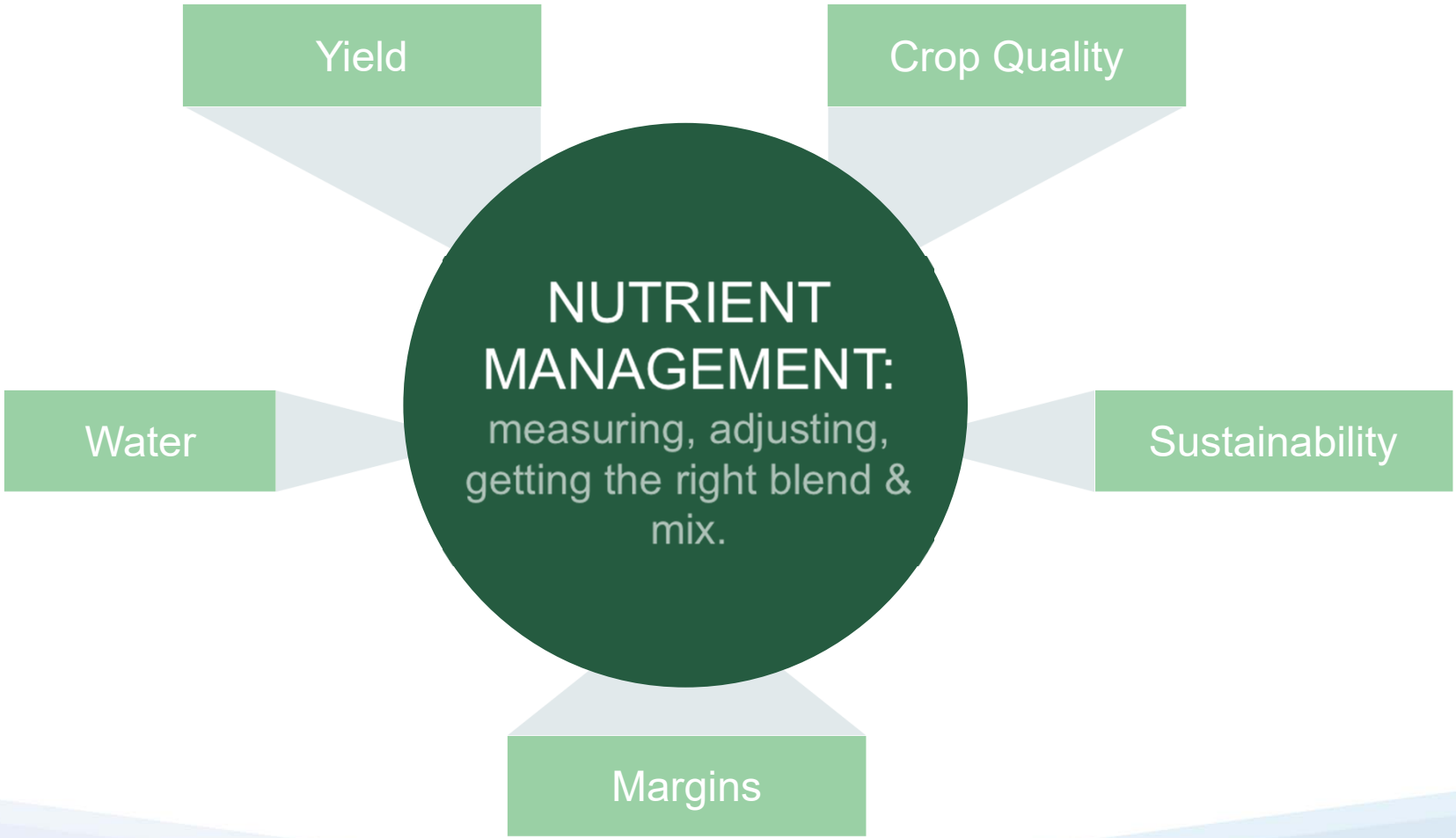
CleanGrow

Change how people use

NUTRIENTS

IMPORTANCE OF NUTRIENT MEASUREMENT



What do Growers do now?

