

Second generation pyro-optical immunoassay system: improved signal-to-noise in a multiplexed cartridge



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INTRODUCTION

Vivacta have developed a novel point of care immunoassay system for the measurement of analytes in **whole-blood**, without separation of the cells and with no wash step. The system comprises a low-cost instrument in combination with a disposable cartridge. Signal is generated when illumination of sample results in micro-heating effects on carbon particles bound to piezofilm sensor.



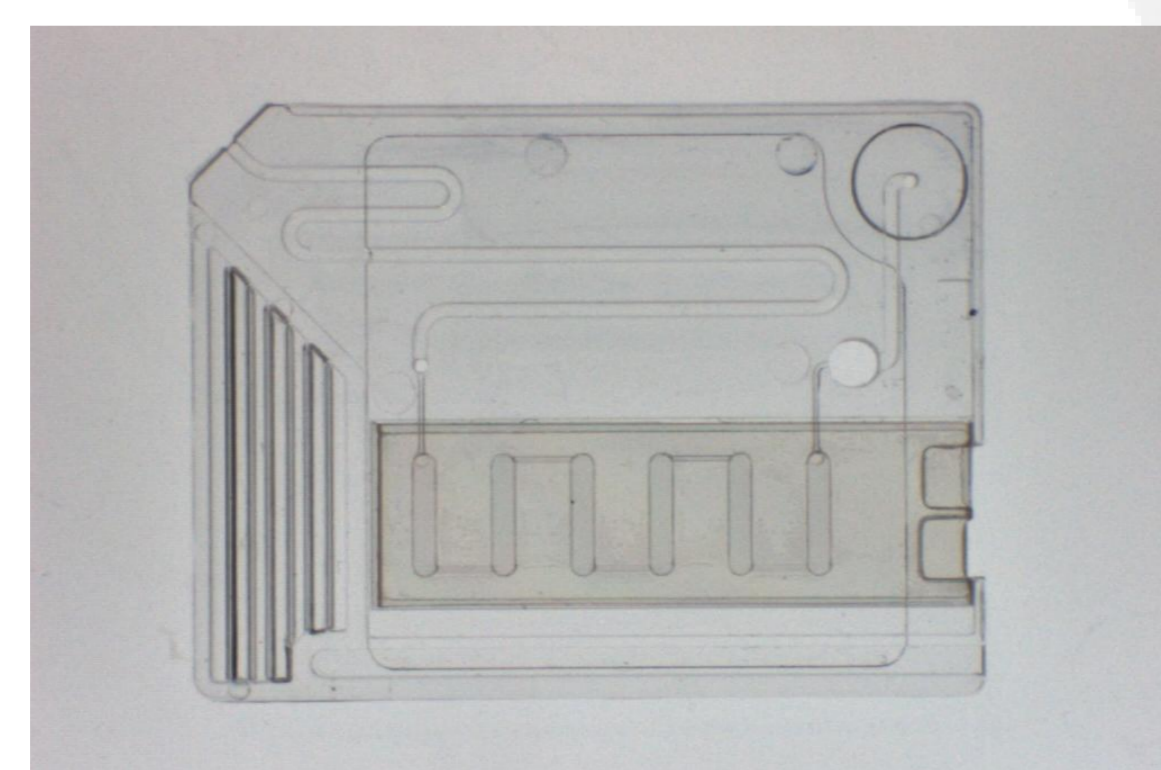
Features of 1st generation instrument –

- Whole blood measurement
- 30µl sample volume
- No wash step
- Time to result < 10min

Here we describe the development of a 2nd generation instrument with multiplexing capability.

