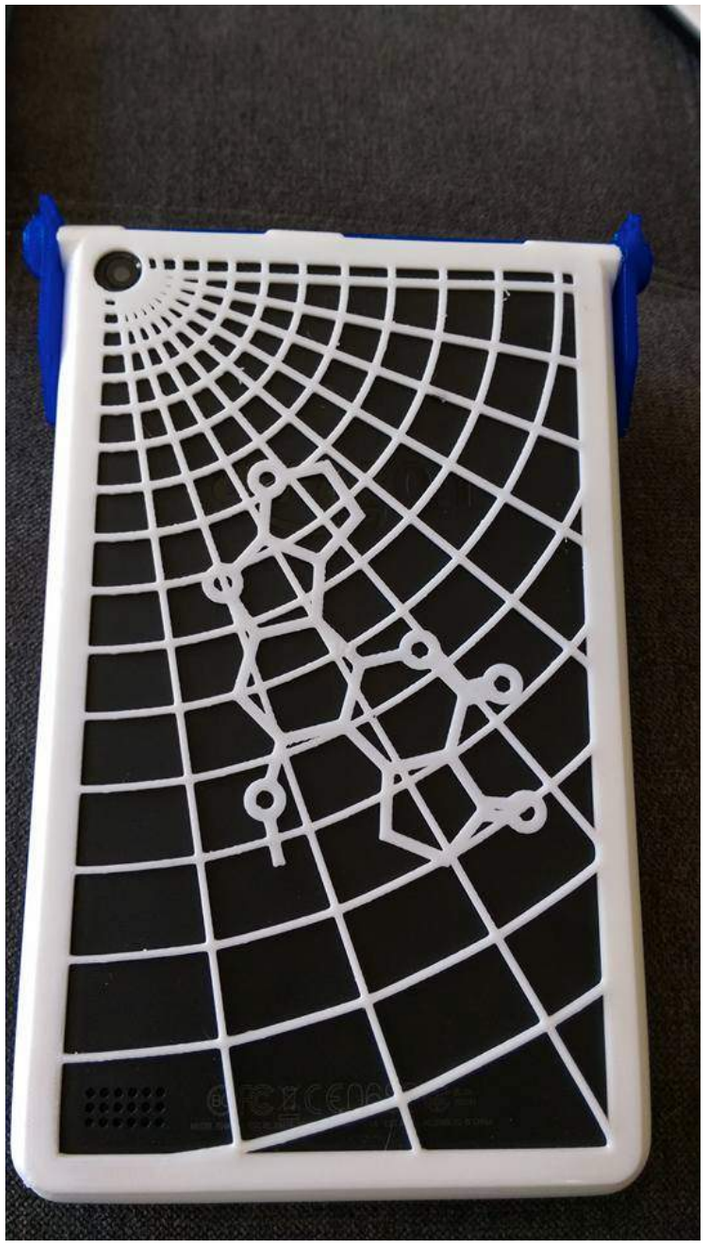
The Real-time Diagnostics Platform for food safety, agriculture and human health monitoring