Environmental Sampling?

In-house testing

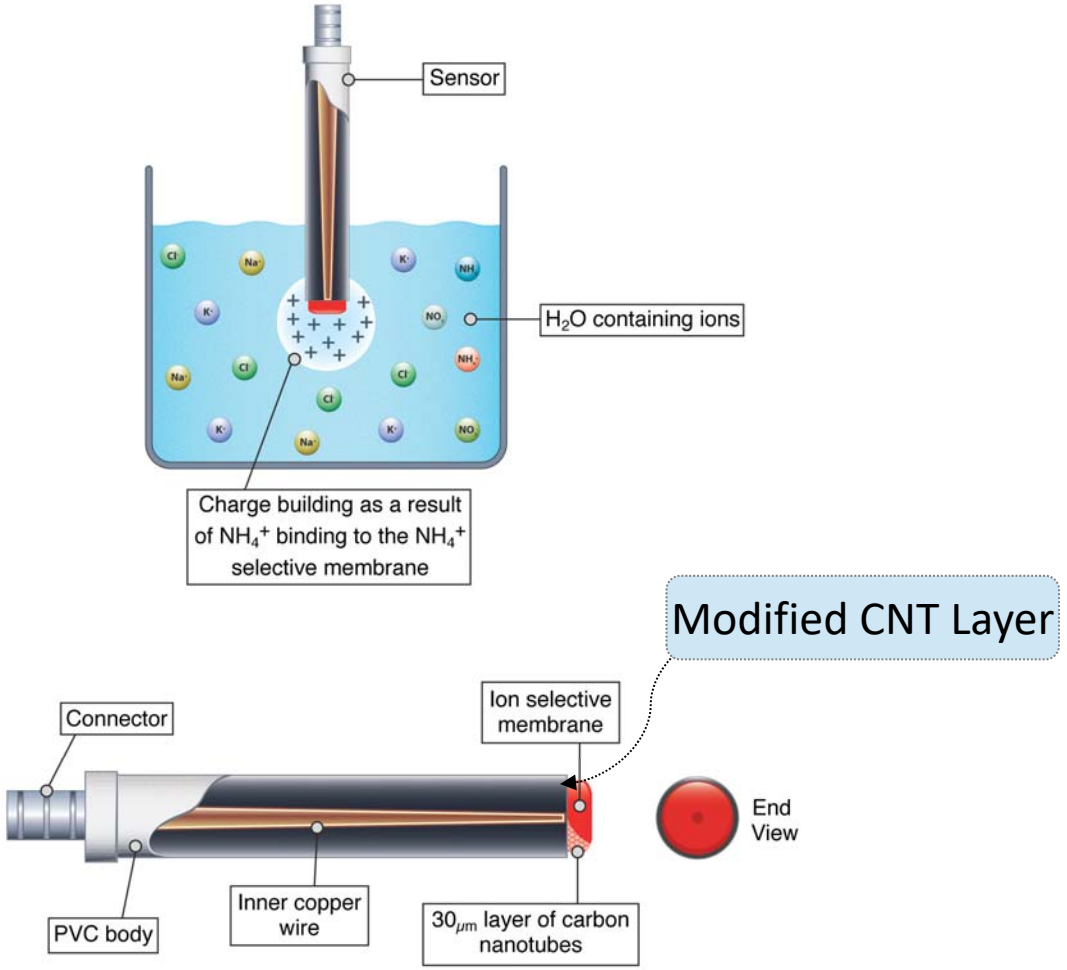
Ref electrode

ISE

Filling solution

ISAB
Or
TISAB

Not a pleasant user experience! Not suitable for space!