SYSTEM DESIGN

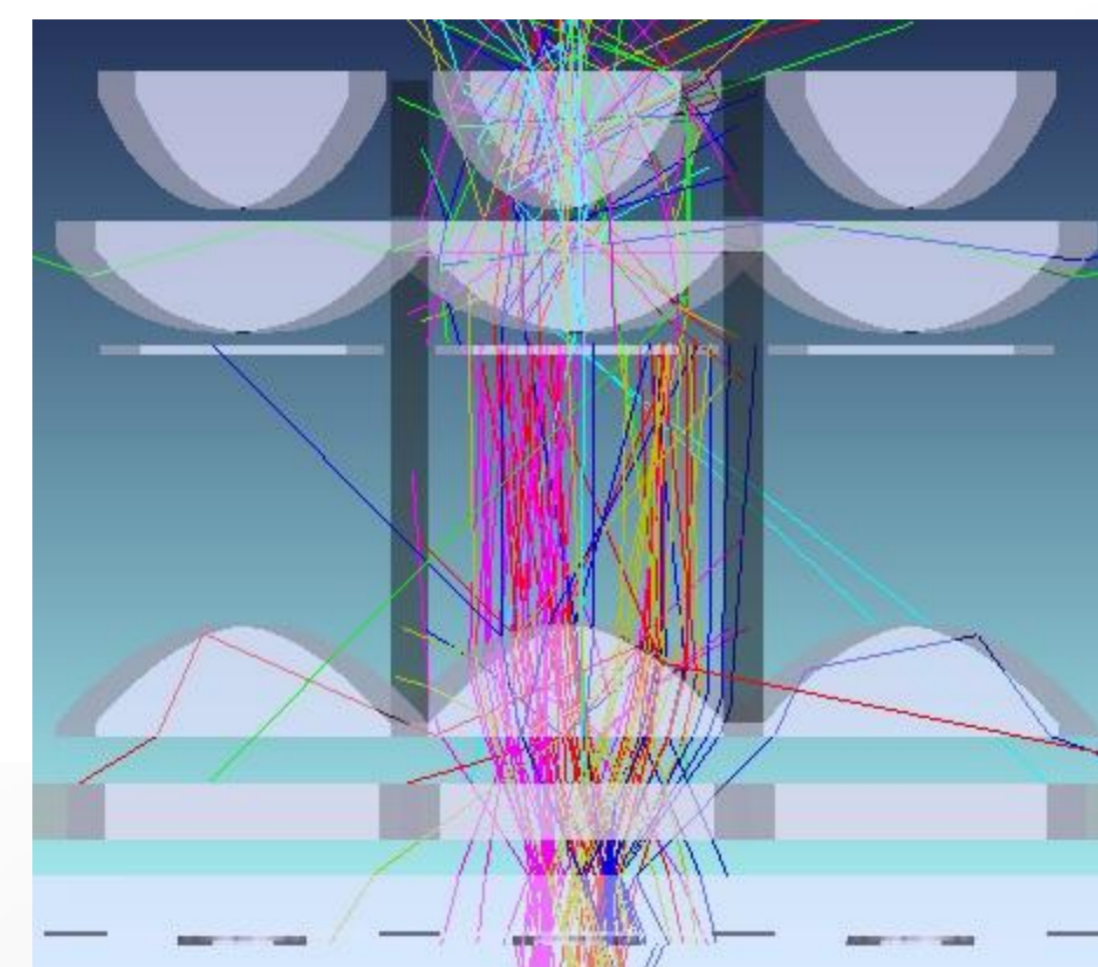
The 2nd generation Vivacta PzoDx is designed to allow 6 measurements to be carried out simultaneously. The cartridge has 6 individual test spots, enabling a number of different combinations of test and control spots.