Bill and Melinda Gates Grand Challenge Exploration Award:Summary



Patented technology for quantification of rapid diagnostic tests

Patent: Modular Illumination and sensor chamber



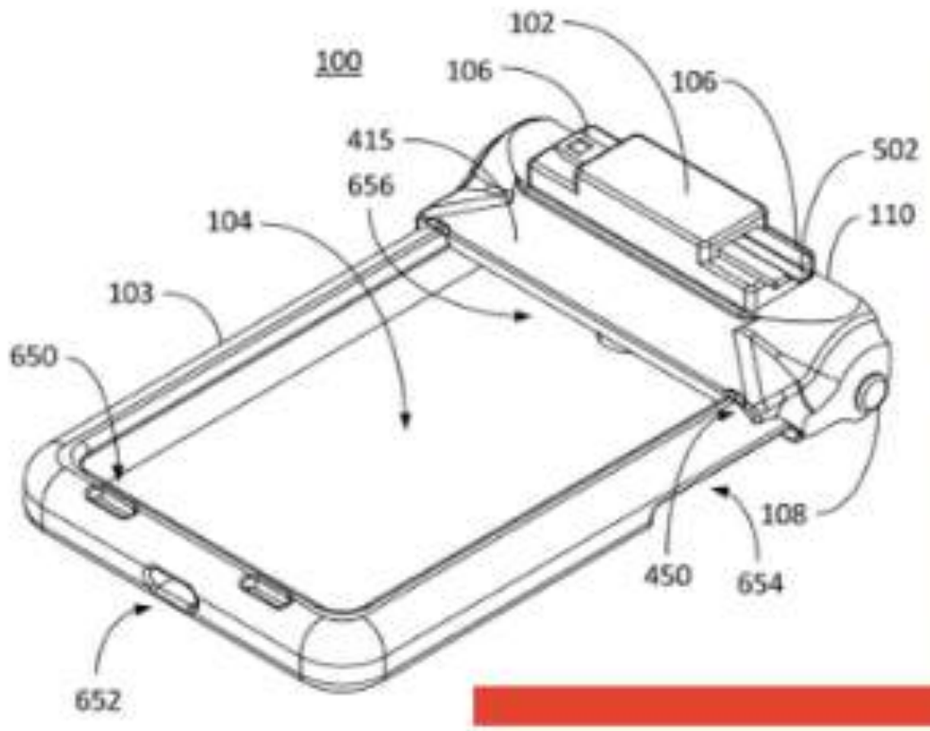
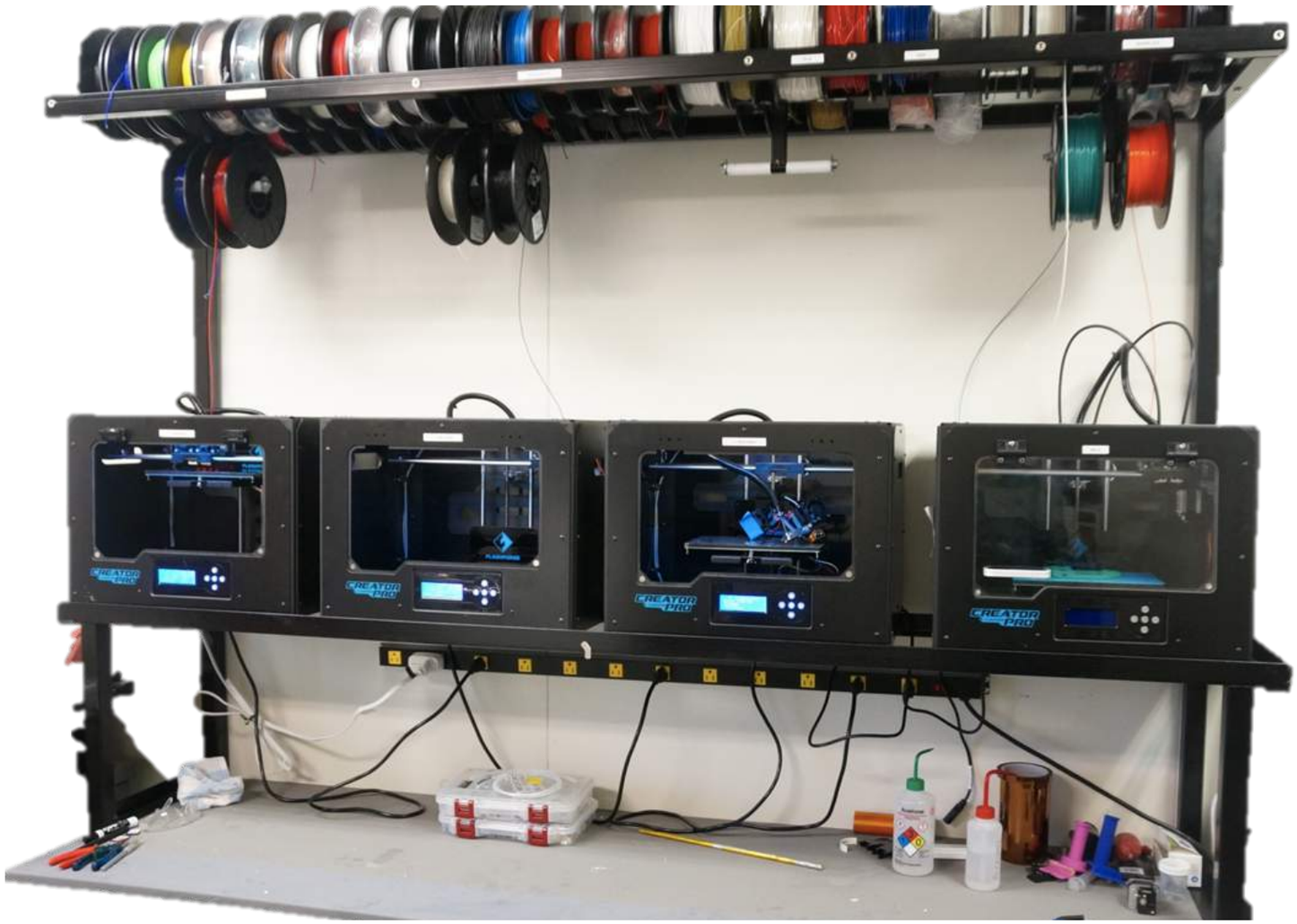


