

## ANTEO SHAREHOLDER PRESENTATION

ASX Release

7 August 2018

Anteo Diagnostics Ltd (“**Company**”) is pleased to provide the attached shareholder presentation that will be presented to shareholders in Brisbane, Sydney and Melbourne over the next three days.

The Shareholder briefings will update shareholders on the Company’s strategic direction as well as developments and progress for Batteries and Life Science applications.

Below are the locations and times of the presentation.

**Brisbane** - 2:30pm Tuesday 7<sup>th</sup> August 2018  
ClarkeKann Lawyers offices  
Level 7, 300 Queen Street, Brisbane QLD 4000

**Sydney** – 2:30pm Wednesday 8<sup>th</sup> August 2018  
ClarkeKann Lawyers offices  
Level 4, 9 Castlereagh Street, Sydney NSW 2000

**Melbourne** – 2:30pm Thursday 9<sup>th</sup> August 2018  
BDO offices  
Tower 4, Level 18, 727 Collins Street, Melbourne VIC 3008

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### ABOUT ANTEO GROUP – Anteo Diagnostics Limited (ADO:ASX) & Subsidiaries

Anteo Group is a surface chemistry company with Intellectual Property (“**IP**”) in its core technology product groups: AnteoCoat, AnteoBind and AnteoRelease. The Company’s purpose is to create shareholder value by identifying and solving important global industry problems and providing unique value-add solutions for its customers. Anteo’s customers operate in the Life Sciences, Diagnostics, Energy and Medical Devices markets.

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For more information, please visit [www.anteotech.com](http://www.anteotech.com)



# **Investor Update**

**August 2018**

**Dr Jack Hamilton (Chair)**

**Mr Christopher Parker (CEO)**

# Disclaimer

The purpose of the presentation is to provide an update of the business of Anteo Diagnostics Ltd (ASX:ADO). These slides have been prepared as a presentation aid only and the information they contain may require further explanation and/or clarification. Accordingly, these slides and the information they contain should be read in conjunction with past and future announcements made by Anteo and should not be relied upon as an independent source of information. Please contact Anteo and/or refer to the Company's website for further information.

The views expressed in this presentation contain information derived from publicly available sources that have not been independently verified. No representation or warranty is made as to the accuracy, completeness or reliability of the information.

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# Agenda

- Anteo's Strategy and Focus Areas
- Batteries
- Point of Care
- Summary

# **Anteo's Strategy & Focus Areas**



# Strategy & Focus Areas

1

The Board has re-visited the purpose and strategy outlined last November and has narrowed the focus of exploiting the company's IP to the potential AnteoCoat™ offers in the battery market and to the superior conjugation properties of AnteoBind™ in the Point of Care market.

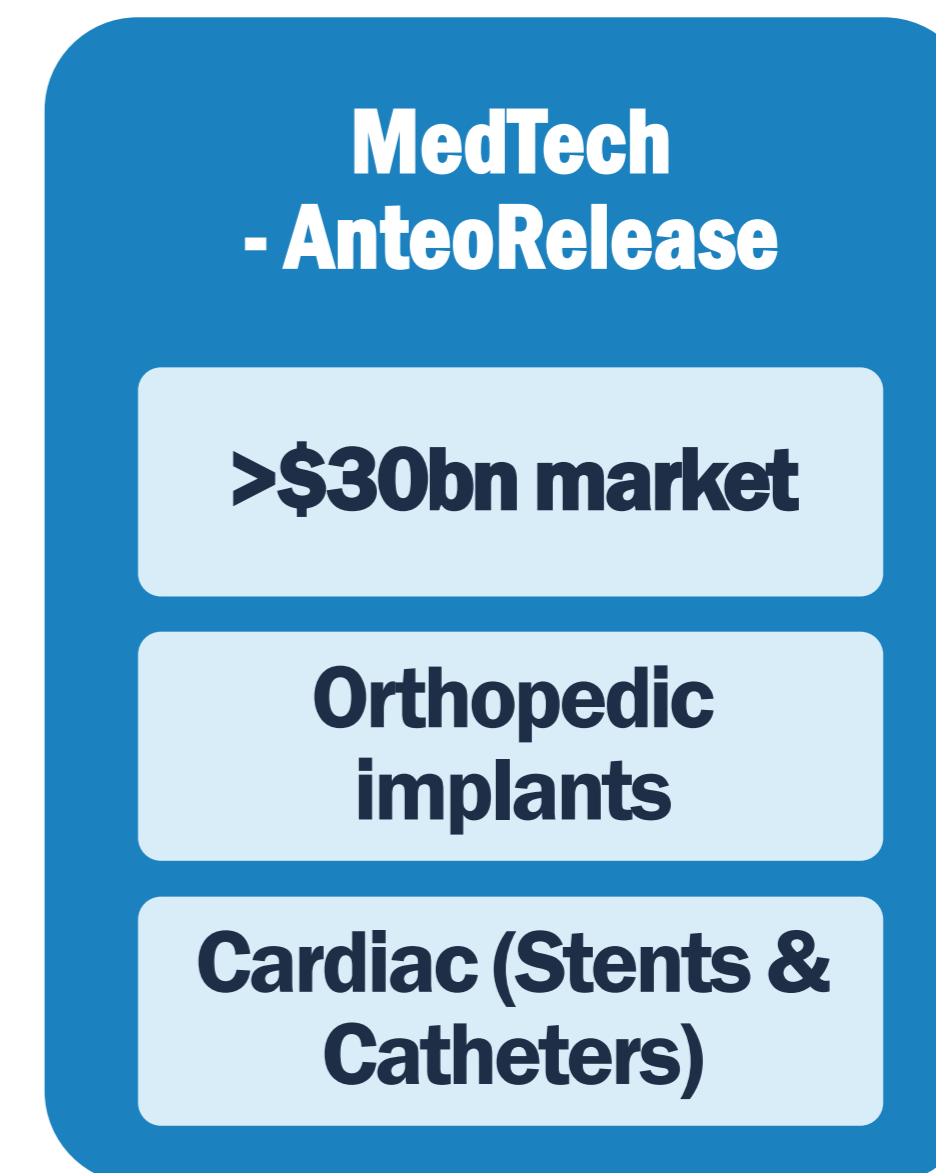
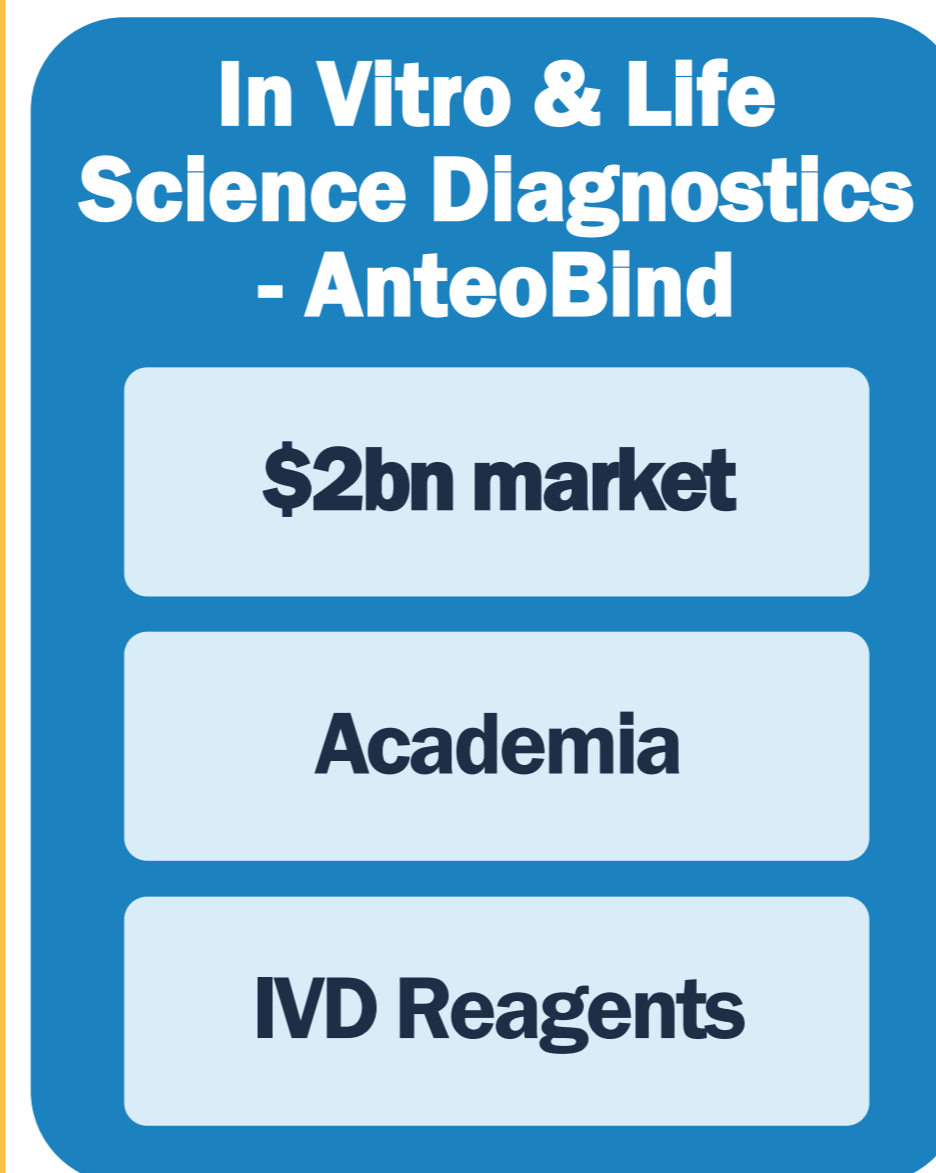
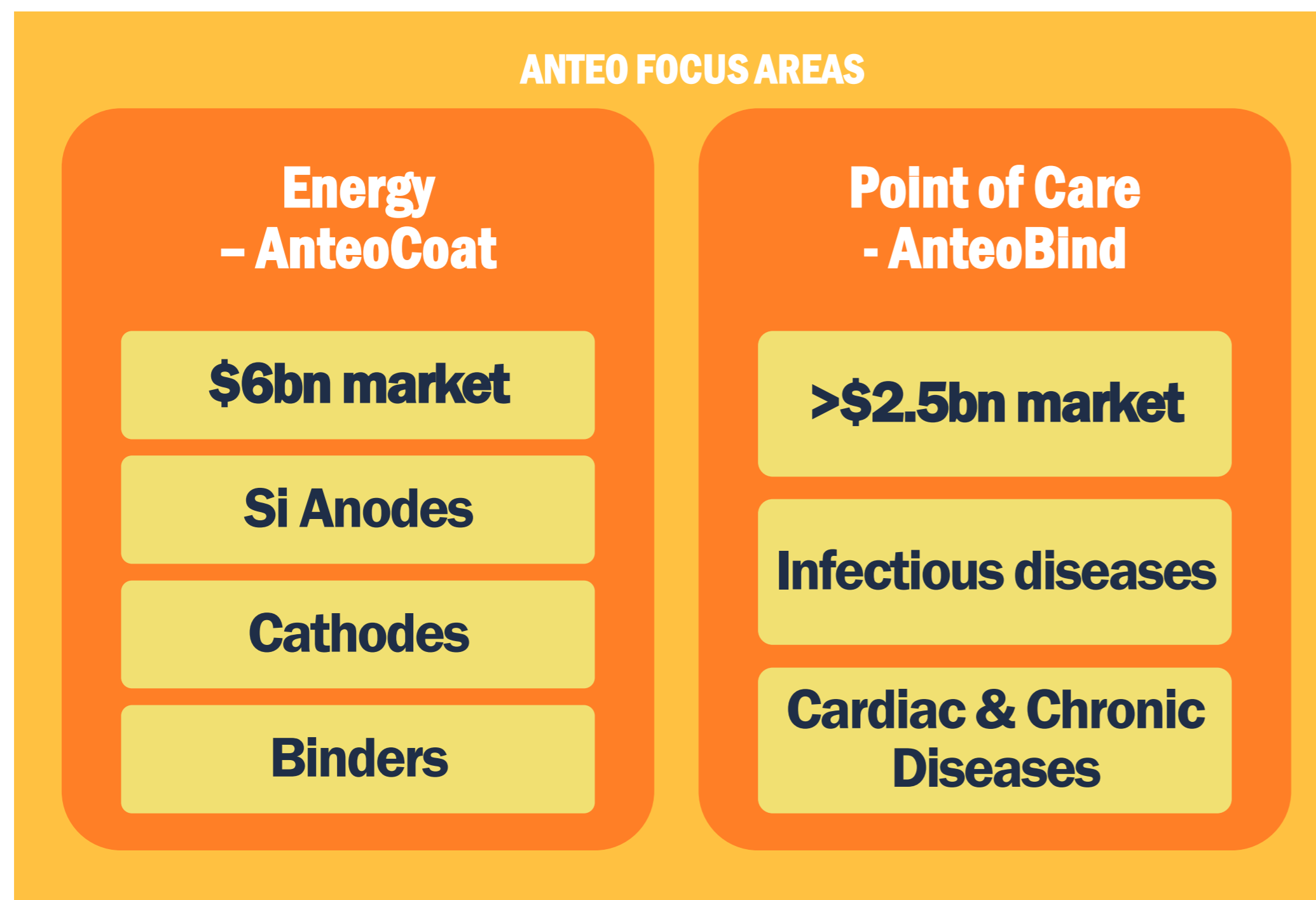
2

The company strategy will be built around the leverage of its core IP in being a supplier of superior surface modifying speciality products and services into the battery and life science markets.

3

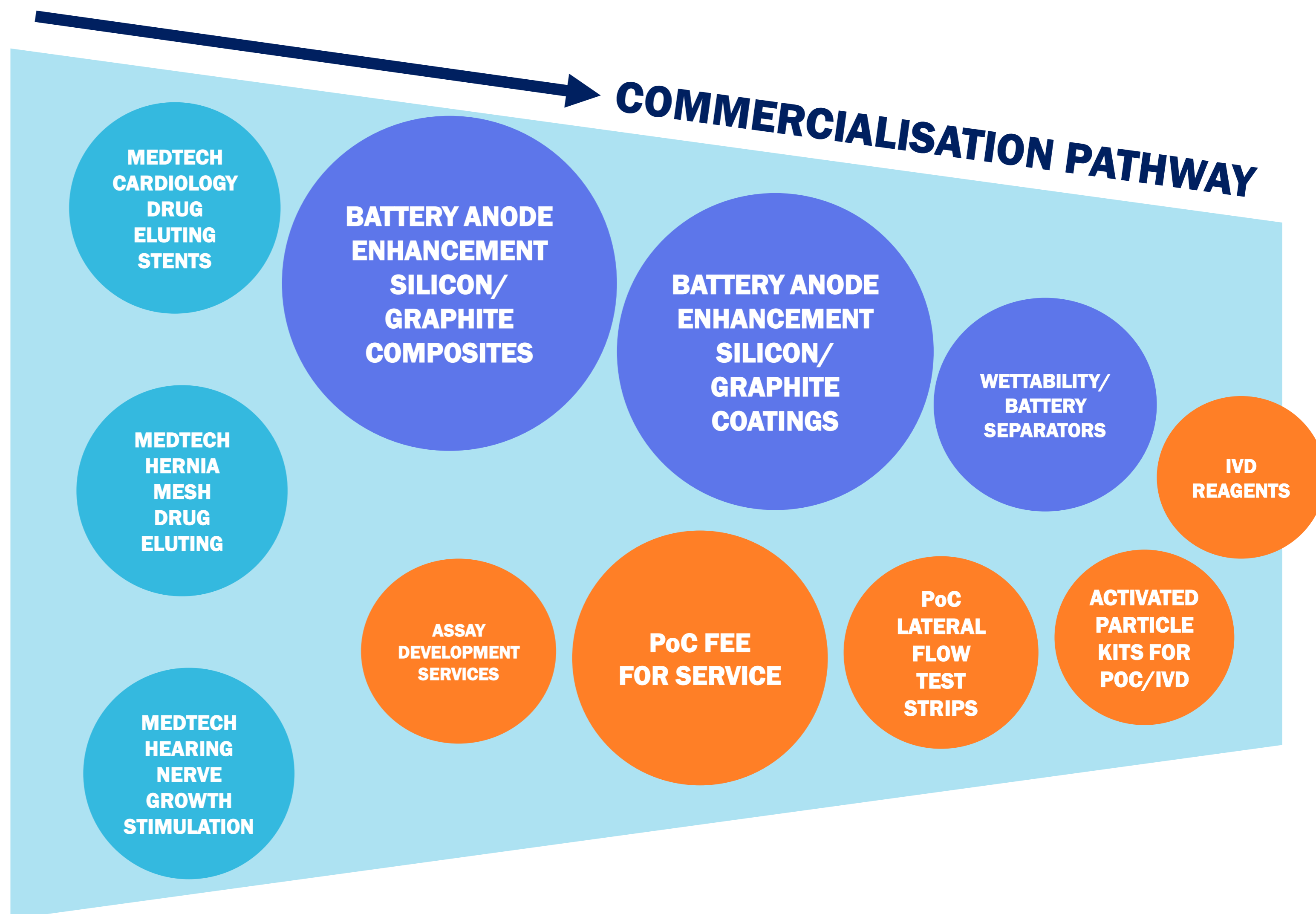
The company is protecting its IP in the Medtech markets but has slowed development internally in this area given the typical long lead times to realise value whilst exploring options on how to realise nearer term value.