Sensor
H_2O containing ions
Charge building as a result of NH_4^+ binding to the NH_4^+ selective membrane
Modified CNT Layer
Connector
Ion selective membrane
End View
PVC body
Inner copper wire
$30_{\mu m}$ layer of carbon nanotubes

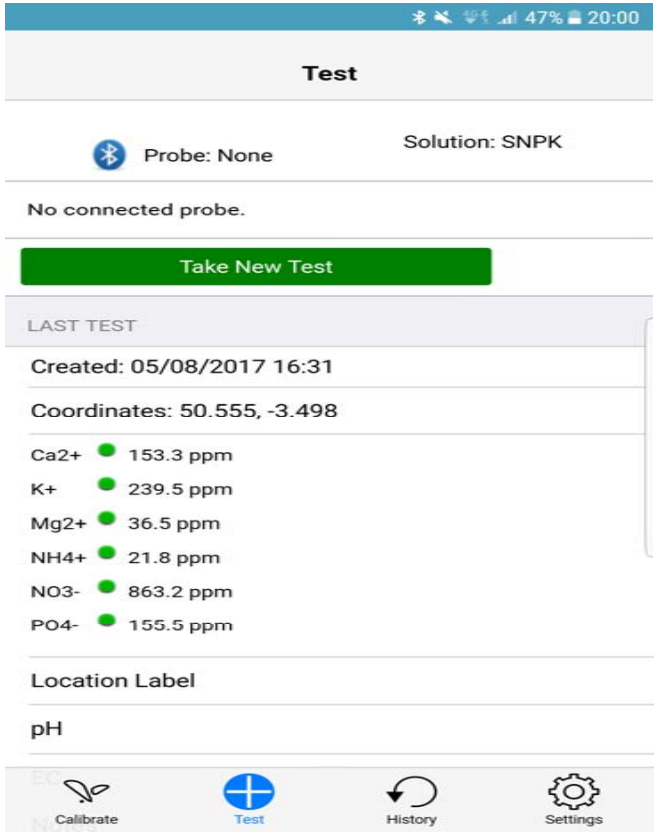
OUR Mobile APP

- Measure all six ions in a sample in less than 60 seconds
- Date, time and co-ordinates are recorded
- Add result

- Calibration of all six sensors in three easy steps < 60 seconds
- Quality of calibration is displayed

- Review the values for each ion, time, date, location and comments
- Results can be emailed*