Figure 2. (Left) Asus MemoPad 8 HD case and illumination hood holding the aflatoxin test strip adapted from the provisional patent MODULAR ILLUMINATION AND SENSOR CHAMBER. (Right) Zambia Ministry of Agriculture testing Aflatoxin using the 3D printed case and holder.

In house 3D Digital Print-to-Product Manufacturing



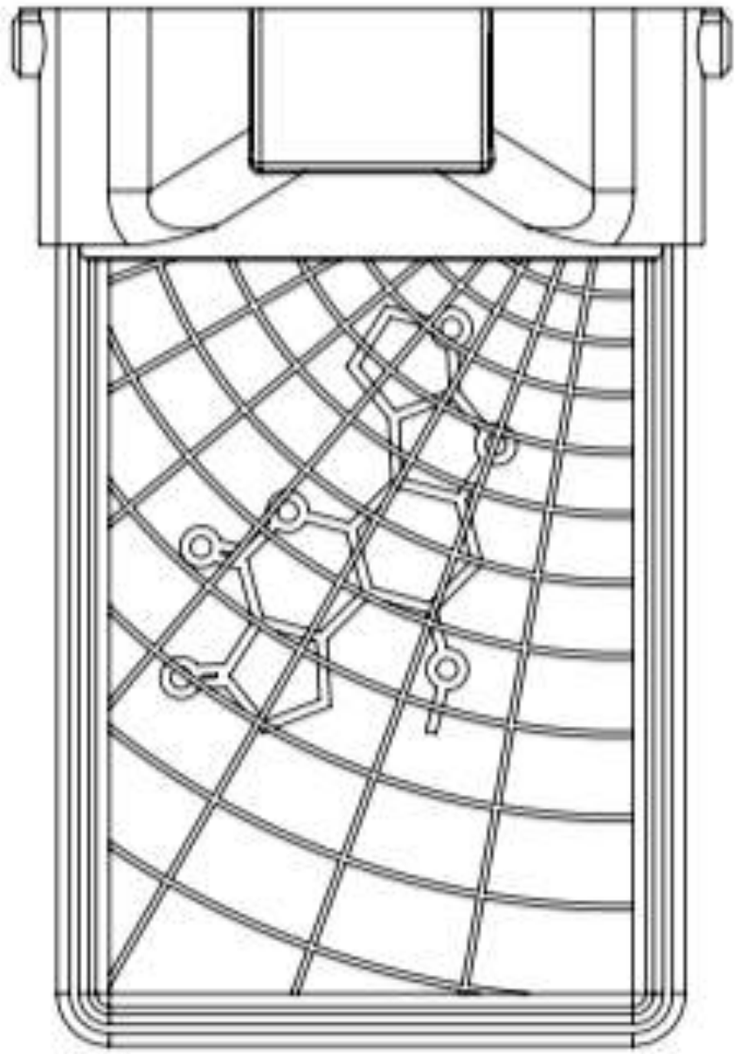


Figure 3. Mobile Assay Inc. 3D print Manufacturing of mobile device illumination chamber and cases for Aflatoxin testing in Africa and Haiti.

Real-time Diagnostics Cloud Platform

Features

- Charting and visualization tools
- **Electronic and printable reporting**
- Quantitative and qualitative results
- Real-time data synchronization
- Local and remote Storage
- Sensor calibration
- **Exports data sets and reports to popular formats such as CSV, JSON, Excel, and PDF**
- Geotagged data points
- **Up to 256-bit PCI Compliant SSL Encryption**
- API Access Credentials for custom interfaces
- **Support for Amazon EC2 deployment**
- Secure Chain of Custody
- Intuitive interface

Please contact us to inquire about gaining evaluation access.