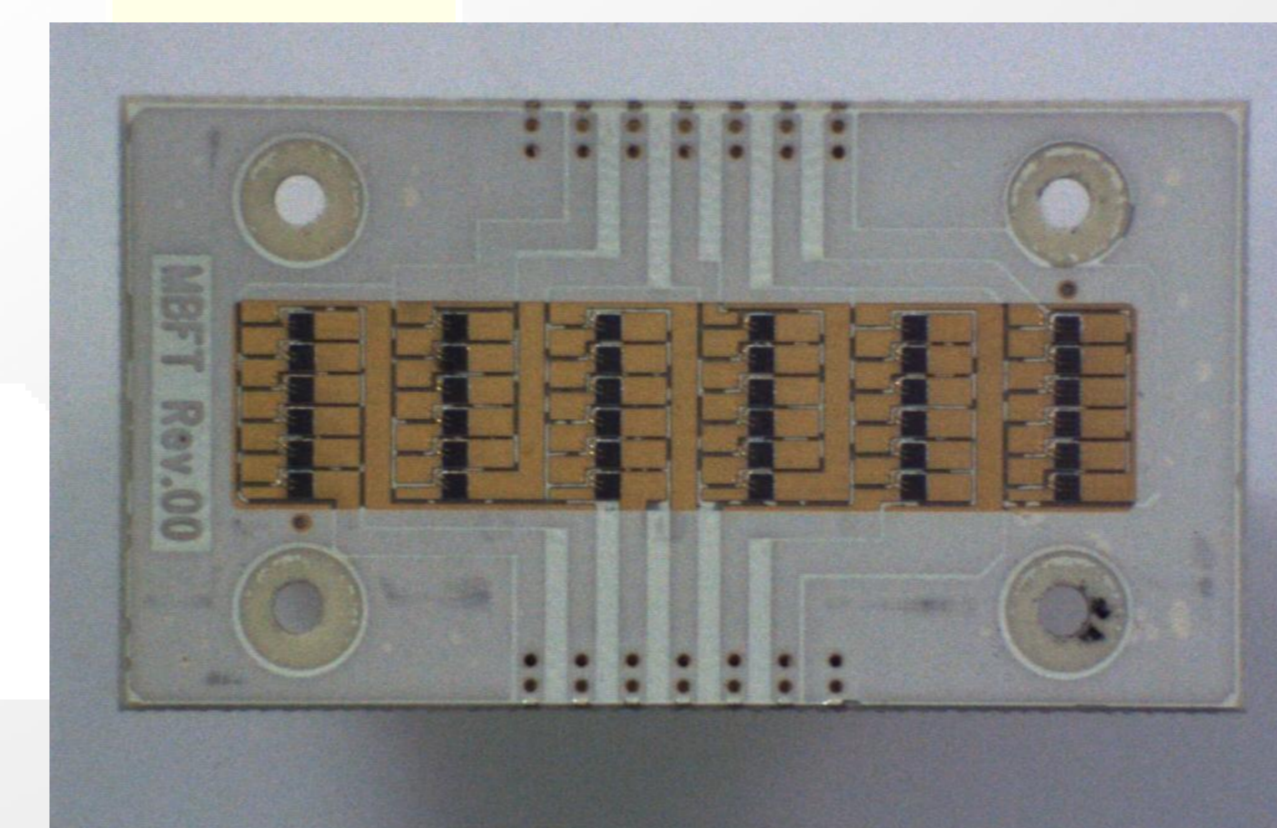
Extra features of 2nd generation instrument –

- Increased optical power
- Improved signal to noise
- Improved precision
- Multiplexing - Cardiac panels
- Improved dynamic range – small molecule assays

Optimisation of the system was achieved using optical modelling. This led to selection of appropriate cartridge materials and development of customised illumination sources. The test areas are illuminated by linear arrays of high powered LEDs (x6) to deliver increased light per spot.