# Anteo's markets, opportunities, and focus areas



# Funnel of Opportunities

- Focus is on driving the near term opportunities to commercial realisation where demonstrable benefit is available to users
- Battery focus is on demonstrating AnteoCoat's™ ability to bind Silicon to graphite for anode production with significant uplift in energy storage
- PoC focus is to demonstrate the impact of AnteoBind™ on delivering significant uplift in lateral flow test strip performance vs existing benchmarks

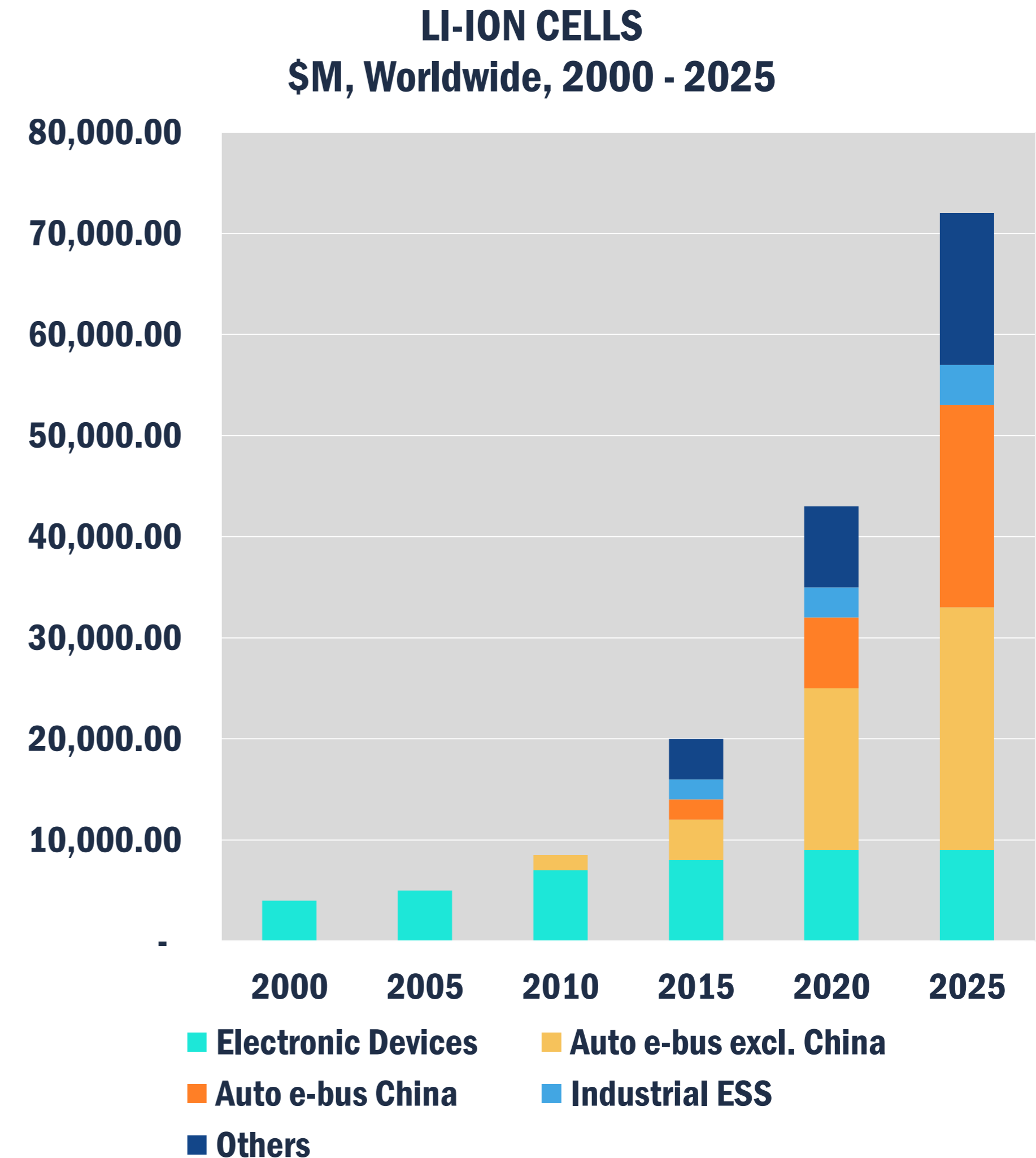




# Batteries

# Why is Anteo pursuing Battery Opportunities?

- The world is on a path to electrification. Batteries will play an ever increasing role in transport as well as many industrial and home uses, such as energy storage, tools etc.
- Market growth. The 2018 Avicenne Energy report projects a total market size of up to US\$70B by 2025
- Cheaper to manufacture. Battery manufacturing costs have fallen from US\$ 1000/ kWh in 2010 to US\$ 230/ kWh by 2017 with some best in class achieving US\$ 150/kWh (Source: McKinsey June 2018).
- Cost tipping point. McKinsey’s Centre for Future Mobility estimates that at ~US\$ 100/kWh batteries will reach a tipping point where EV’s will be cheaper than Internal Combustion Engine cars, although not forecast to be achieved until ~ 2025.



Others: medical devices, power tools, gardening tools, e-bikes.  
Source: AVICENNE Energy 2018

# Why silicon?

## THE OPPORTUNITY

- Higher silicon content in battery anodes equates to higher electrical storage capacity compared to conventional graphite and a resulting lower cost in \$/kWh
- Silicon theoretical max. capacity of 3579 mAh/g as opposed to 372 mAh/g for graphite (~10x higher capacity)

## THE PUSH FROM INDUSTRY

- The US D.O.E. set a target\* to achieve below US\$ 125/MWh by 2020 with their R&D program, focusing on use of silicon in the anode, to achieve both higher energy density as well as lower cost, as the key next steps on the journey

## THE CHALLENGE

- When the battery is charged (lithium ions migrating from cathode to anode) silicon swells up to 300% of its size
- During charge/discharge cycling the anode structure degrades and causes battery failure
- Silicon is a poor electronic conductor meaning it has to be brought into close contact with graphite or conductive carbons to create suitable electrode structures

## CURRENT STATUS

- To date it is proving challenging to achieve stable and long battery life with sufficiently high levels of silicon to make a substantial impact on battery energy densities and cost



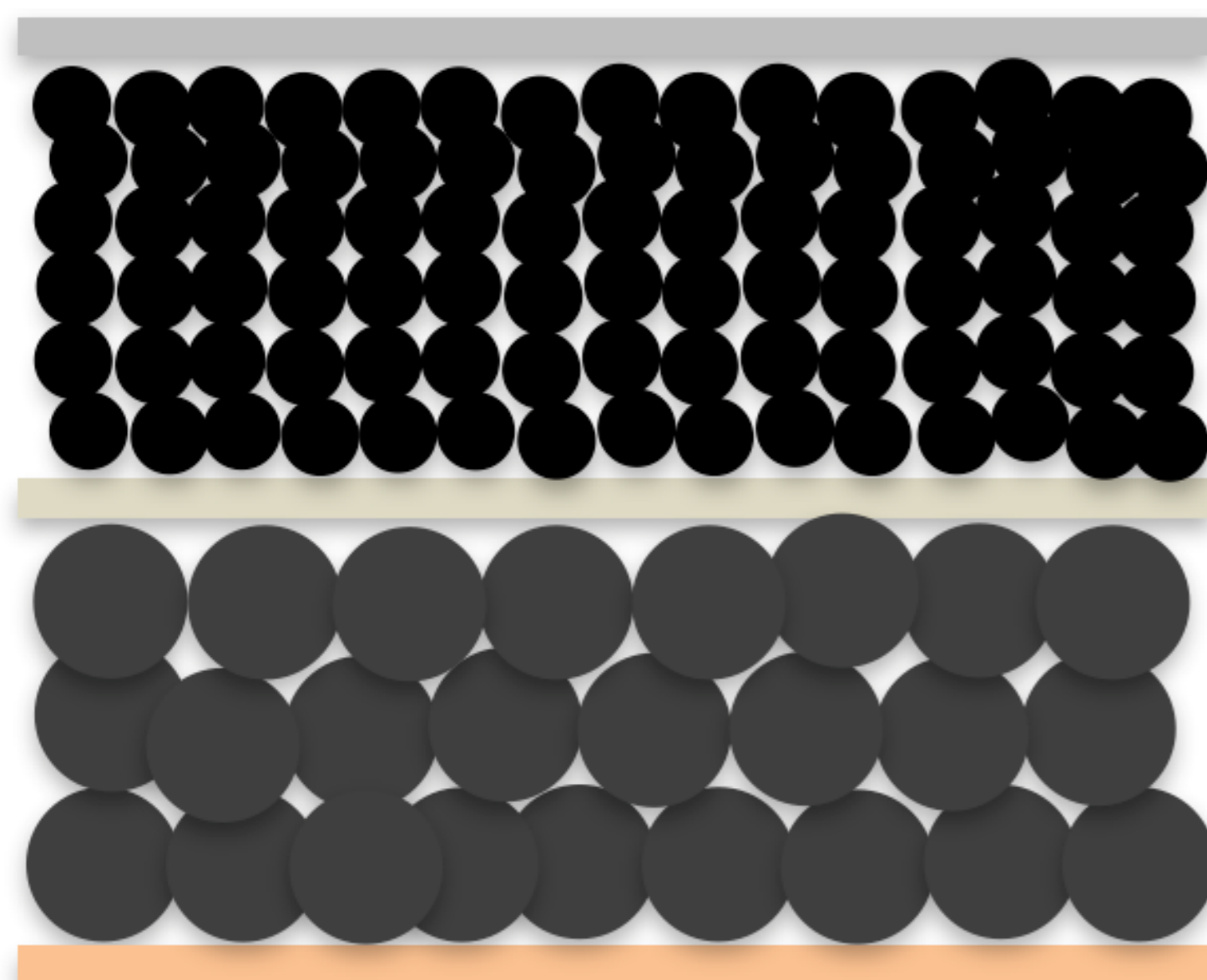
**Work with AnteoCoat™ has given  
encouraging results towards being  
part of the solution.**



# Problem and Current Solution

## PROBLEM:

Energy density is nearing its limit



Conventional cell design

## GRAPHITE ACTIVE MATERIAL

- Limited capacity but
- Stable and safe performance

## HIGH ENERGY ACTIVE MATERIALS

- Micro-silicon has high energy but poor stability
- Nano-silicon is hard to integrate into electrode
- Added in small quantities to existing anodes
- Volume expansion causes electrode degradation

## IMPROVEMENTS REQUIRED

- Increase use of high energy active materials (e.g. silicon)
- Improve stability and way of integration
- Sustainable and cost-efficient processing



# Technology Development

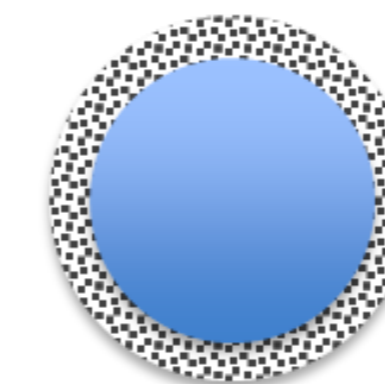
## Two Focus Areas

### INCREASE OF BATTERY ENERGY DENSITY:

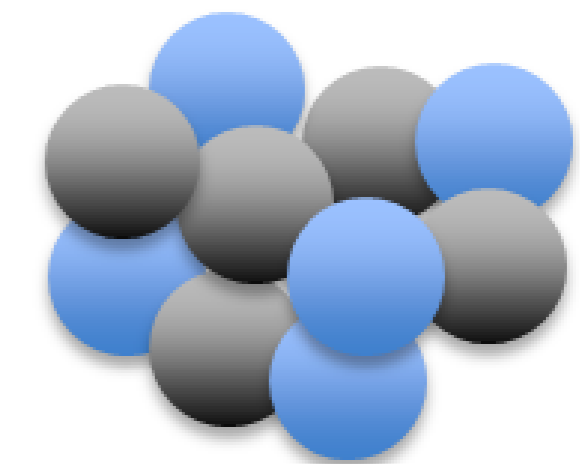
- Increase in silicon content in lithium ion battery anodes to increase anode capacity and cell energy density
- Two approaches are being investigated
  - 1) Surface coatings on silicon particles enabled by AnteoCoat™
  - 2) The creation of composite particle structures enabled by AnteoCoat™

### IMPROVED ELECTRODE PERFORMANCE & COST REDUCTION VIA:

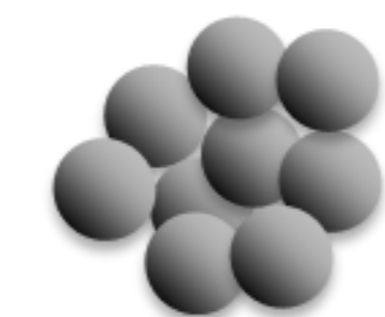
- Surface modifications enabled by AnteoCoat™
- Improved processing of battery components through improved wettability and dispersion enabled by AnteoCoat™