RTDX cloud Dashboard

+ New Project | CSV

+ New User

Projects 7

- DonTest
- Old Sample
- Peanut
- Spiked Peanut
- Test1
- UW 59

Users 5

- Don
- ICRISAT Samples
- Standard
- Test
- Uds

Standards

- 200pt Standard
- PeanutsTest

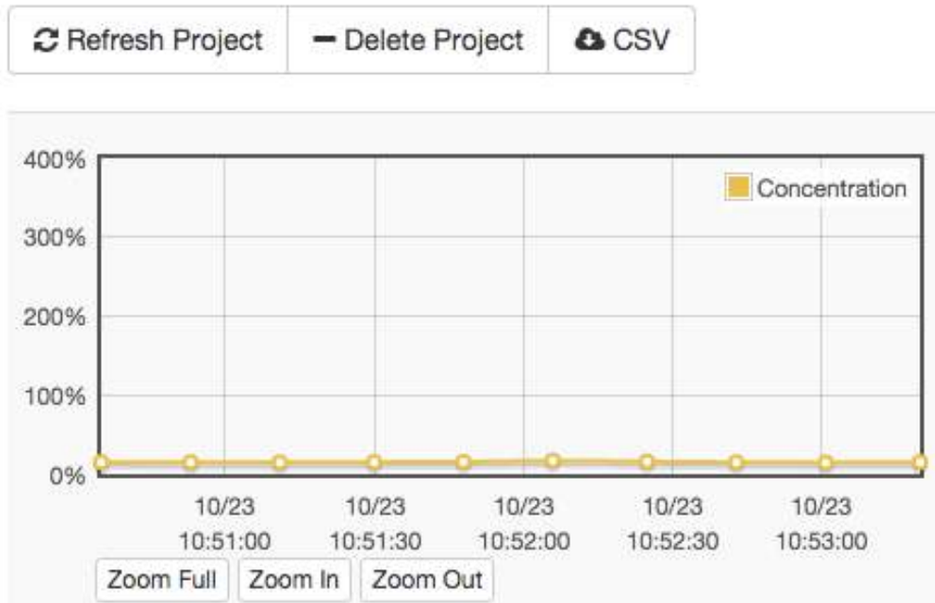
Cloud visualization and tracking database

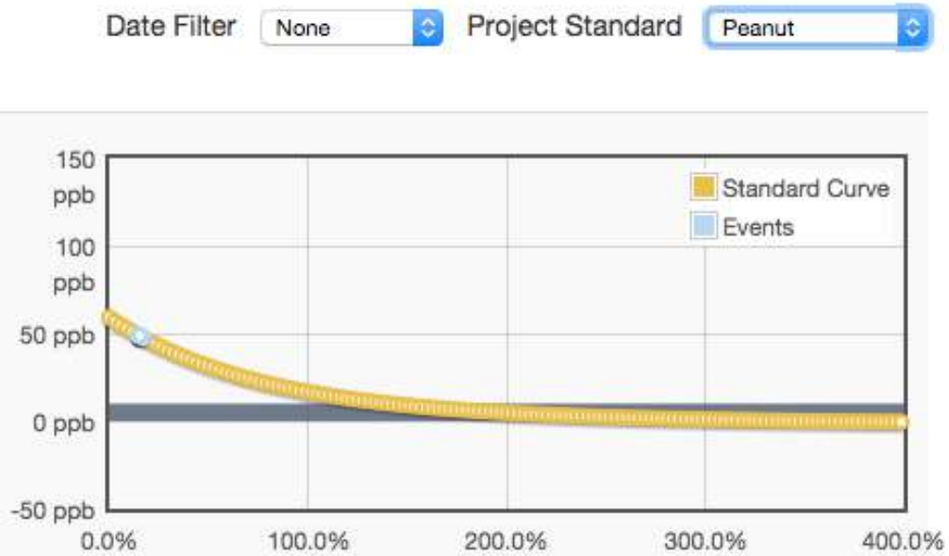
RTDX cloud Dashboard

102315_peanuts_PN11A events for UGA Peanut Validation_WangLab

Refresh Project | Delete Project | CSV

Date Filter: None Project Standard: Peanut





Created On	By	Location	Type	Result	Extended Result	Device	Image
2015-10-23 10:53:20	UGA Peanut Validation_WangLab	33.94° N, -83.38° W	Q+ Device (Colloidal Gold)	**Valid,** 48.77 ppb	0.15108011495902	asus K011 4.4.2 20151009	