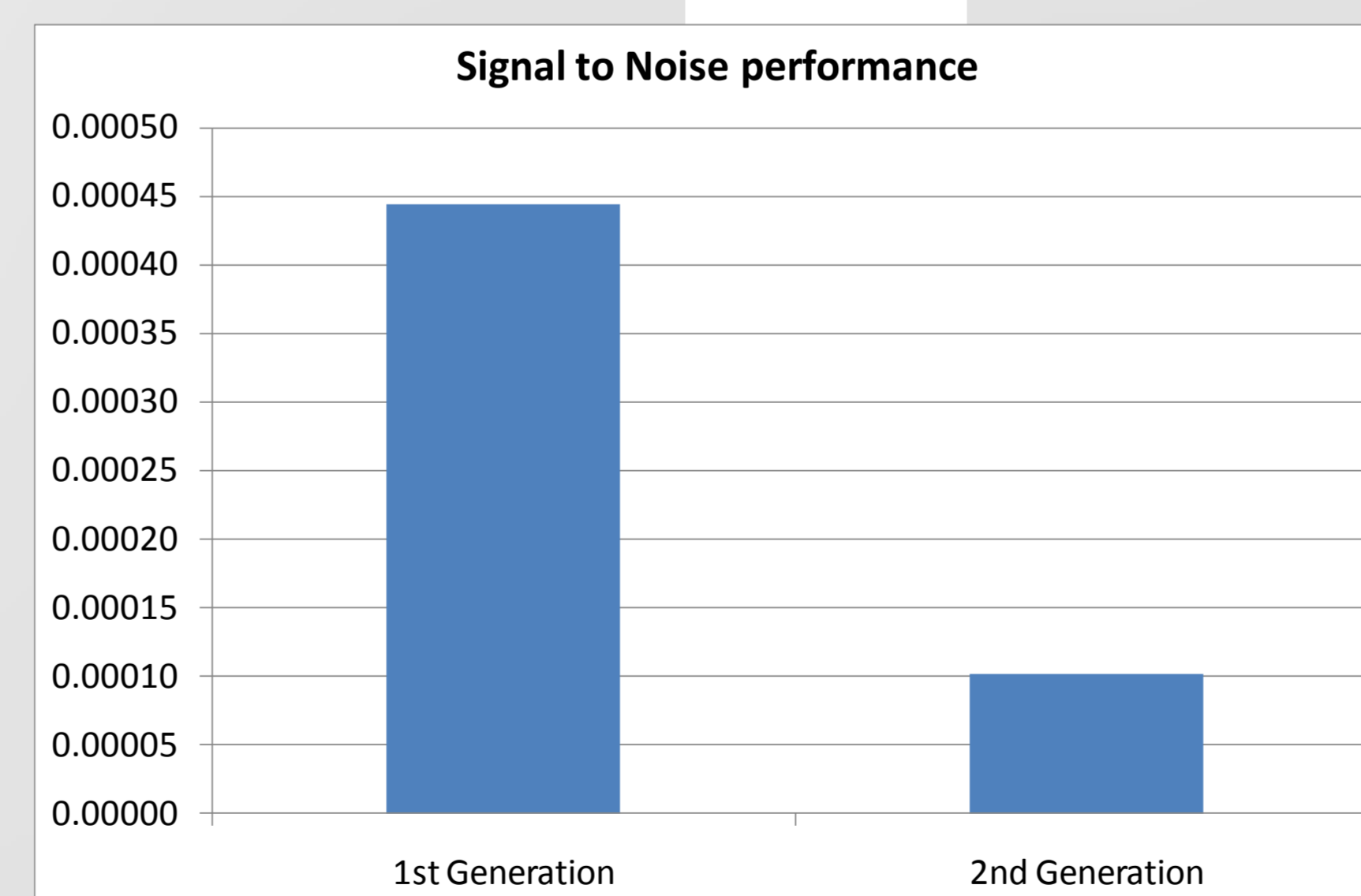
Optical modelling image



LED array board

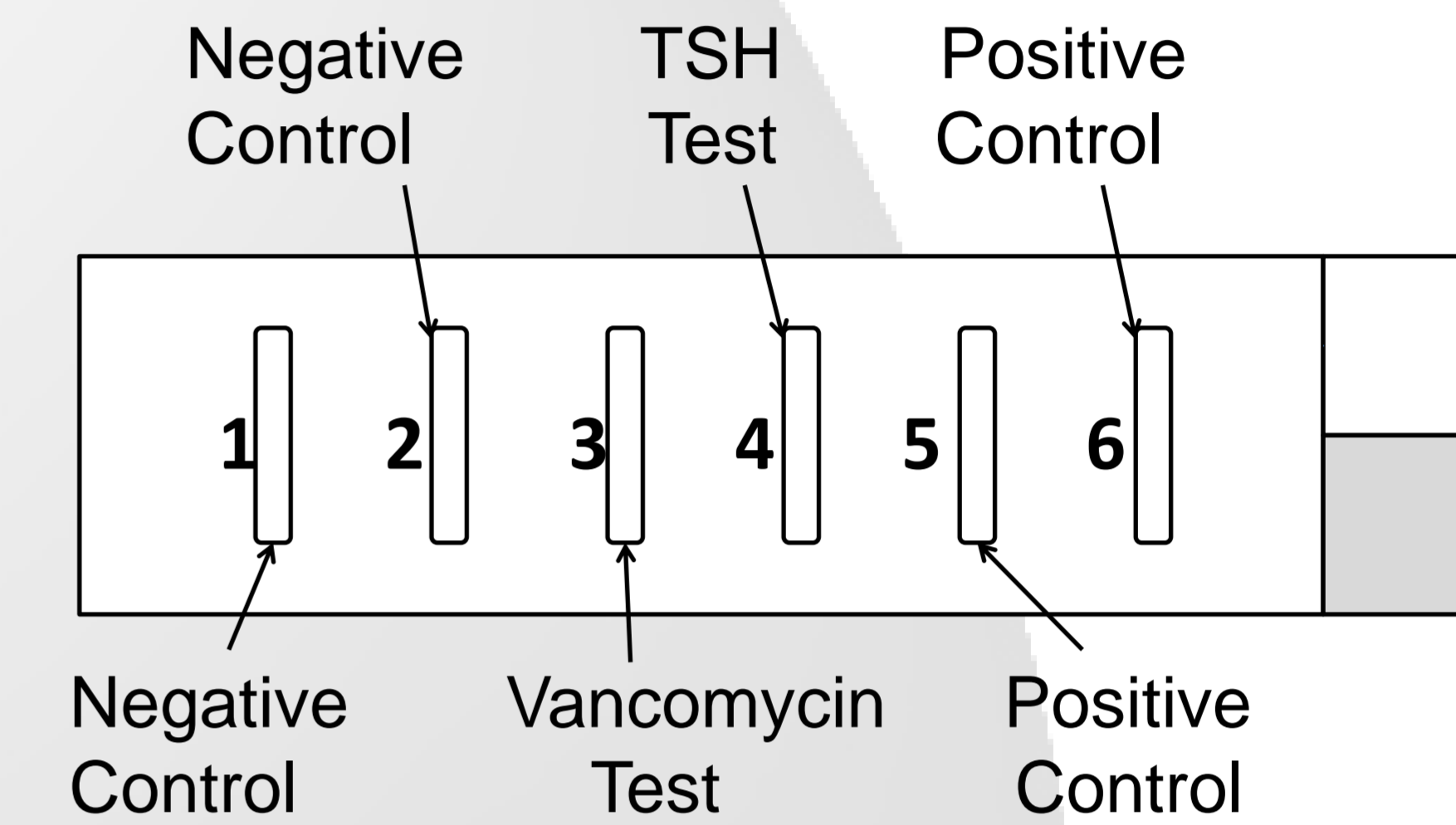
SYSTEM IMPROVEMENTS

The new system has a x6 increase in optical power per spot compared to the 1st generation - 60 vs 420 mW. The consequence of this was significantly improved signal to noise (instrument resolution).