**Surface coated nano-Si**



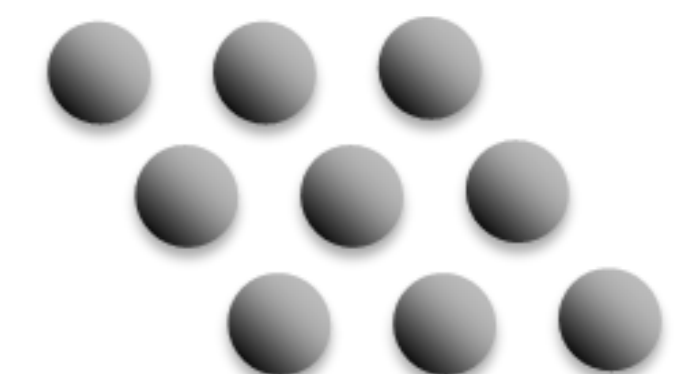
**nano-Si/carbon composite**



**Carbon particle agglomerate  
(in water)**

**Surface  
modification**

→



**Carbon particle dispersion  
(in water)**

# AnteoCoat™ and Silicon in Batteries

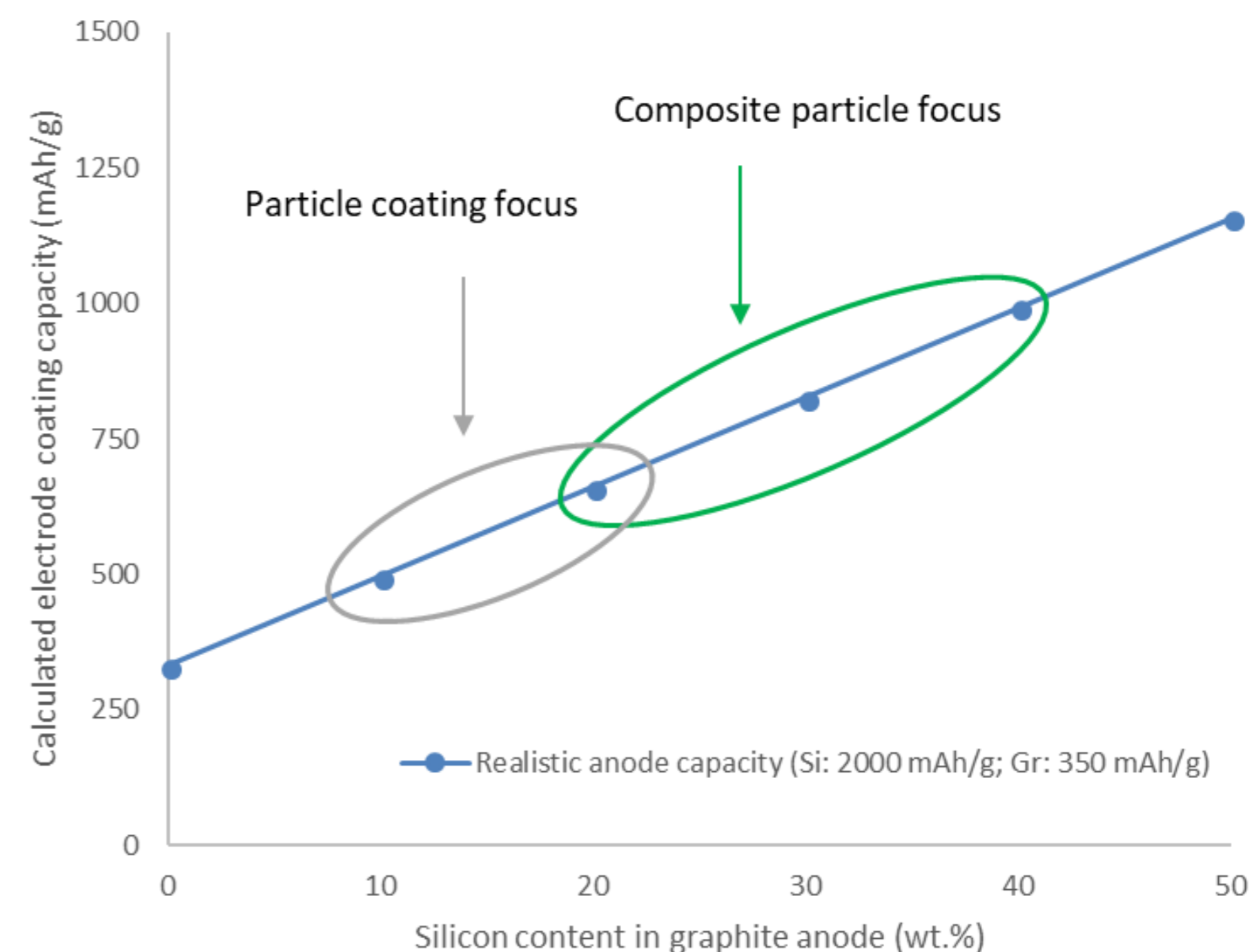
## Silicon particle coatings enabled by AnteoCoat™ are targeting:

- Up to 20wt.% Si content in anode
- Surface coating applied to silicon particles achieves
  - Improved material processing
  - Performance improving coating

## Silicon/carbon composite particle coatings enabled by AnteoCoat™ are targeting:

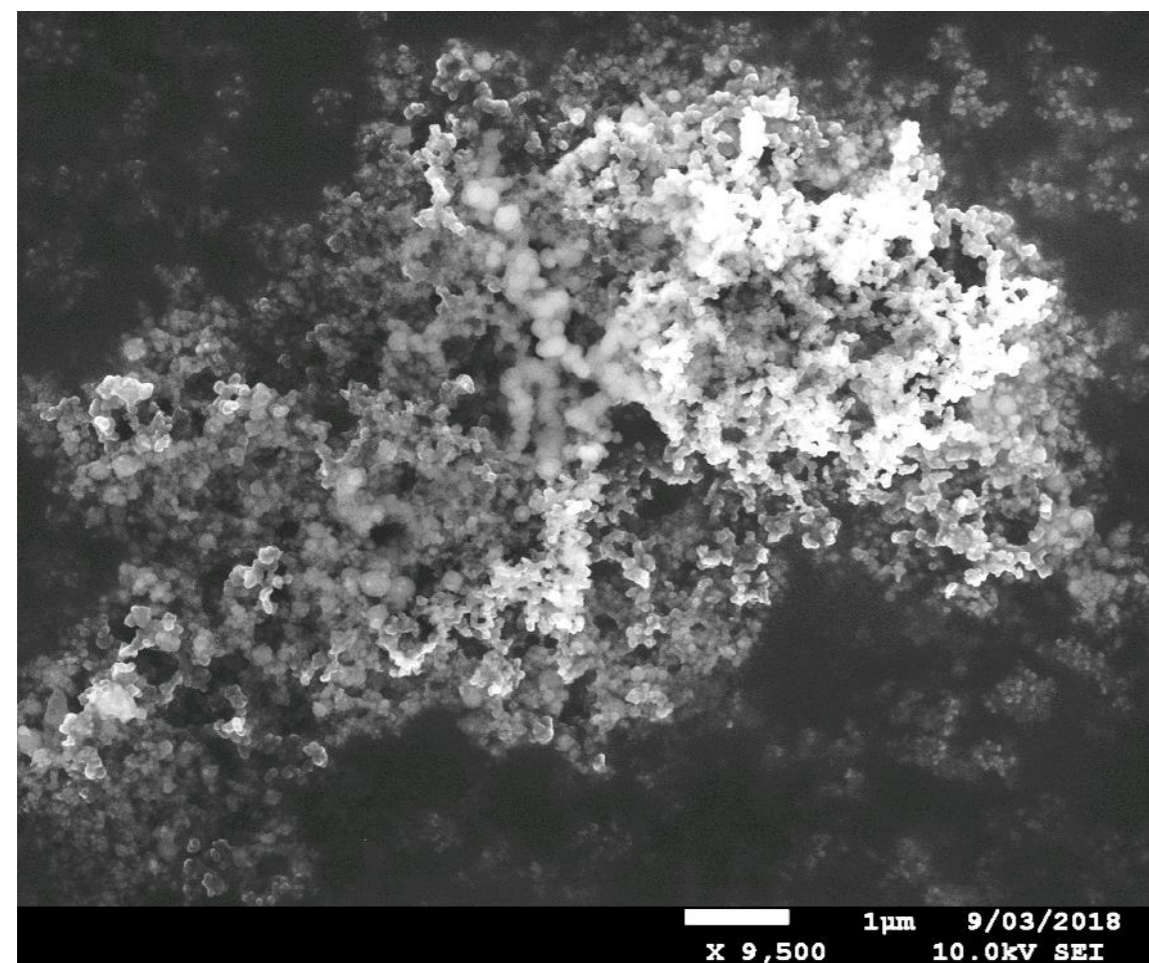
- Up to 40wt.% Si content in anode
- The creation of a conductive network of silicon and carbon
- Improved network integrity during charge/discharge cycling

Modelled impact of increasing silicon content on anode capacity

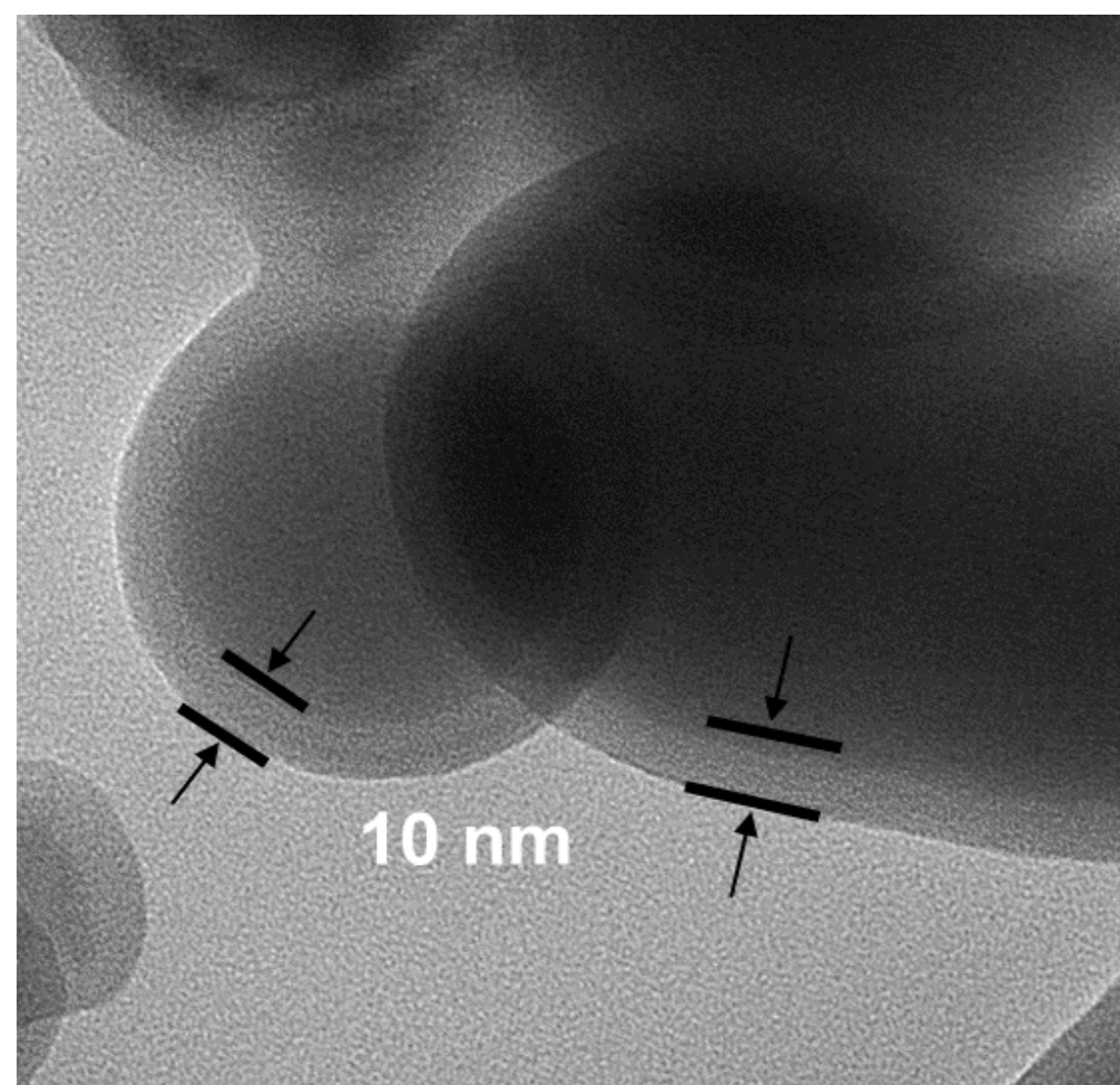




# AnteoCoat™ – Processing Achievements



nano-Si/C composite



Coating on nano-Si

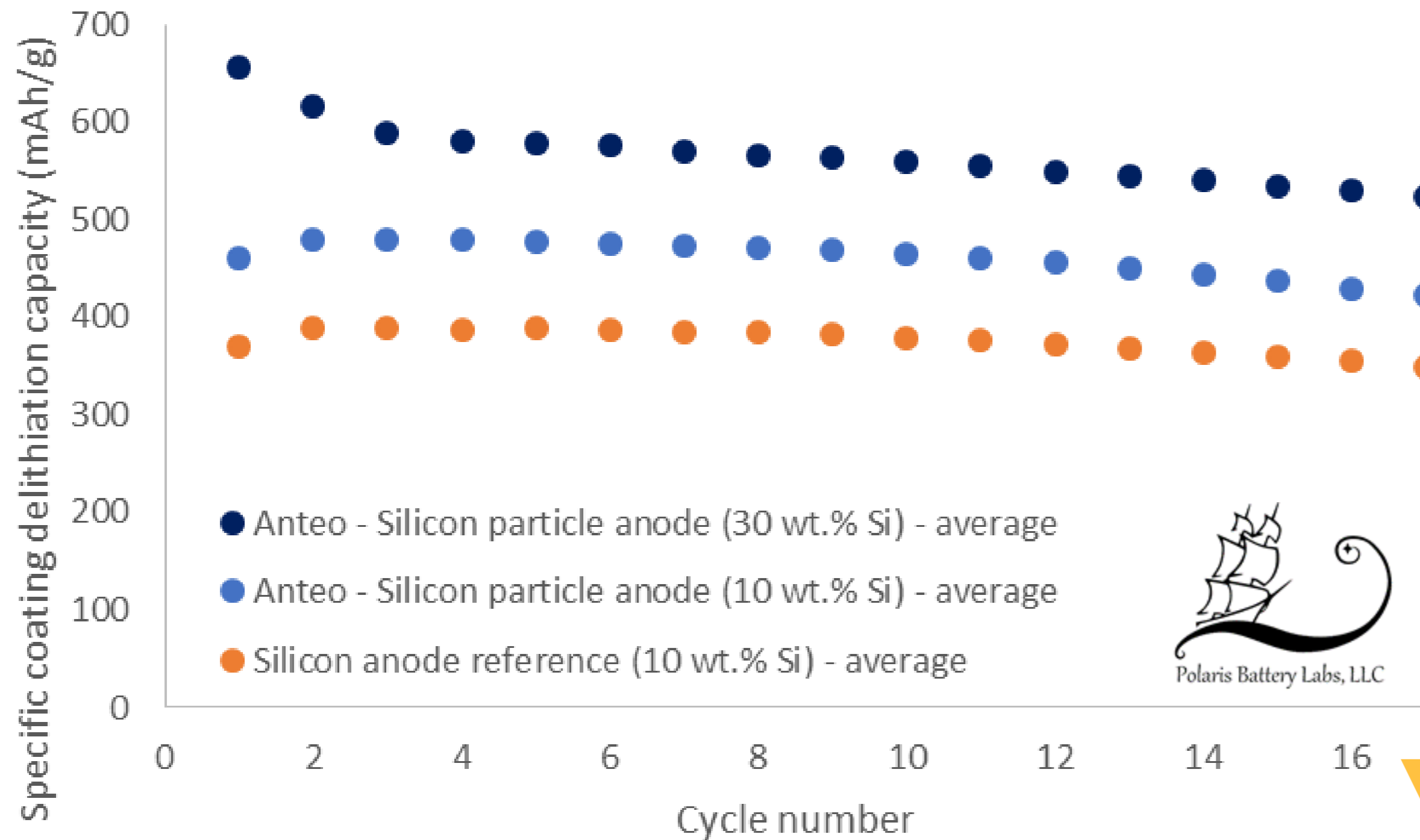
- Internal development work has been heavily focused on demonstrating the use of AnteoCoat™ in lab-scale processes that allow for the creation of:
  - 1) Silicon particle coatings
  - 2) Silicon/carbon composites
- Anteo has demonstrated that both coatings on silicon and the assembly of composite particles can be achieved by the use of AnteoCoat™

Next steps are to refine lab-scale processing conditions, evaluate the range of particle structures that can be created and isolate performance characteristics



# Particle Coating Results Encouraging

Half cell cycling test (cycling performed at C/2)



The commissioned work by Polaris on the evaluation of Anteo’s coated silicon particles demonstrated that:

- 1) For a 10wt.% silicon anode a better starting capacity, compared to a 10wt.% silicon anode without AnteoCoat, could be achieved