mReader - Validation in Peanut products

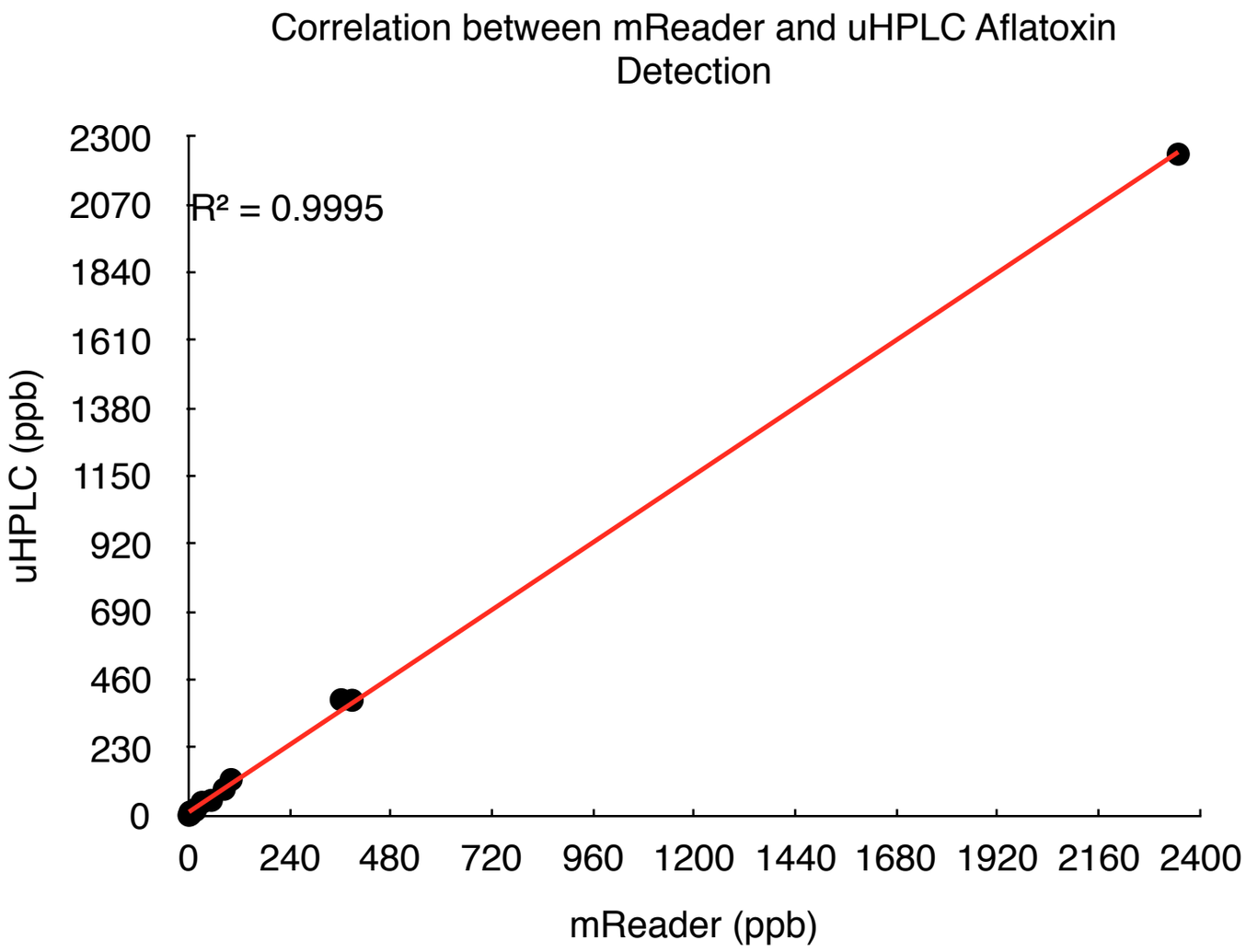
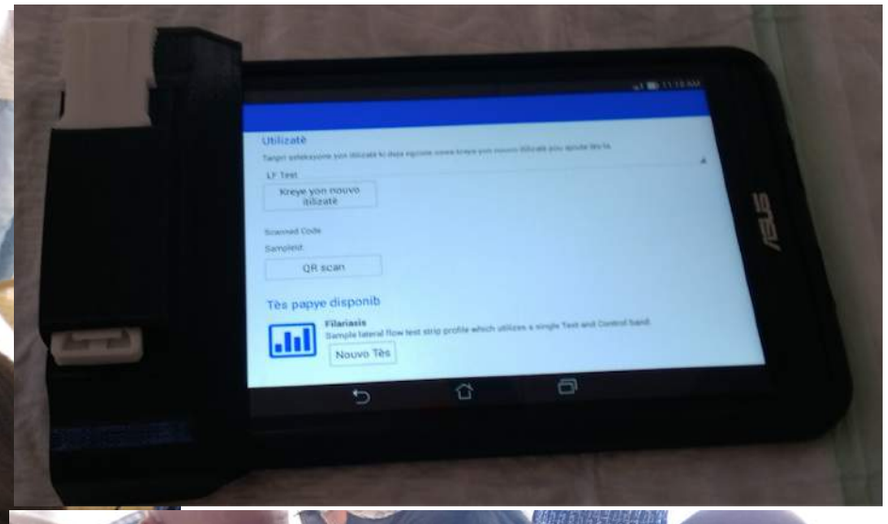