Screenshot of simultaneous data



TIMESCALE

The Horizon 2020 Programme

TIMESCALE PROJECT

At-line analyser for Space

University of Stuttgart
Germany

NTNU
Social Research

WAGENINGEN UNIVERSITY
WAGENINGEN UR

UNIVERSITEIT GENT

CleanGrow

cmr Prototech

DTM TECHNOLOGIES

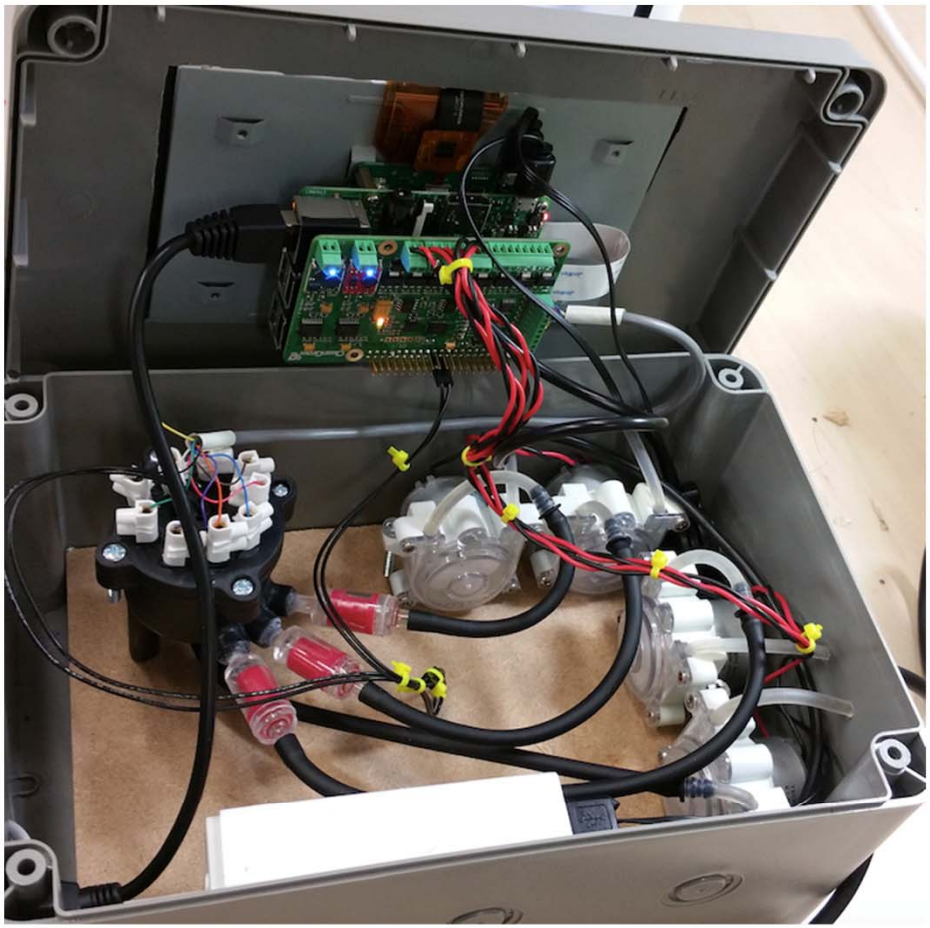
Interscience

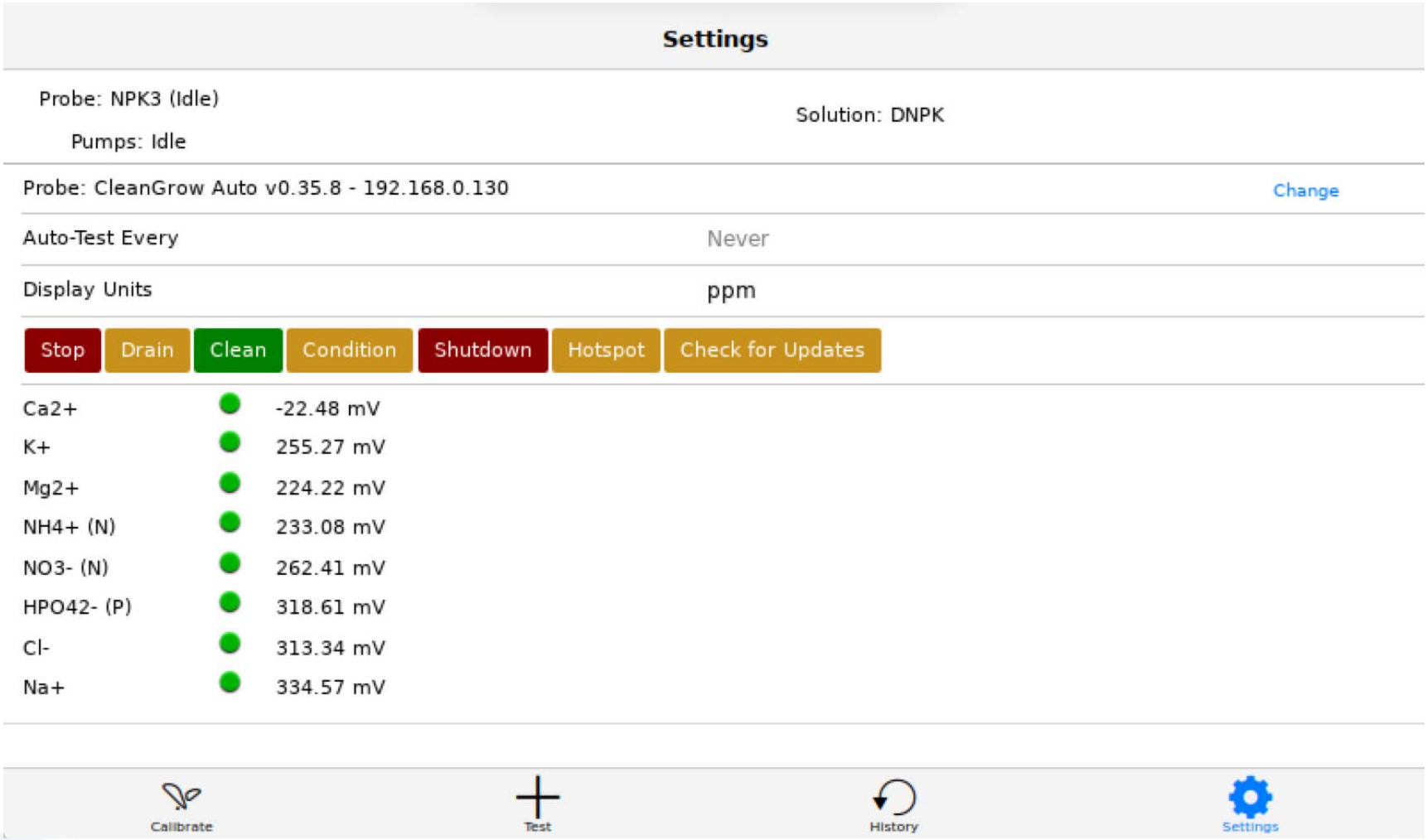