Polaris: “AnteoCoat™ improved dispersion of nano-Si/Graphite slurries compared to our baseline nano-Si/Graphite anode slurry”

- 2) A working 30wt.% silicon anode could be created by use of Anteo’s coated silicon particles

Polaris: “It was not possible to disperse 30wt.% nano-Si (without AnteoCoat™ treatment) into the graphite anode slurry”

Focus of the next phase of work will be to apply learnings from the silicon particle coating experiments to further the development of silicon/carbon composites

# Silicon Particle Coating – CustomCells

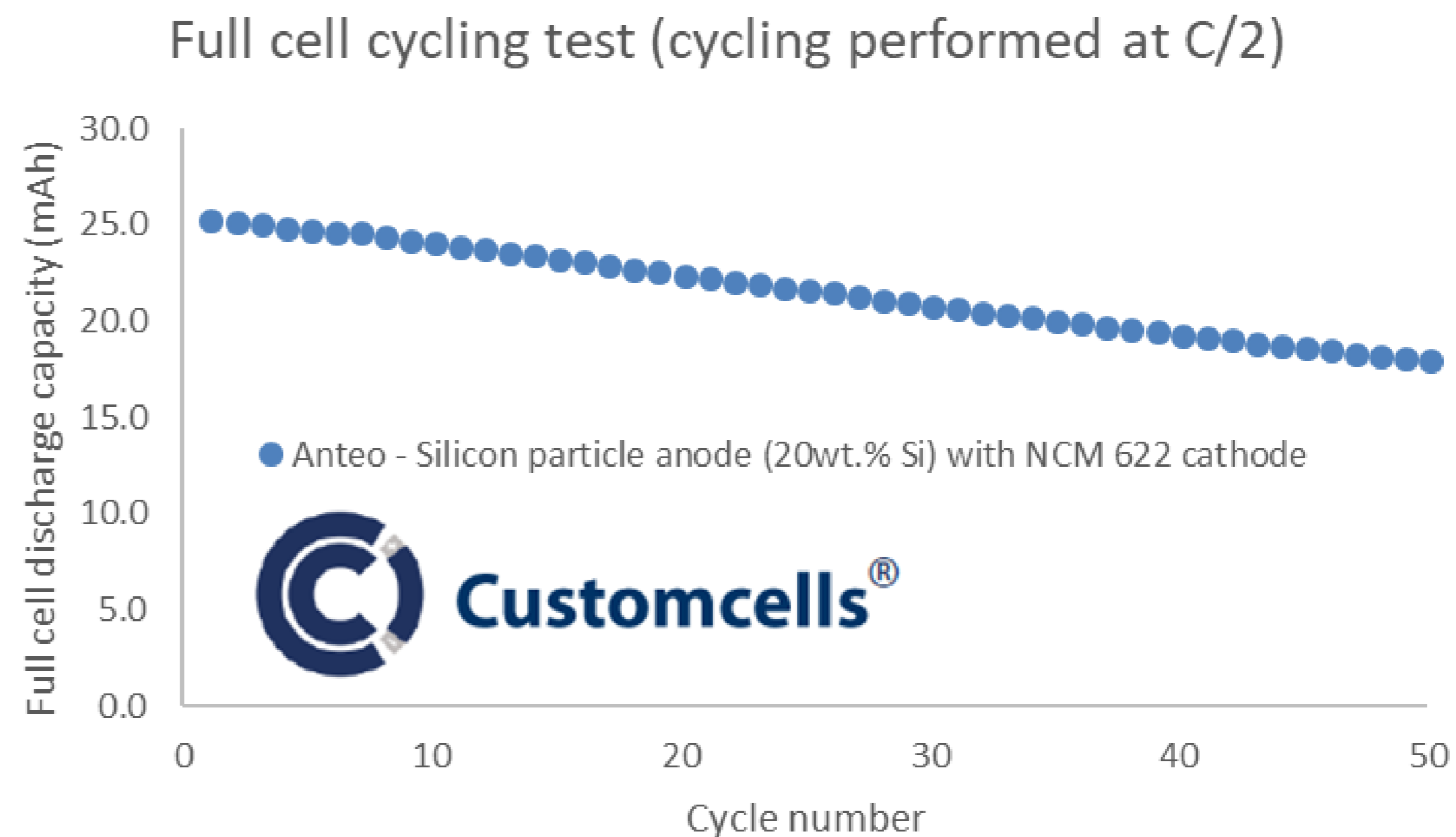
- Anteo's coated silicon particles were processed into anode electrodes and paired with commercial cathode electrodes (NCM 622) by CustomCells
- Tests were conducted with full pouch cells using a Nokia type cell format
- Full cells were created successfully and normal cycling behaviour could be demonstrated



Anteo's Si anode



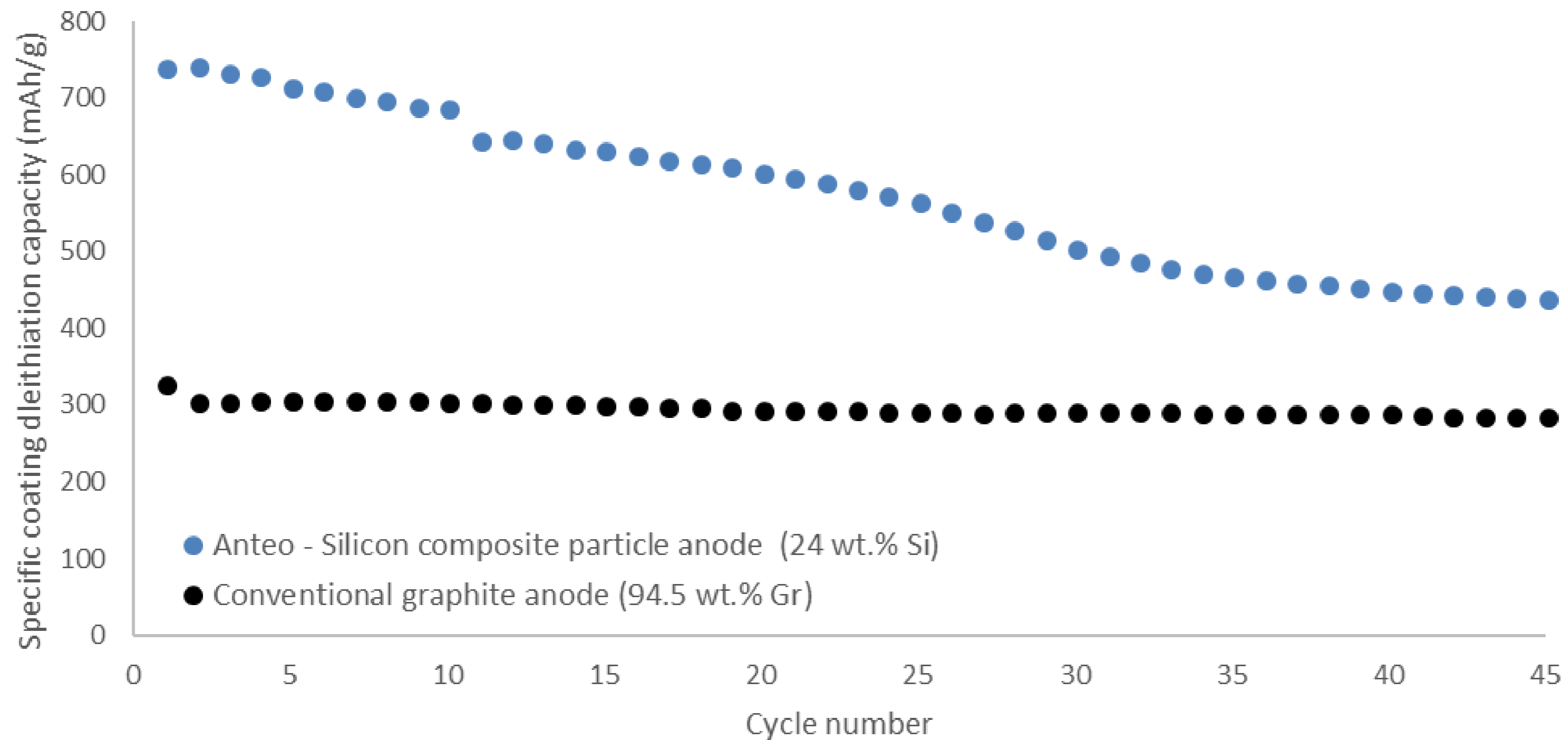
Pouch full cell with Anteo Si anode





# Composite Particle Results Encouraging

Half cell cycling test (cycling performed at C/2 from 10<sup>th</sup> cycle)



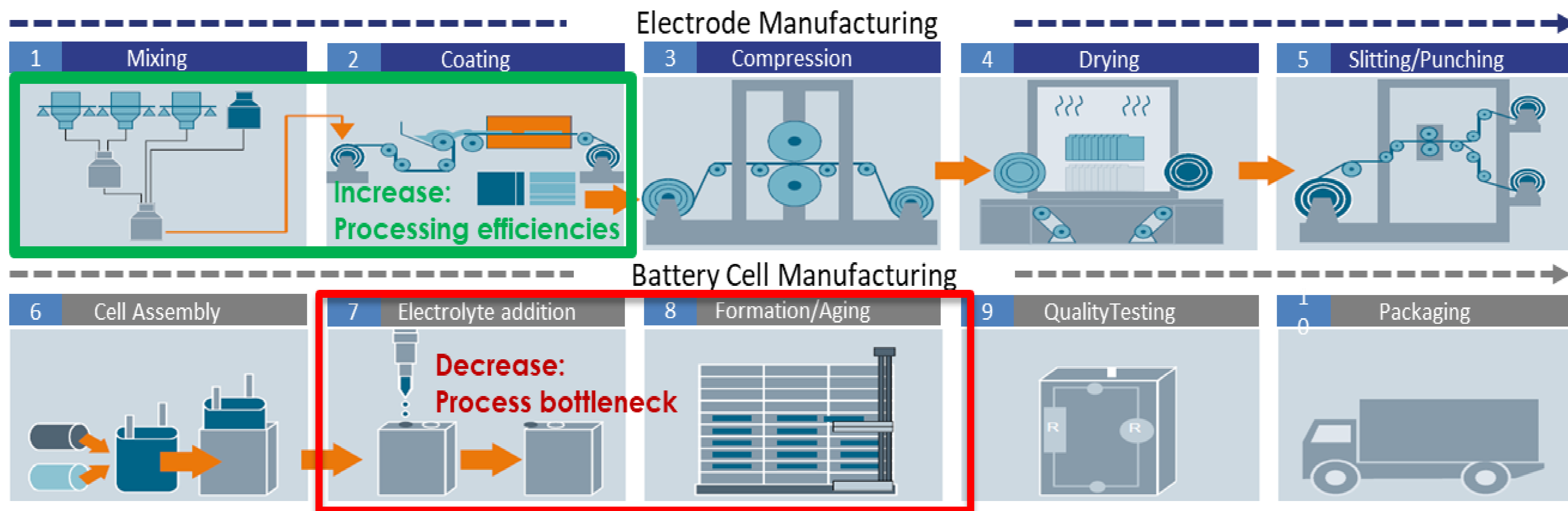
- The commissioned work by Polaris showed Anteo's silicon/carbon composite was able to produce a working battery using an anode with a silicon content of 24wt.% demonstrating a substantial improvement in electrode capacity compared to a conventional graphite anode
- Whilst initial use of silicon's capacity was in the expected range, the anode capacity fell away faster than ideal.



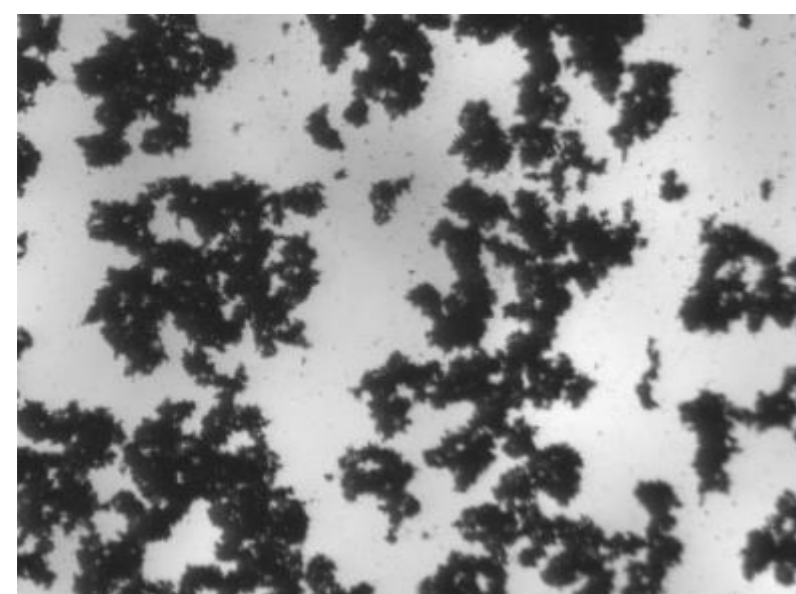
Focus of the next phase of work will be to optimise silicon composite structures and improve anode cycling stability

# AnteoCoat™ Potential in Battery Manufacturing

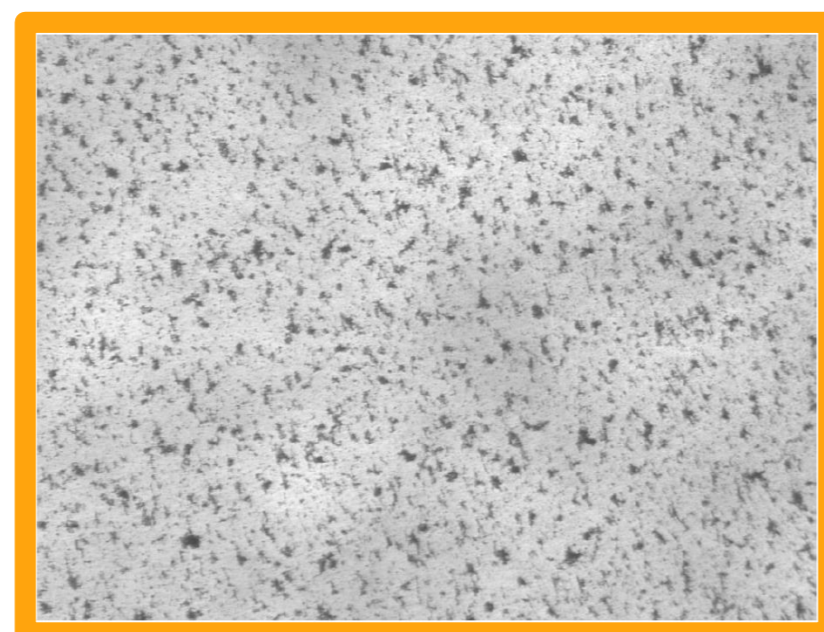
- The second development stream is evaluating the potential for AnteoCoat™ to improve electrode performance and generate cost reductions by increasing electrode and battery processing efficiencies
- Processing efficiencies can be introduced through surface modifications enabled by AnteoCoat™ that can
  - improve the wettability and dispersion of graphites/carbons in combination with aqueous processing
  - Improve the wettability of electrode and cell components in combination with organic solvents



# Battery Separator - Wettability Studies



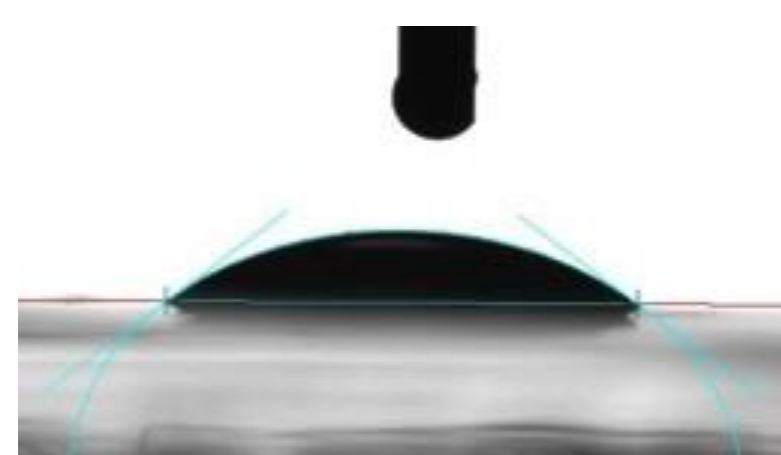
Carbon particle agglomeration in water (without AnteoCoat™)