Table 1

	uHPLC	mReader 1	mReader 2	Average	IAC method	Mycosep method
Spiked Peanut paste 1	0.2	1.68	2.10	**1.89**	1.04	0
Spiked Peanut paste 2	19.65	18.48	13.83	**16.155**	14.82	8.44
Spiked Peanut paste 3	121.15	156.70	47.08	**101.89**	70.16	36.73
RUTF 1	10.96	4.4	4.7	**4.55**	4.9	2.98
RUTF 2	44.10	34.59	30.88	**32.735**	15.51	5.33
RUTF 3	391.95	327.15	398.80	**362.975**	171.35	0.59
Peanut flour 1	390.14	358.75	419.01	**388.88**	311.55	27.59
Peanut flour 2	2241.67	2483.5	2213.18	**2348.34**	1629.23	147.53
Infected oil	50.75	52.38	57.46	**54.92**	47.57	11.18
Spiked Oil 1	88.55	87.35	83.71	**85.53**	91.7	24.35
Spiked Oil 2	16.72	22.1	11.59	**16.845**	13.97	2
Spiked Oil 3	3.03	5.16	5.79	**5.475**	1.02	0.09

Amanda Seawright, Ph.D. UGA
Kumar Mallikarjunan, Ph.D. Virginia Tech

RTDX Collaborative Case Study I: Aflatoxin contamination surveillance



RTDX Collaborative Case Study I: Food Safety

The Problem: Poor quality and contaminated maize and soybeans throughout Africa.

Nestlé requires at least 11,000 MT of maize and at least 6,000 MT of soybeans that meet or exceed Nestlé's grains-reception criteria obtained from ~20,000 smallholder farmers in the Keduna region of Nigeria.

Solution: Provide better mobile diagnostic mapping tools all along the value chain, training and analysis capabilities to deploy a sustainable food safety surveillance system.

Approach: Train teams on the RTDX platform to quantitatively map Mycotoxins (Aflatoxin, Fumonisin, T2) and Aluminum levels starting in November.

Method: Deploy 4000 tests/year to trained Nestle and Government scientists in November continuing for a total of 3 years.