Measuring electrolytes (Ions) in Blood

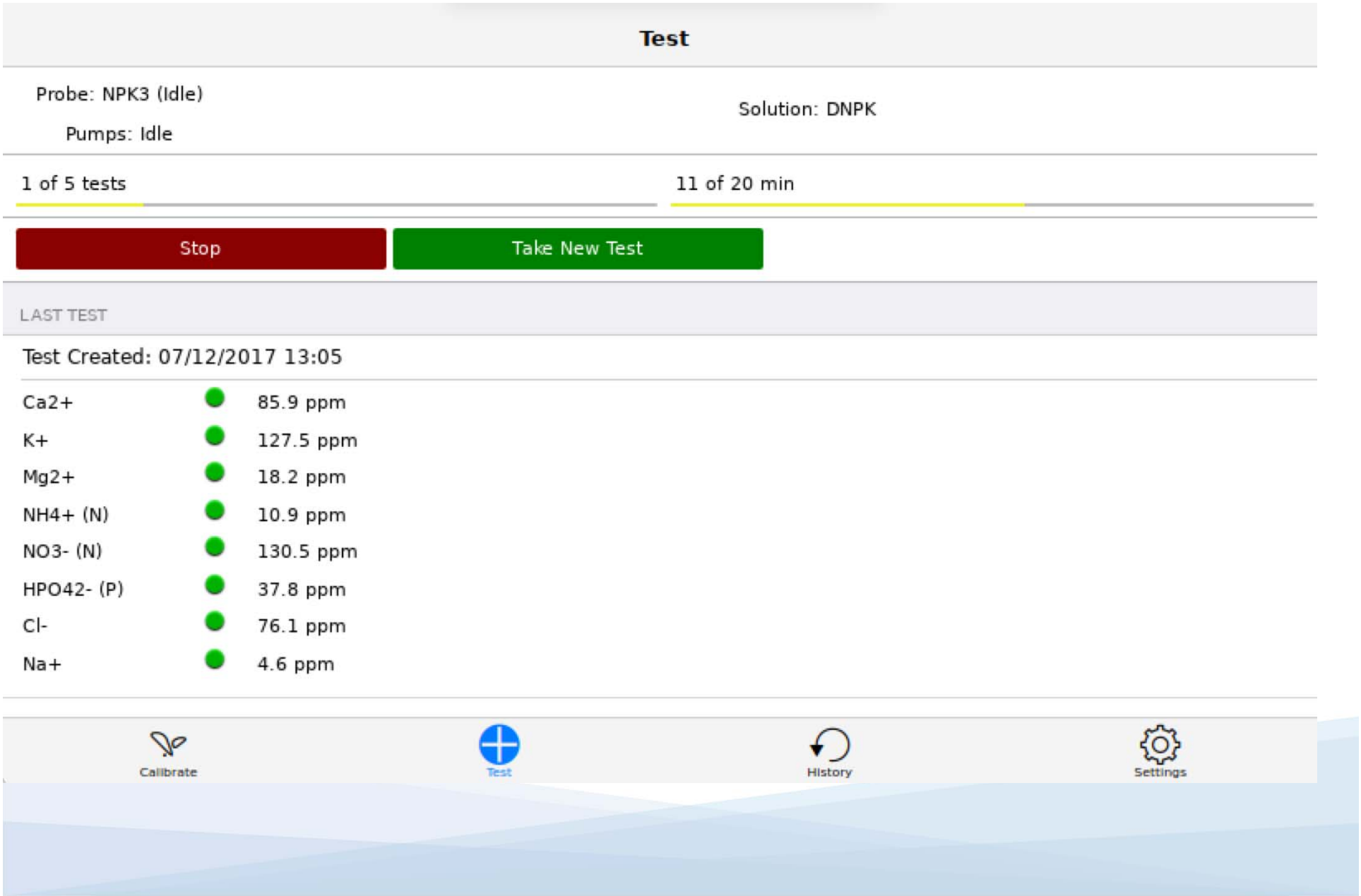
Self-contained Solutions Pack contains liquid calibrants and collects all waste, eliminates sample contact