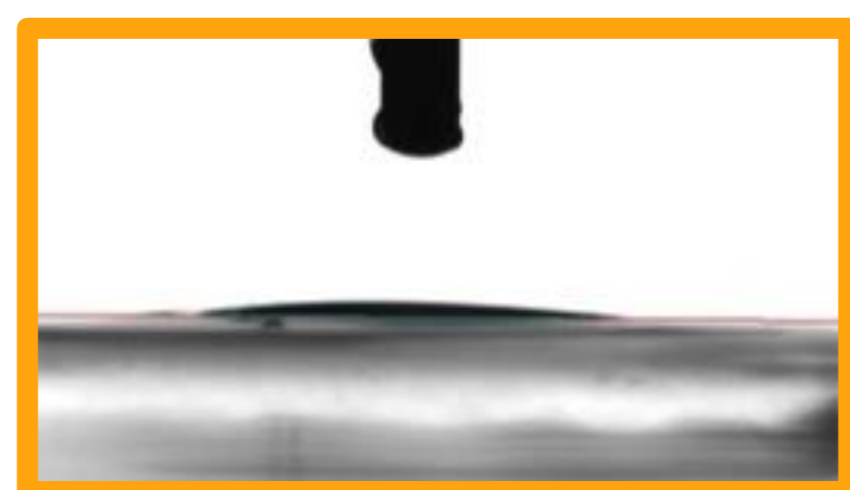
Surface modified carbon in water (enabled by AnteoCoat™)

- Surface modified carbon enabled by AnteoCoat™ demonstrated improved wetting and dispersion in water
- One target is to increase processing efficiencies during component mixing and electrode coating steps
- Another target is to increase manufacturing efficiencies during electrolyte addition and formation steps
- Change in wetting behaviour of an untreated separator featuring surface coatings enabled by AnteoCoat™ was observed using contact angle measurements
- Increase in wettability of a modified separator with battery electrolyte solvents was demonstrated

Increased wettability



Untreated separator  
Contact angle: 36.52°



Modified separator enabled by AnteoCoat™  
Contact angle: 15.04°

Next steps involve the testing of commercial interest in surface modified components



# Established Battery Team & Internal Battery Lab

**MANUEL WIESER**  
HEAD OF BATTERY  
DEVELOPMENT

**Materials science and energy storage technologies.**

**Technology management and collaboration  
experience in Australia, US and Europe.**

**ALEX SUPRUN**  
CHEMICAL ENGINEER

**30 years experience in chemical engineering,  
production scale-up and process optimisation.**

**R&D experience in developing energy storage materials  
for lithium ion batteries.**

**TIM WEBB**  
PHD MATERIALS  
SCIENTIST

**Physics, materials science and electronics.**

**Experience in batteries, hydrogen storage  
and crystallography.**





# Internal Battery Capabilities

- Internal battery capabilities allow Anteo to mix battery anode slurries, cast slurries onto current collector foils and assemble electrodes into coin cells for electrochemical evaluation
- Internal battery capabilities will allow for improved control of testing parameters and faster concept testing
- Work with external partners will continue for the purpose of external validation

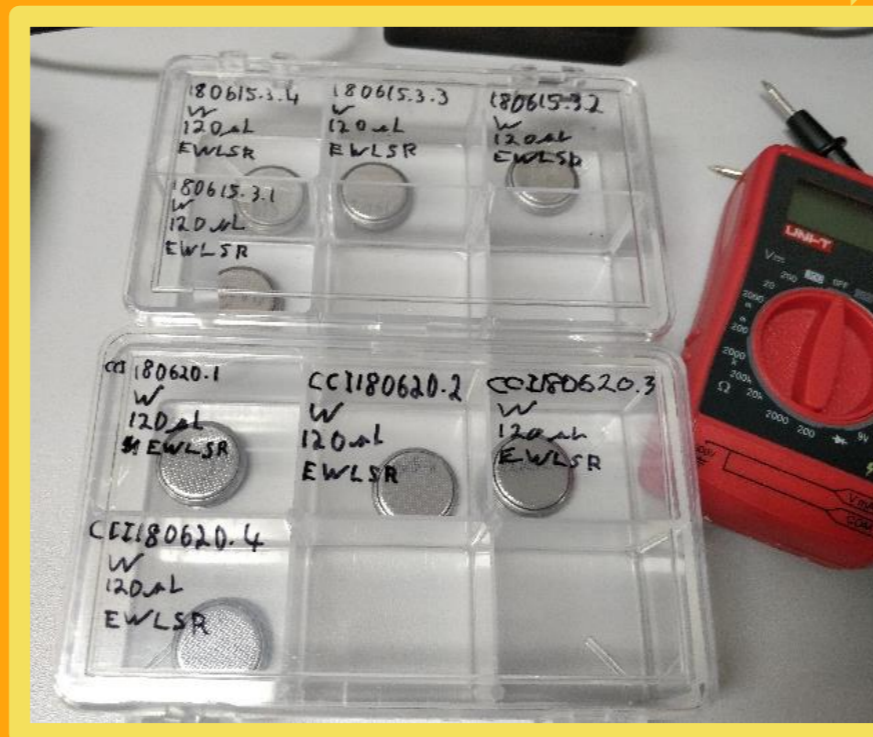
## Electrode coating and cell assembly process



**Slurry mixing.**



**Electrode coating.**



**Cell assembly & testing**



**Internal battery lab capable of: slurry mixing, electrode coating, cell assembly and testing**



# Battery next steps

1

Tested interest and relevance of AnteoCoat™ preliminary results at various trade conferences – Complete. Verified interest.

2

Follow up discussions identifying potential commercial partners to seek involvement in next stages with focus being on:

- Progressing the near term development and use of particle coatings in nearer term applications
- Testing interest in the medium term use of composites

3

Progress the development of the composite material focusing on composite optimisation (various composites already produced for assessment) with work being undertaken on:

- Understanding the physical and electrochemical behaviour on a material level
- Optimising electrode coating compositions aimed at better integration of the composite into anode coatings to obtain improved cycling performance

# Point of Care

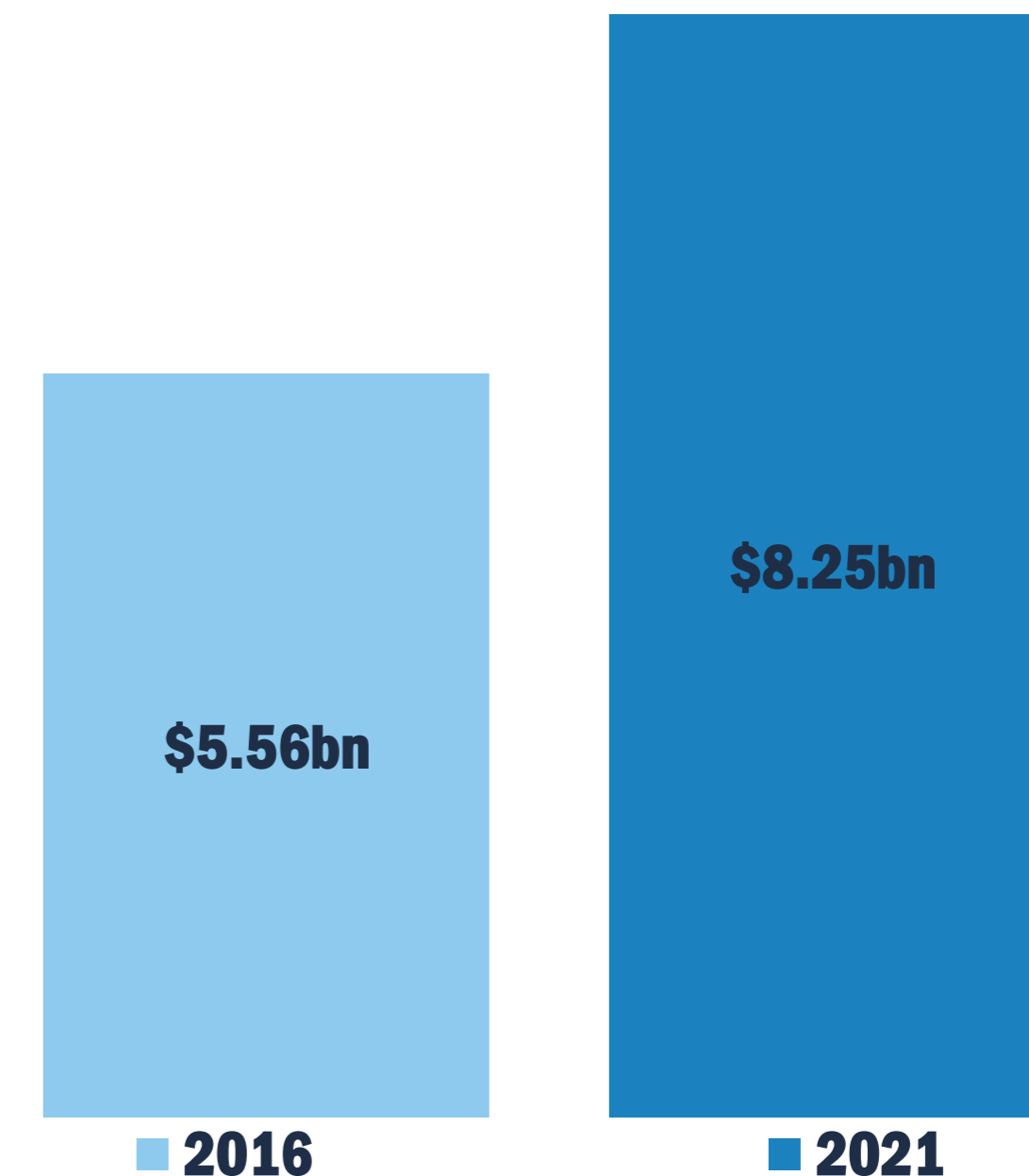
# Tested Shift in PoC Market and Role for AnteoBind™

Confirmation of AnteoBind™ opportunities in quantitative lateral flow assays at Lateral Flow conference (Spain) in May:

- The Lateral Flow Immunoassay (LFIA) segment continues to grow strongly within the overall Point-Of-Care-Test (POCT) market
- Quantitative LFIA rapid tests are becoming popular for a wide range of diagnostic or indicative applications.
- Europium particles are recognized as one of the main fluorescent detection systems for LFIA
- Many companies are expanding and entering China POCT markets.

Based on the clear market opportunity the company embarked on a program to develop and test the performance of several key Lateral Flow assays to “feasibility” stage

**LFIA market  
USD \$Billions**



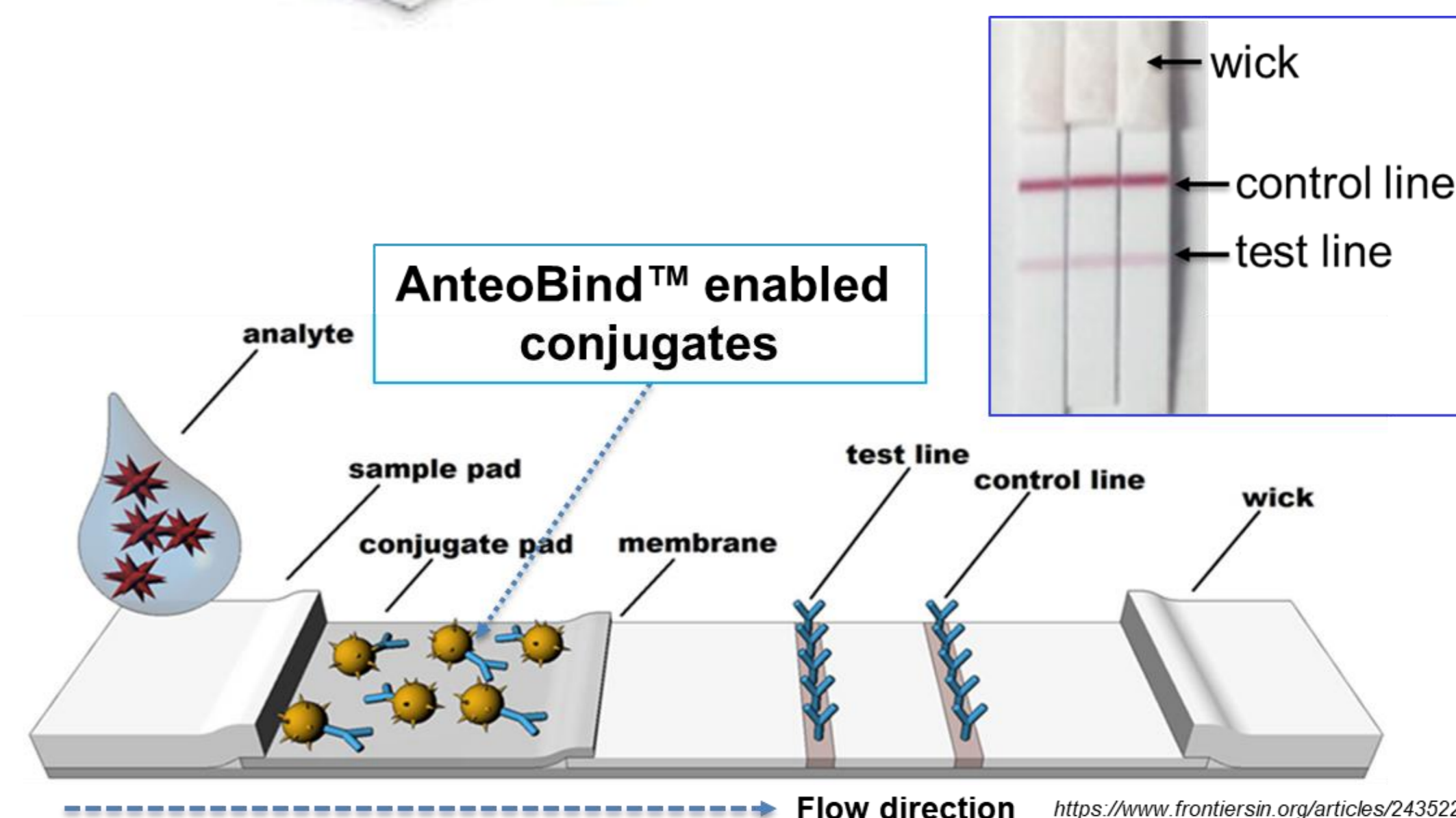
**Market size: The global LFIA market size was valued at USD \$5.56bn in 2016 and is expected to reach USD \$8.25bn by 2021 (Market data forecast 2017)**



# Point Of Care and Life Sciences Commercial Focus



- AnteoBind™ is making a clear difference solving customer issues in relation to antibody conjugation. Critical when building quantitative LFIA systems using the following detection systems:
  - Europium, Gold, Quantum Dots (e.g. Ellume), Dyes and potentially Carbon (new)
- Good awareness of AnteoBind™ with a range of local and international companies
- Increasing interest in fluorescent particle conjugation
- POCT market changes are opening new opportunities with an increasing demand for quantitative PoC diagnostics with increased requirement for detection and speed.
  - An example is the rapidly expanding China POC market where domestic manufacturers are looking to improve performance of current generation assays and are ready to embrace technology that will help drive development efficiencies