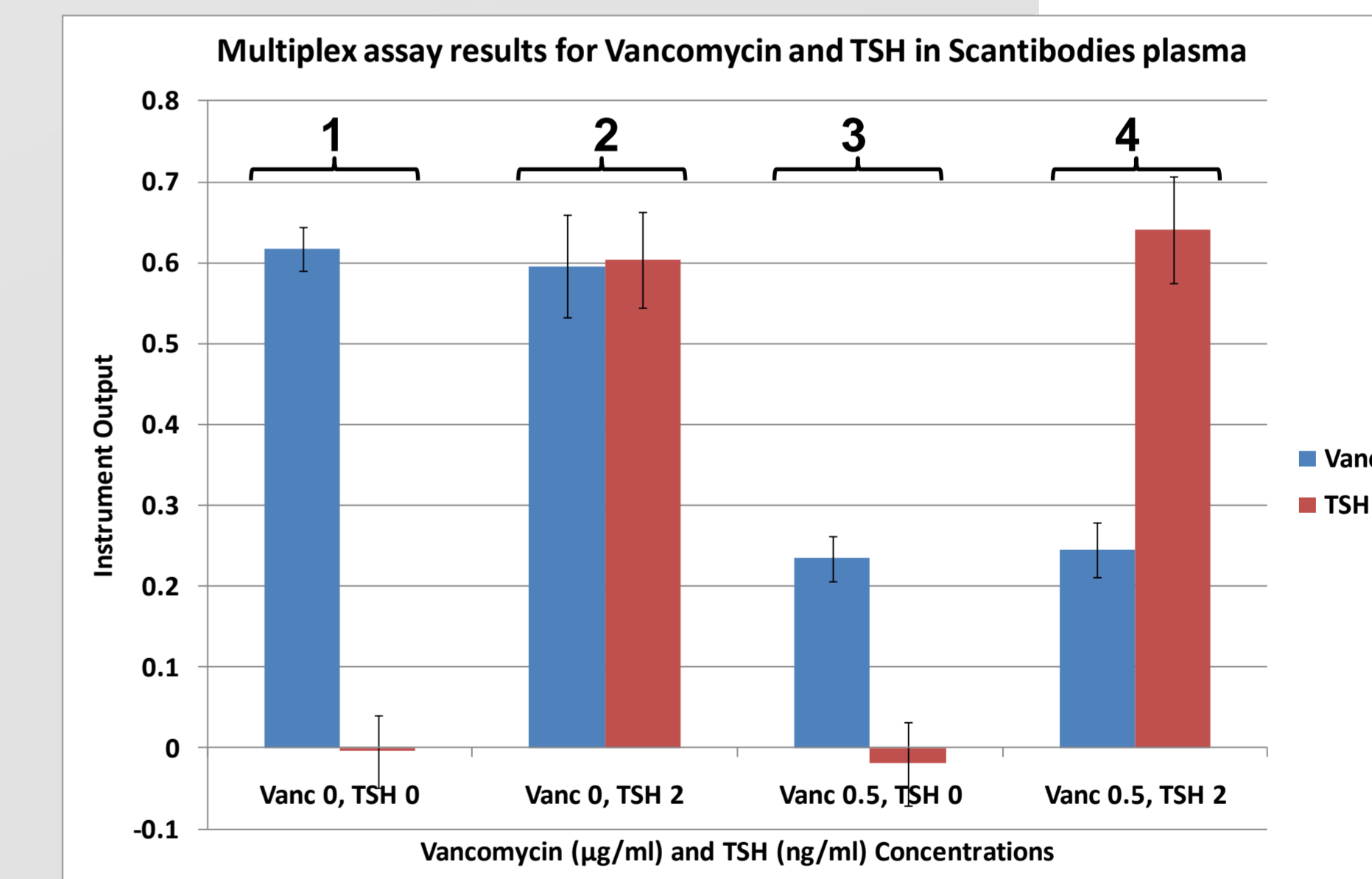
MULTIPLEXING

Multiplex experiments have been carried out using a sandwich assay for thyroid stimulating hormone (TSH) and a competitive assay for vancomycin. For this cartridges were coated as shown below.



Assay mixes –

1. Plasma, no analyte
2. Plasma, 2ng/ml TSH
3. Plasma, 0.5µg/ml vancomycin
4. Plasma, 0.5µg/ml vancomycin + 2ng/ml TSH



Results show successful detection of both analytes in parallel.

CONCLUSION

- Improved signal to noise
- Improved precision – 2 test repeats in one cartridge
- Multiplexing of sandwich assay and competitive assay