A
B
AeroGarden

Under the lid




Settings
Probe: NPK3 (Idle)
Pumps: Idle
Solution: DNPK
Probe: CleanGrow Auto v0.35.8 - 192.168.0.130
Change
Auto-Test Every
Never
Display Units
ppm
Stop
Drain
Clean
Condition
Shutdown
Hotspot
Check for Updates
Ca2+
-22.48 mV
K+
255.27 mV
Mg2+
224.22 mV
NH4+ (N)
233.08 mV
NO3- (N)
262.41 mV
HPO42- (P)
318.61 mV
Cl-
313.34 mV
Na+
334.57 mV
Calibrate
Test
History
Settings


Test
Probe: NPK3 (Idle)
Pumps: Idle
Solution: DNPK
1 of 5 tests
11 of 20 min
Stop
Take New Test
LAST TEST
Test Created: 07/12/2017 13:05
Ca2+ 85.9 ppm
K+ 127.5 ppm
Mg2+ 18.2 ppm
NH4+ (N) 10.9 ppm
NO3- (N) 130.5 ppm
HPO42- (P) 37.8 ppm
Cl- 76.1 ppm
Na+ 4.6 ppm
Calibrate
Test
History
Settings

History

07/12/2017 13:05

Test Created: 07/12/2017 13:05

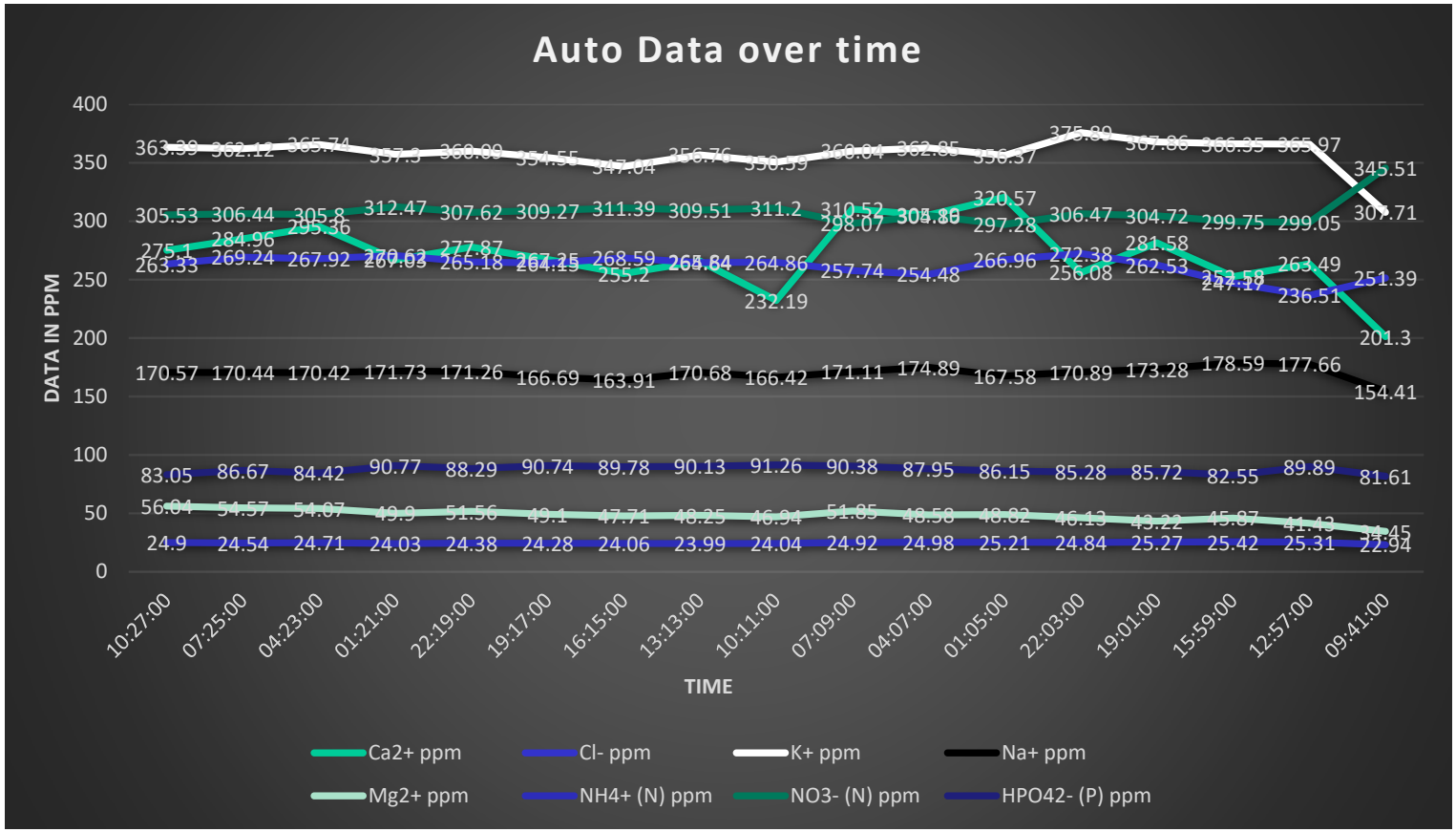
Ca2+	85.9 ppm	
K+	127.5 ppm	
Mg2+	18.2 ppm	
NH4+ (N)	10.9 ppm	
NO3- (N)	130.5 ppm	
HPO42- (P)	37.8 ppm	
Cl-	76.1 ppm	
Na+	4.6 ppm	

Last Calibration:

Ca2+	$r^2 = 1.00$, m = 28.69
K+	$r^2 = 1.00$, m = 47.85
Mg2+	$r^2 = 1.00$, m = 30.98
NH4+ (N)	$r^2 = 1.00$, m = 65.19
NO3- (N)	$r^2 = 1.00$, m = -52.17
HPO42- (P)	$r^2 = 1.00$, m = -40.46
Cl-	$r^2 = 1.00$, m = -42.20
Na+	$r^2 = 1.00$, m = 58.89

Delete All

Autonomous sampling = lots of Data



Future applications

- Commercial hydroponics with closed loop irrigation [coupled with fertilizer pumps]
- Field soil sampling coupled to lysimeters with solar panels and GPRS communications
- Environmental sampling triggering coupled to auto samplers next to rivers and lakes etc.
- Industrial water control for environmental release of water to the environment.

Next Steps-space and land

- Potentially via GSTP funding:
  - A space ready version using capillary tubing
  - Screen print nano-electrodes
  - Micro-electronics
  - EC+pH sensors (pH control of P detection)
  - Reduce overall size and volume consumption by at least 5 times smaller.
  - Design for manufacture-create jobs

CONTACT INFORMATION

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