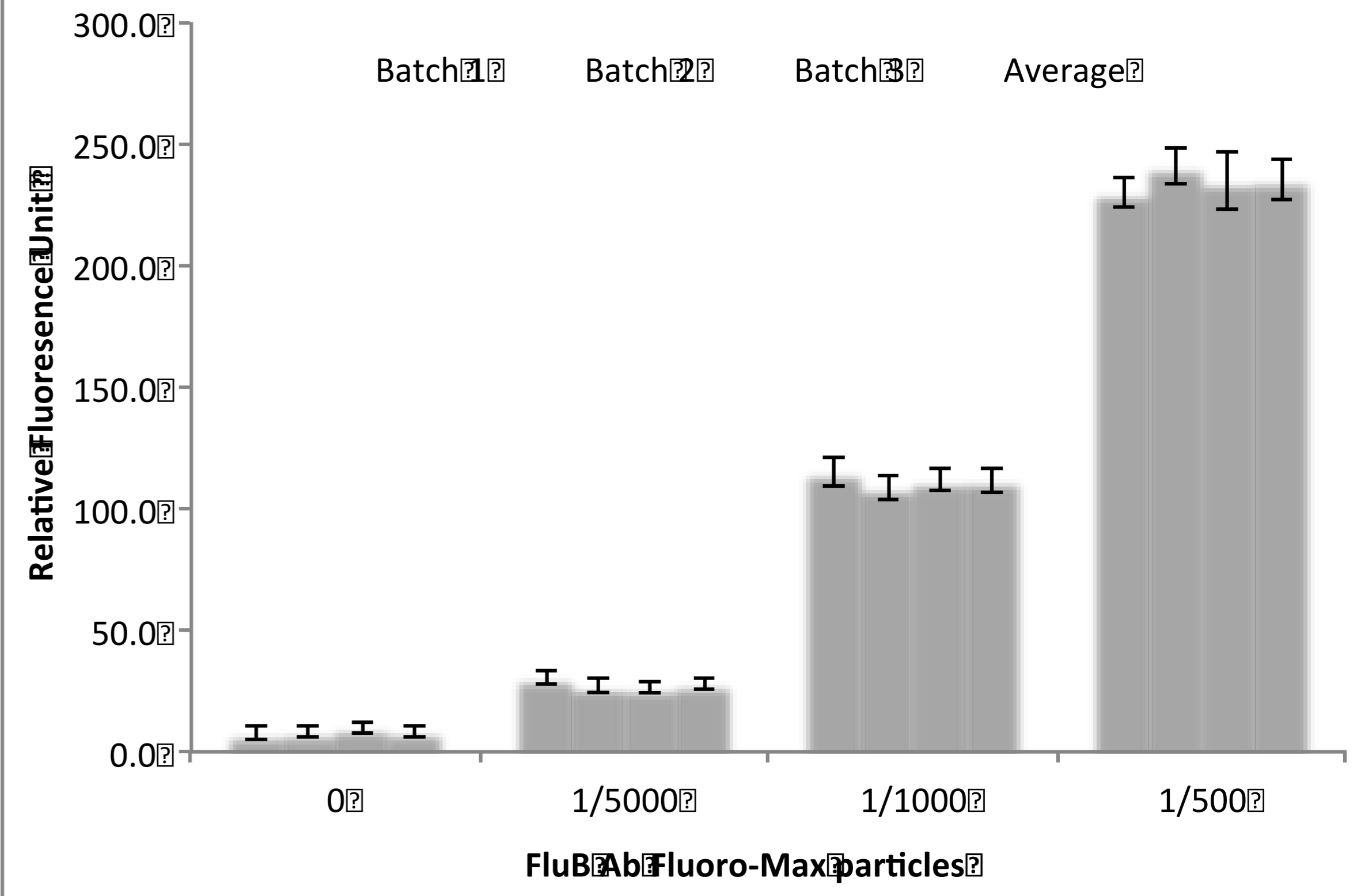
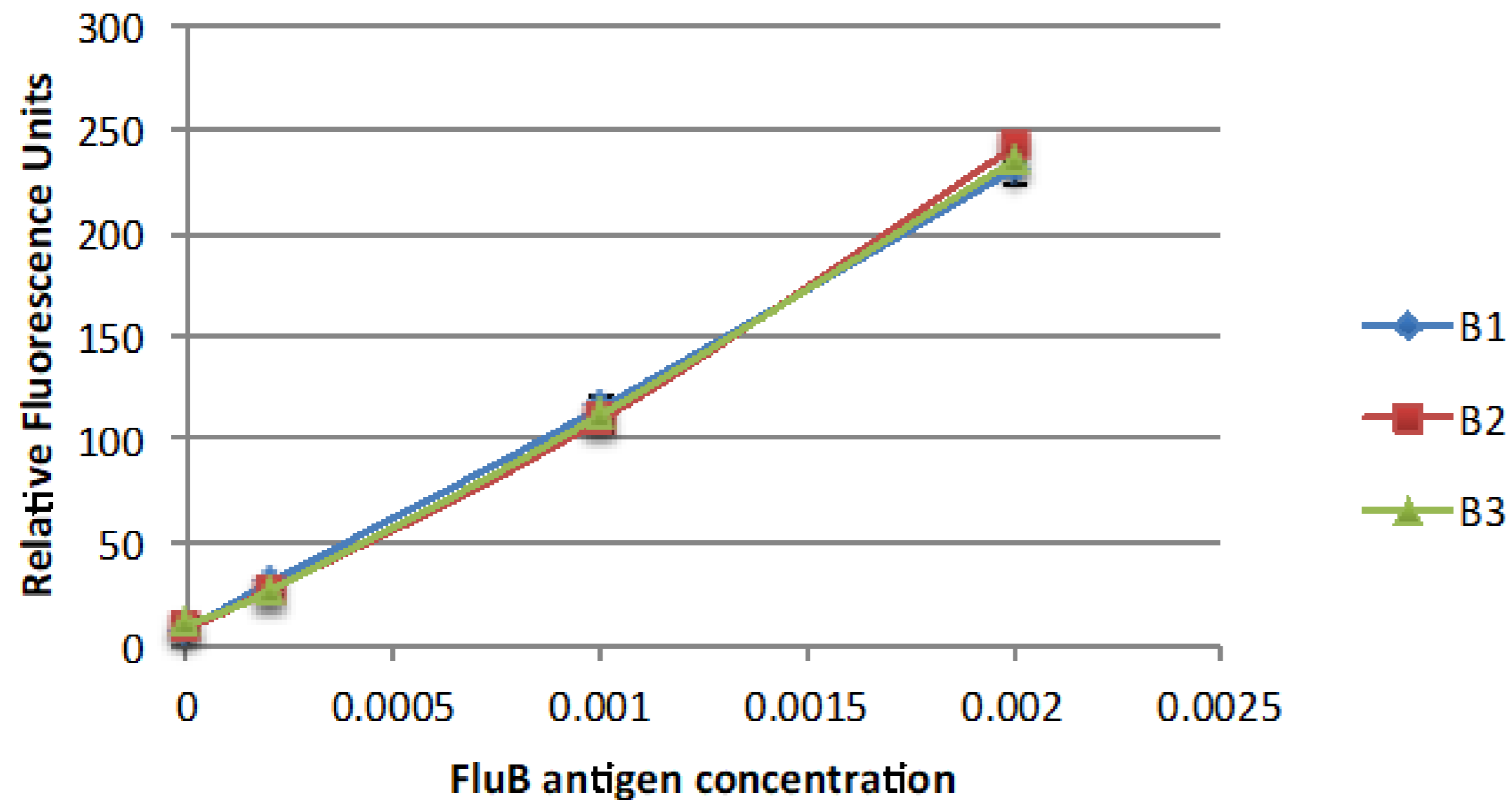


# AnteoBind™ FluB Europium Conjugates

## Improving Batch Reproducibility & Performance



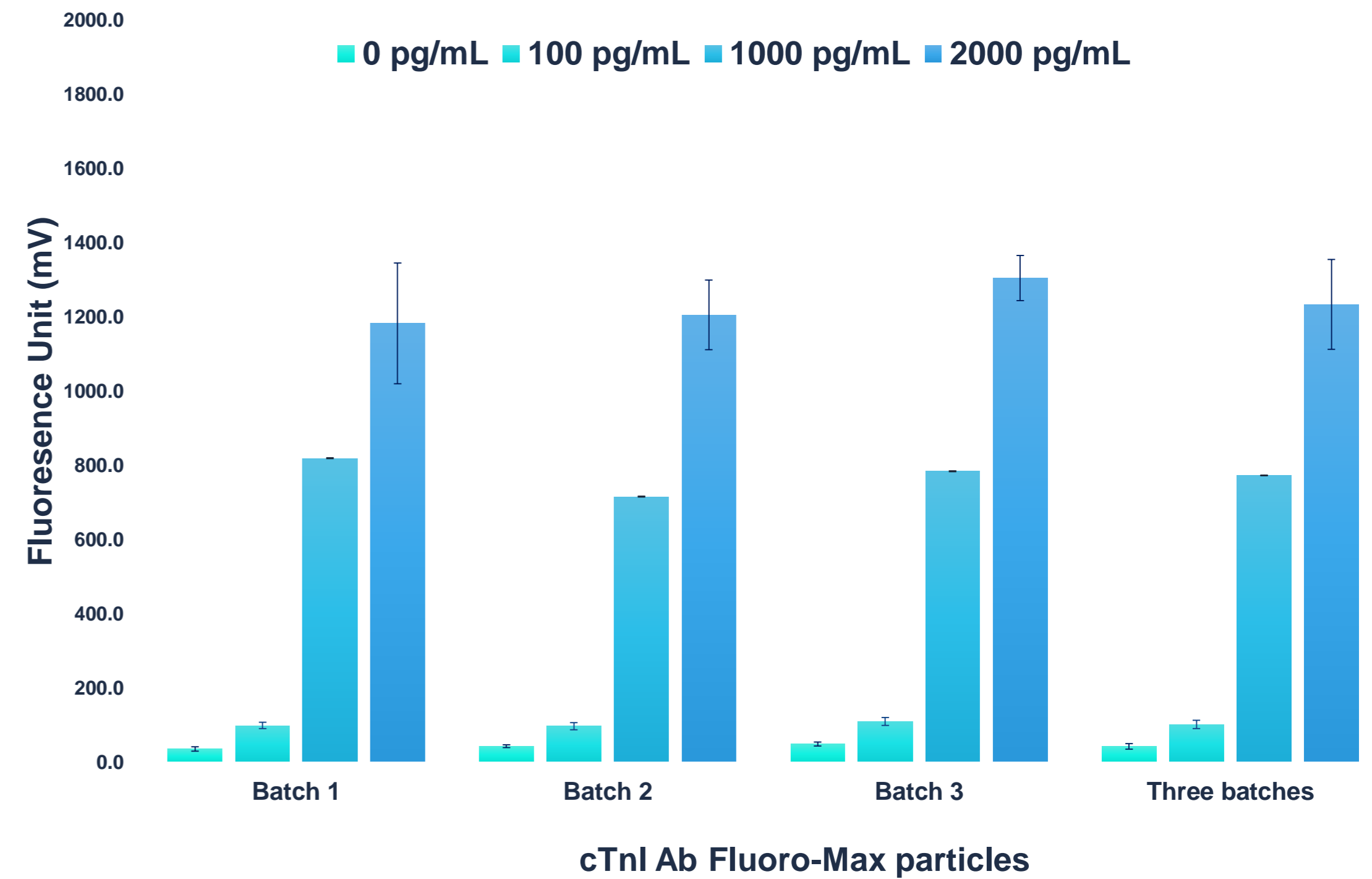
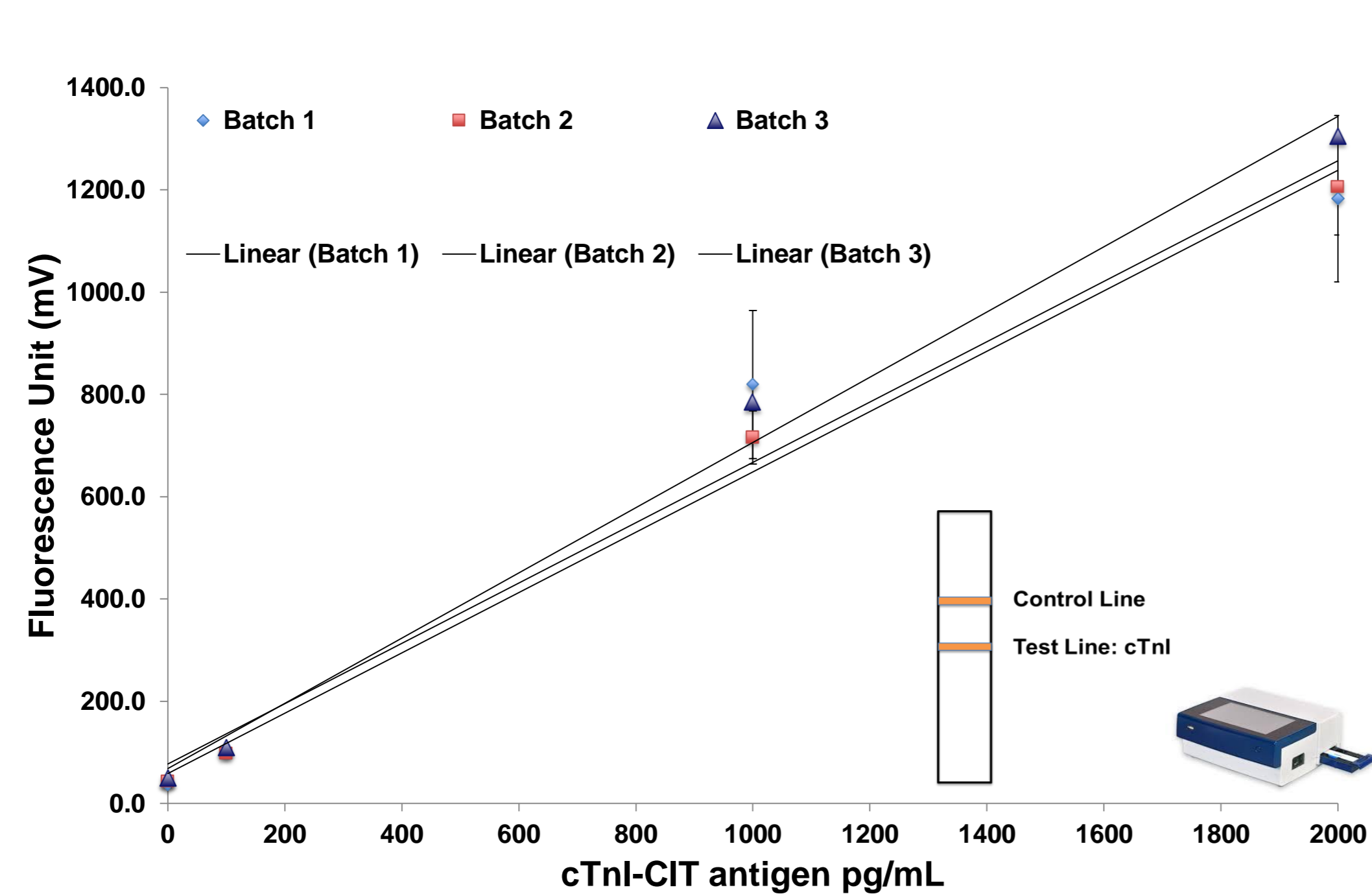
**FluB Replicate Testing**