Long term Goal: Sustainable surveillance system in place

The Full Belly Project- Zambia

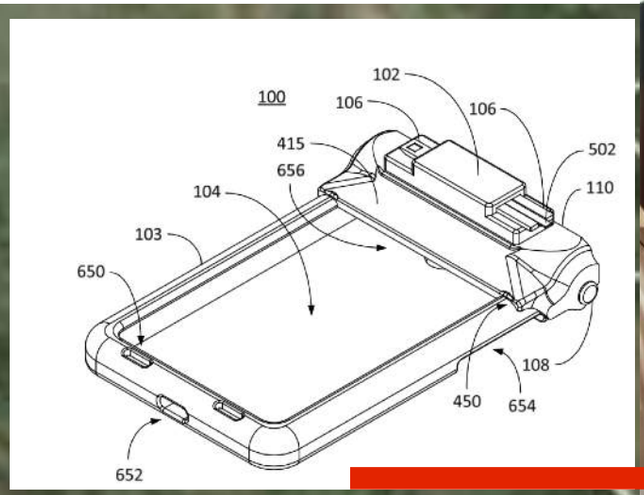
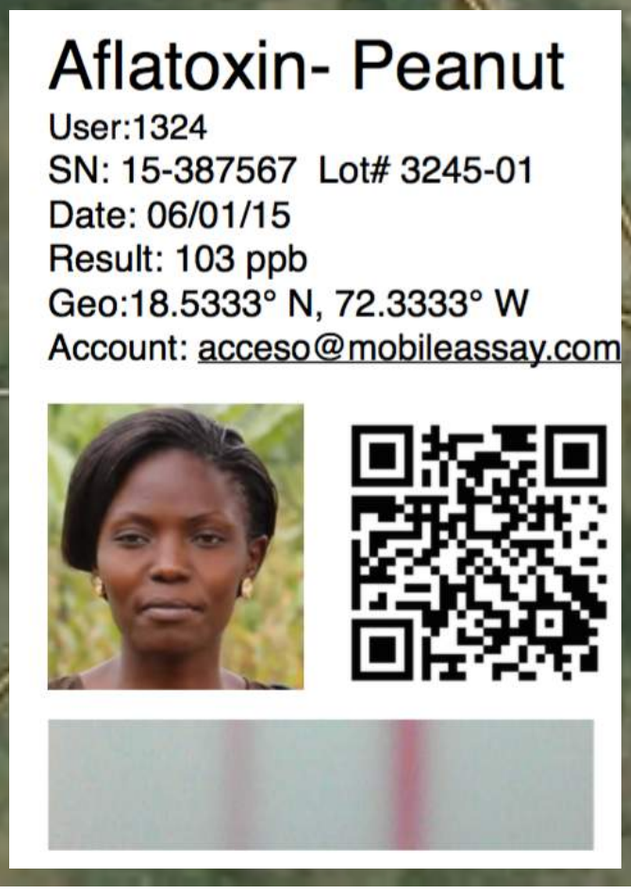


Figure 2. (Left) Asus MemoPad 8 HD case and illumination hood holding the aflatoxin test strip adapted from the provisional patent MODULAR ILLUMINATION AND SENSOR CHAMBER. (Right) Zambia Ministry of Agriculture testing Aflatoxin using the 3D printed case and holder.



Collaborative Case Study I: Antibiotics in food mapping

The Problem: antibiotics by farmers in Mauritius is not properly controlled, antibiotic misuse or overuse is possible leading to antibiotic residues in the edible animal products, such as meat, eggs and milk. This can lead to large scale antibiotic resistance.

Partner: University of Mauritius, Professor Kamlesh Boodhoo (Sept, 2017)

Solution: Determine the extent of the problem by mapping antibiotic residues in animal foods across the island of Mauritius.

Approach: Train researchers on the RTDX platform to quantitatively map antibiotic residues in commercially marketed foods using RTDX platform.

Method: Surveys, sampling across different areas on products testing for the presents of several classes of antibiotics.

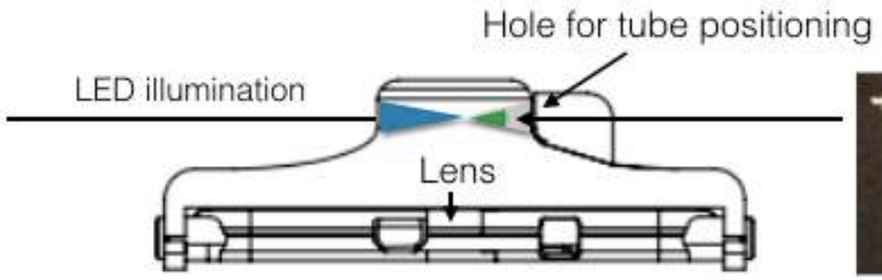
Long term Goal: Sustainable surveillance system in place