**ANTEOBIND™ ENABLES EXCELLENT INTRA & INTER BATCH REPRODUCIBILITY & PERFORMANCE**

# AnteoBind™ cTnI Europium Conjugates

## Improving Batch Reproducibility & Performance

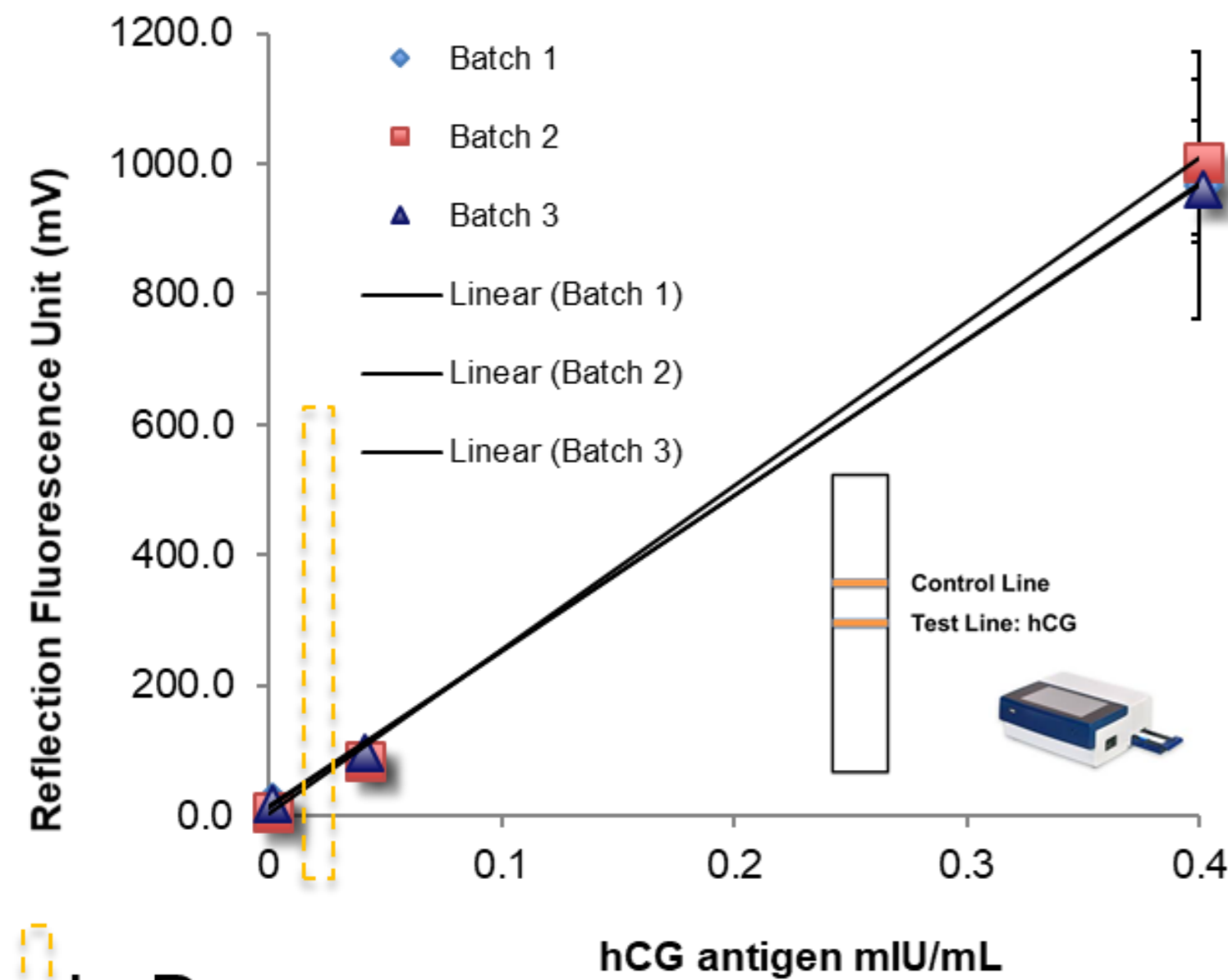


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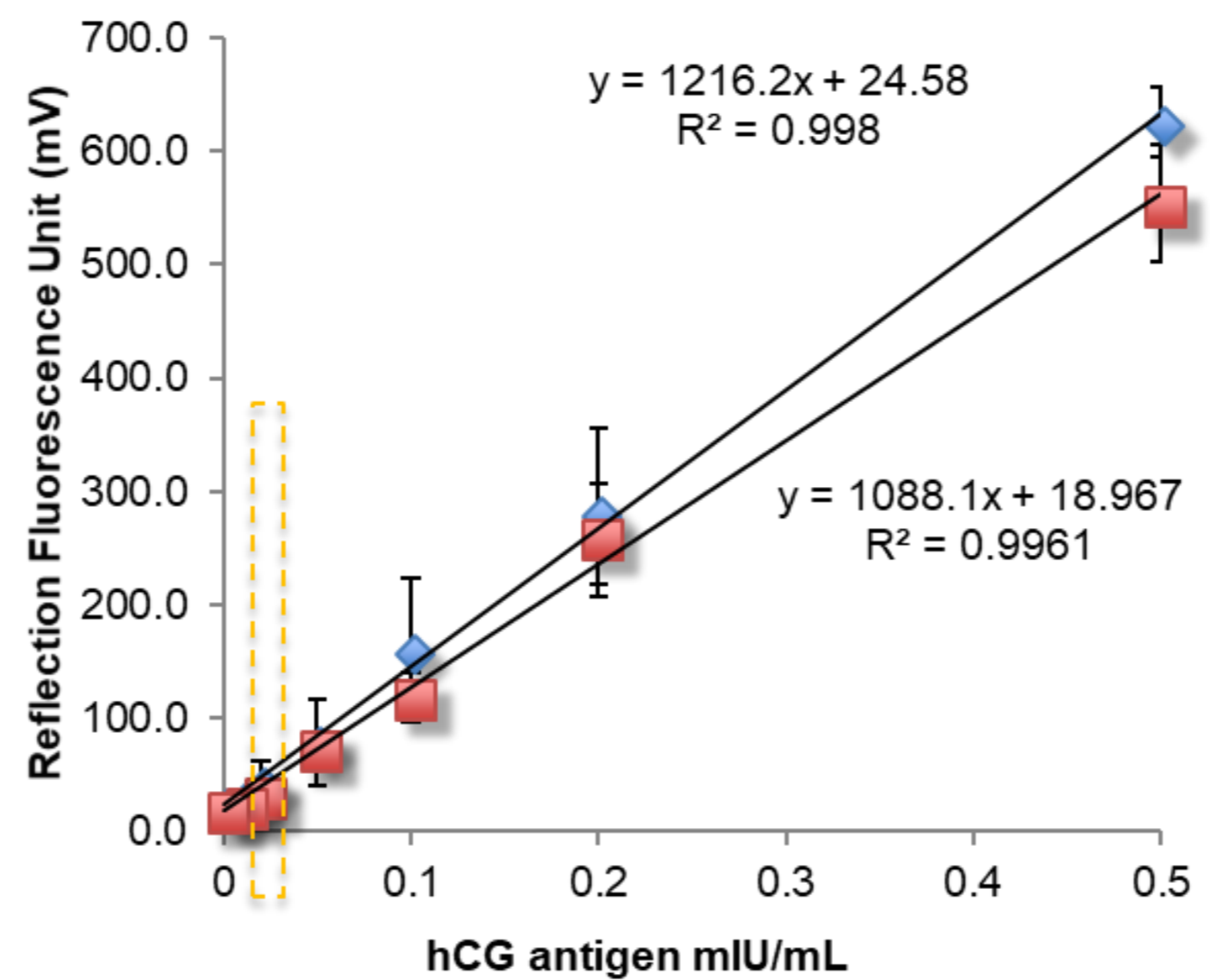
# AnteoBind™ Compatability

## Europium Particles from 3 Suppliers: hCG Assay

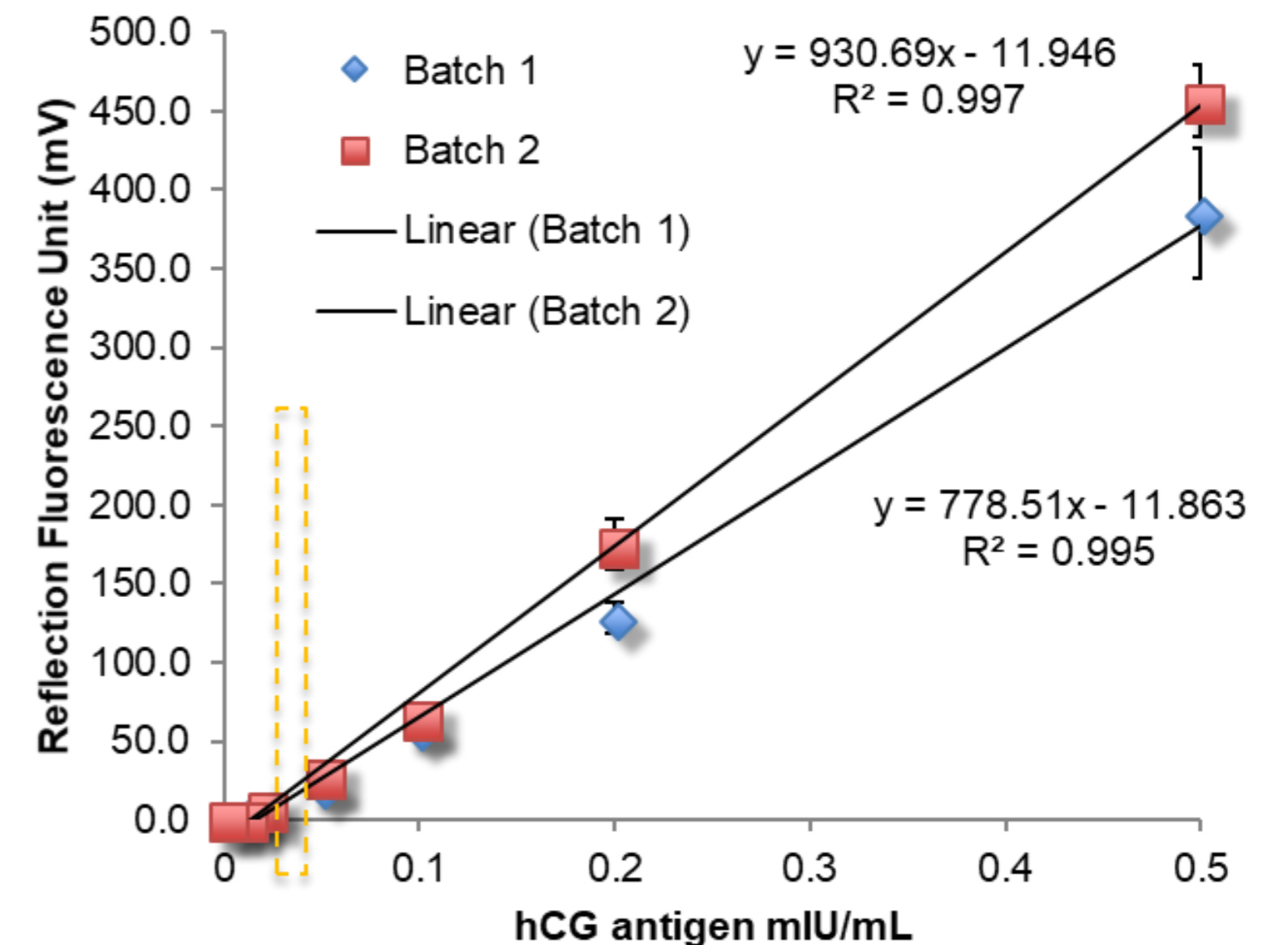


LoD

**Europium particle (F)**



**Europium particle (E)**

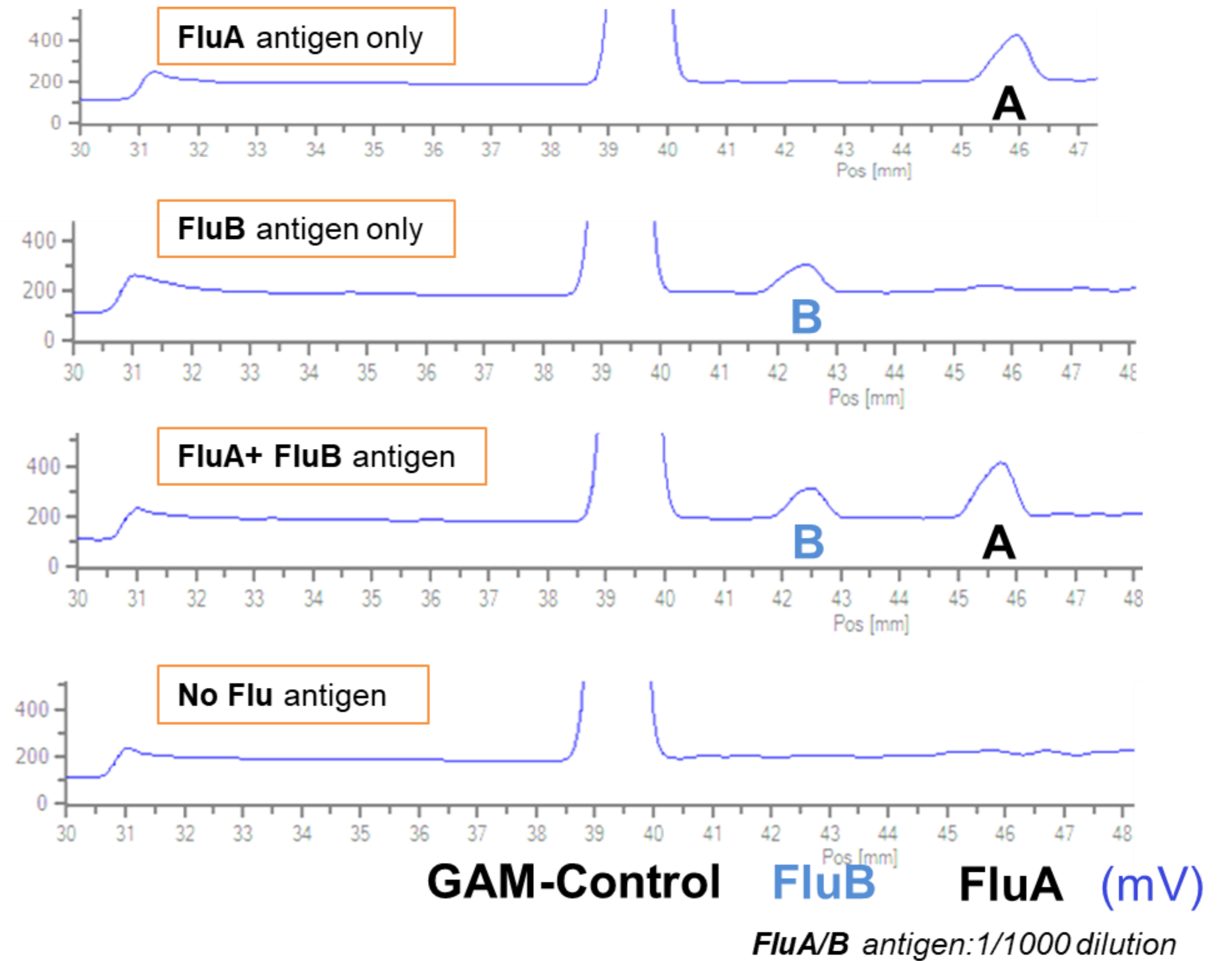
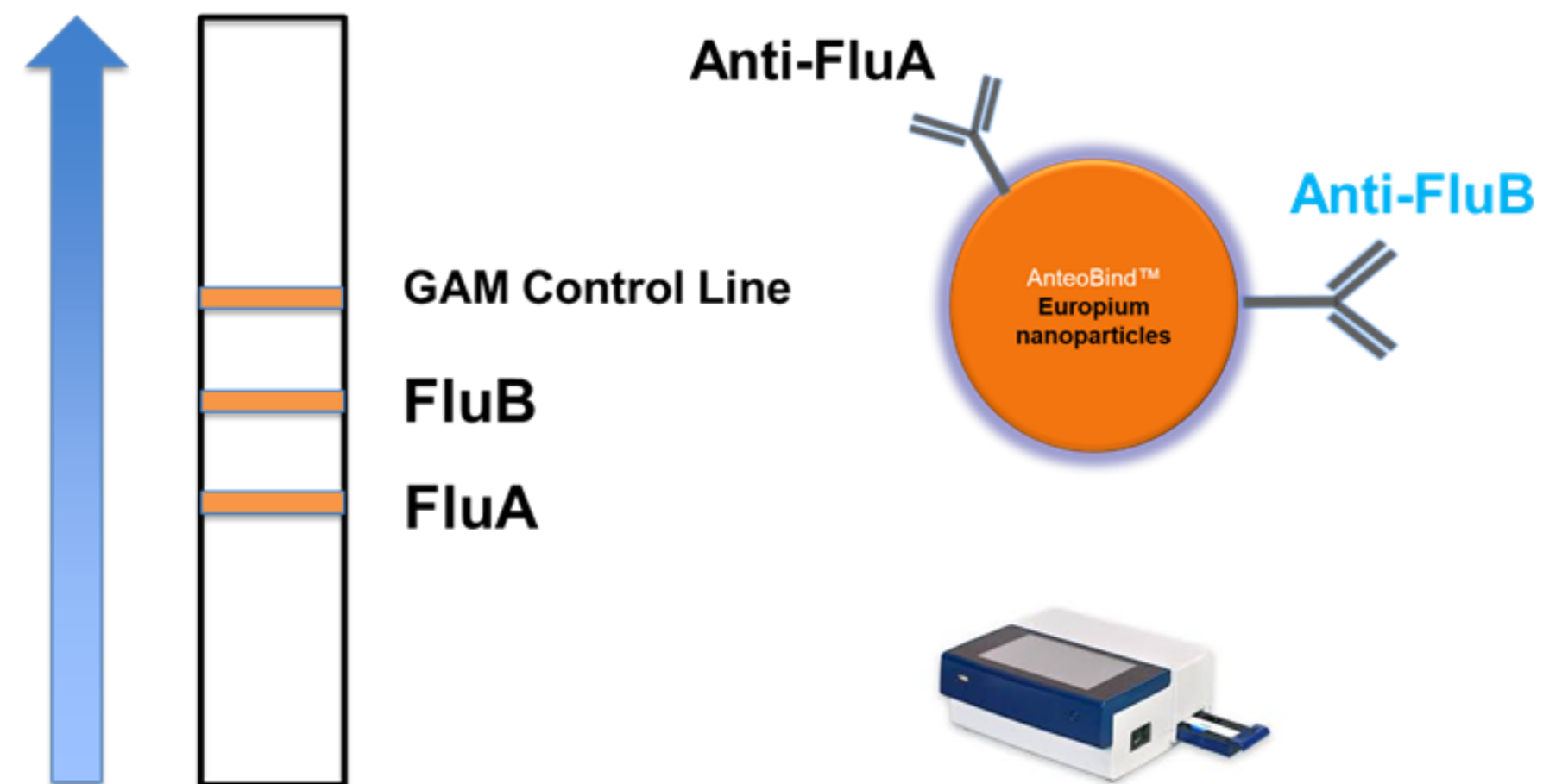


**Europium particle (L)**

**ANTEOBIND™ FUNCTIONAL COATING IS COMPATIBLE WITH THREE COMMERCIALY AVAILABLE EUROPIUM PARTICLES AND SHOWED SIMILAR HCG & CTNI (DATA NOT SHOWN) LOD**

# AnteoBind™ Value:

## Simplifying Multiplex LFIA - Europium FluA/FluB LFIA

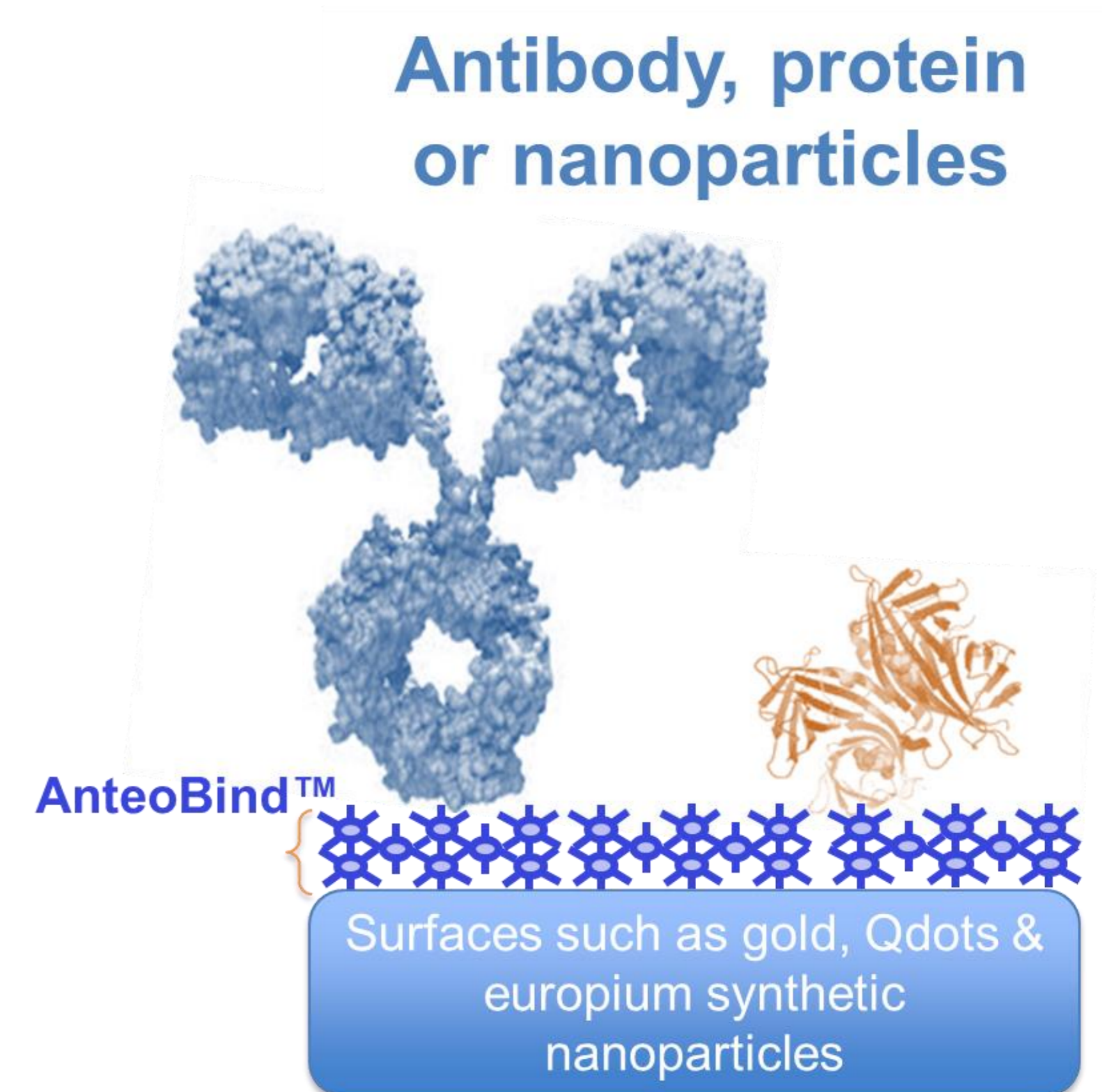


**ANTEOBIND™ FUNCTIONAL COATING DELIVERS SENSITIVE EUROPIUM FLUA/FLUB DUAL-PLEX LATERAL FLOW IMMUNOASSAY**



# AnteoBind™ - What the results tell us

- Significant gains in limit of detection performance across all tests
- Improved reproducibility of conjugate manufacturing
  - Simple method and stable in storage
- Improved assay performance
  - Better analytical sensitivity & lower limit of detection
  - Quicker test reaction time and potentially reduced sample size
- Opens scope for quantitative tests with possible multiplexing strips
- Works across multiple supplier platforms
- Multiple diagnostic applications
  - Emergency cardiac testing, early cancer detection, woman's health, infectious disease
- Faster commercialisation
  - Can reduce development & transfer time significantly





# Anteo POC Business Model Focus

POCT VALUE CHAIN		Research large IVD companies	POCT LFIA companies	Particle companies	Assay or Reader companies	Anteo own brand LFIA
High value	Develop full POCT assays - ISO13485		High value, high competition		High value, high competition	High value, high competition
	Contract assay development to feasibility		Medium value, medium competition		Medium value, medium competition	
Medium value	Bio-conjugation services	Low value, low competition	Low value, low competition	Low value, low competition	Low value, low competition	
	Activated or SAV particles KITS	Low value, low competition	Low value, low competition	Low value, low competition		
Low value	AnteoBind micro, nano solution	Low value, low competition				

# Anteo POC Business Model Focus

## POCT VALUE CHAIN

<b>High value</b>
<b>Medium value</b>
<b>Low value</b>

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<b>Bio-conjugation services</b>	Low value, low competition	Low value, low competition	Low value, low competition	Low value, low competition	
<b>Activated or SAV particles KITS</b>	Low value, low competition	Low value, low competition	Low value, low competition	<b>STAGE 1: RE-VITALISE/ EXTEND DISTRIBUTION CHANNELS</b>	
<b>AnteoBind micro, nano solution</b>	Low value, low competition				

# Anteo POC Business Model Focus

POCT VALUE CHAIN		Research large IVD companies	POCT LFIA companies	Particle companies	Assay or Reader companies	Anteo own brand LFIA
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	Activated or SAV particles KITS	Low value, low competition	Low value, low competition	Low value, low competition	<b>STAGE 2: PARTNER IDENTIFICATION AND EXTEND SERVICES</b>	
Low value	AnteoBind micro, nano solution	Low value, low competition				



# Anteo POC Business Model Focus

## POCT VALUE CHAIN

		Research large IVD companies	POCT LFIA companies	Particle companies	Assay or Reader companies	Anteo own brand LFIA
High value	Develop full POCT assays - ISO13485		High value, high competition		High value, high competition	High value, high competition
	Contract assay development to feasibility		Medium value, medium competition		Medium value, medium competition	<b>STAGE 3: POTENTIAL FUTURE</b>
Medium value	Bio-conjugation services	Low value, low competition	Low value, low competition	Low value, low competition	Low value, low competition	
	Activated or SAV particles KITS	Low value, low competition	Low value, low competition	Low value, low competition		
Low value	AnteoBind micro, nano solution	Low value, low competition				

# Point of Care next steps

1

Offer conjugation services starting with a “suite” of activated particle kits (plus validation data package)

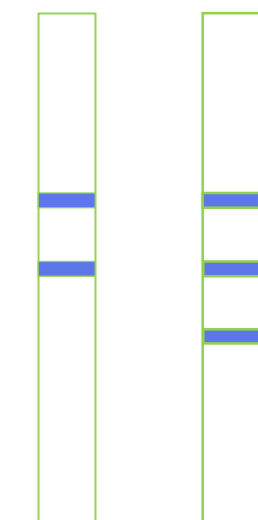
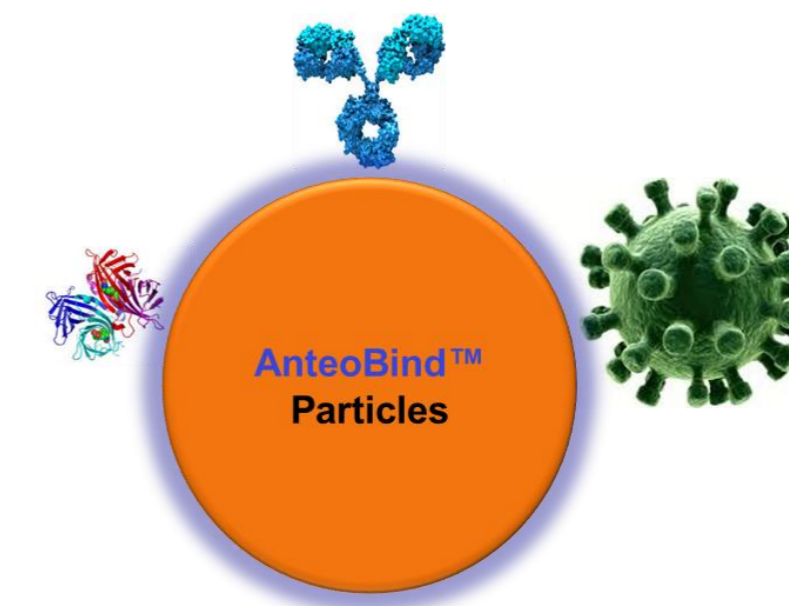
- reopen/revitalise large geographic market opportunities ie China/Japan with this approach
- test approach with current customers and Lateral Flow PoC companies at the major American Assoc. of Clinical Chemistry (AACC) conference in Chicago at end July

2

Support and explore future development options with existing partners (e.g Ellume, Atomo Diagnostics and others)

3

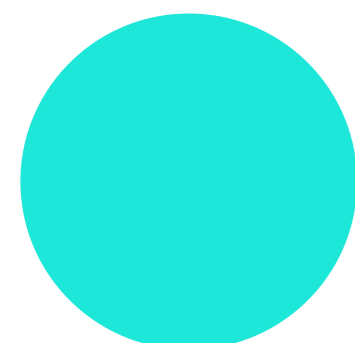
Reopen discussions with local and international companies. In June we re-signed with IMRA ([www.imra.com](http://www.imra.com)) and re-energised the relationship focused on finalising the development of a Gold Conjugation Kit (using AnteoBind™). Have re-engaged with Merck KGaA on potential additional areas of co-operation



# Summary

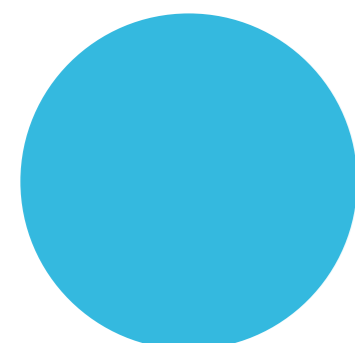


# Anteo Focus in Summary



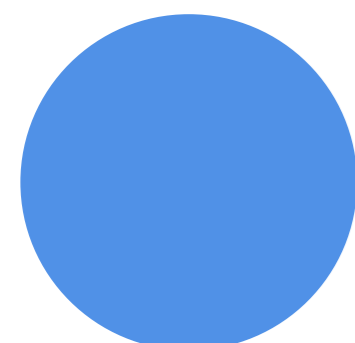
## **BATTERY PARTNERSHIPS**

Develop external Battery partnerships through Q3 based on the results obtained



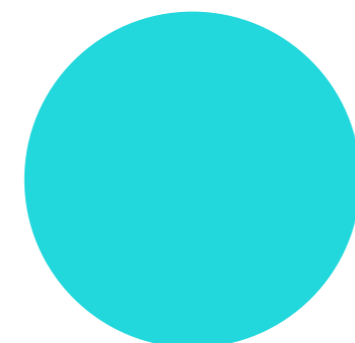
## **COMMERCIAL DEVELOPMENT**

Strategy focused on developing commercial solutions and opportunities in Point of Care and generating externally verified results potential in Batteries near term.



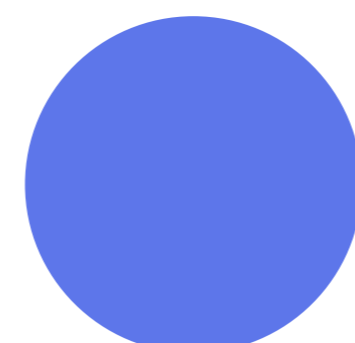
## **PARTICLE DEVELOPMENT**

Extend composite particle development focused on improving use of Silicon and improving cycle efficiency in demonstrating AnteoCoat™ potential.



## **ANTEOBIND MESSAGING**

Re-focus AnteoBind™ messaging on superior conjugation performance and solving difficult assay development with Europium, Gold, Quantum Dots (e.g. Ellume), Dyes and potentially Carbon (new) in Lateral Flow Point of Care Diagnostics.



## **EXTEND VALUE CHAIN REACH**

Developing partnership relationships for extending the reach of Anteo in the value chain supported by the re-launch with demonstrable improved performance for Flu A/B test strips, hCG and Troponin I from in-house testing.

# For more information contact

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