Future development of RTDX Platform

RTDX
real time diagnostics

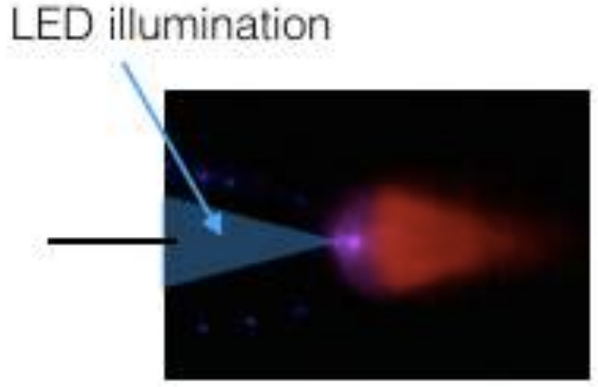
Mobile Devices for use in field LAMP DNA assay for *phytophthora infestans* in potato and tomato

Patented



Courtesy of Jean Ristaino Ph.D.

Sensitivity - LOD ~500 fg/ul



Captured image of solution in tube for colorimetric analysis

Capacity building with RTDX platform

RTDX
real time diagnostics

Award winning start-ups

Peanut & Mycotoxin Innovation Lab
A blog about leading science in peanut and food security.

Home | News | Events | In the Media | Opportunities | Field Notes

Mar 2016
16

PMIL-supported researcher trains others at home in Ethiopia

4

Making use of the training he received through the Peanut & Mycotoxin Innovation Lab, Ethiopian graduate student Abdi Hassen recently taught the aflatoxin detection technique he learned in the U.S. to supervisors and colleagues in his home country.

Hassen, who is expected to receive a PhD later this year, worked with PMIL scientist Renee Arias at the U.S. Department of Agriculture National Peanut Research Laboratory (USDA NPRL) in Dawson, Ga. His work in Georgia involved analyzing 400 isolates of Aspergillus, a mold that can create aflatoxin in groundnuts, maize and other crops, that were collected in Ethiopia.

Read the rest of the story here.

Mycotoxin Analysis Laboratory (MAL)

Led by Kigozi Julia and Yawe John

MAL is founded on the vision to be Africa's center of excellence providing safe agricultural produce authentic data. The Laboratory is led by Kigozi Julia and Yawe John. MAL is working on a mission to analyse and recommend safe agricultural produce for consumption, processing, trade and research with a goal to collect samples, test and rate them against the national and international regulatory standards with the aim of improving quality for agricultural produce for domestic and export trade. MAL seeks to provide business services on:

(i) food commodities on the market and warehouse, and

(ii) legumes, cereals, grains, animal feed supplements, and products from tubers on-farm.

Acknowledgements:

Professor Kamlesh Boodhoo
University of Mauritius
Prabhu Murthy
Valerie D'Accrement
Swiss Tropical and Public Health Institute

RTDX
real time diagnostics

Collaborative Case Study II: Human Health

RTDX Collaborative Case Study II: Malaria

Swiss TPH
Swiss Tropical and Public Health Institute
Schweizerisches Tropen- und Public Health-Institut

The Problem: Over one million people die from malaria each year, mostly children under five years of age, with 90% of malaria cases occurring in Sub-Saharan Africa. More than 40% of the world's population lives in malaria-risk areas. Malaria must be eradicated.

Solution: Improve the sensitivity 20-100 fold of tried and true rapid diagnostic tests and make them quantitative to rival costly and time consuming DNA-based PCR testing.

Approach: Collaboration with Swiss Tropical and Public Health Institute scientists to measure the ability of RTDX mReader to detect malaria at similar sensitivity to PCR in 3000 malaria blood samples from children in Tanzania.

Method: Comparisons of mReader improved sensitivity with new ultra sensitive RDTs.

Preliminary results: 100% accuracy for human positive calls. PCR results underway. We expect improved detection of false negative calls by human reads.

Long term Goal: Obtain WHO approval for use of mReader in quantitative detection of Malaria.

RTDX
real time diagnostics

Single-Step paper-based quantitative Aluminum test

Coming Soon - November 2017
Sensitivity down to 0.1ppm

RTDX
real time diagnostics

13 26.98
Al
Aluminum