IBIS Technologies Imaging Interactions

## Highly sensitive COVID-19 sensor for high throughput antibody screening.

IBIS Technologies (www.ibis-spr.nl) evaluated the COVID-19 surface plasmon resonance (SPR) sensor that was recently introduced by Ssens (see www.senseye.com). In this evaluation an assay format was used in which patient sera are spotted on the sensor. Sera of 15 COVID-19 positive donors and 3 COVID-19 negative sera (NC) were spotted in duplicate on a SensEye® G SARS-CoV-2 S1 protein sensor which was subsequently analyzed with the IBIS MX96. The donors had been determined positive for COVID-19 by a swab test and their sera had been analyzed for the presence of SARS-CoV-2 IgG and IgM with an ELISA.

After rinsing/equilibration of the spotted SensEye®, the total antibody binding to the S1 protein was determined and subsequently the surface was incubated with anti-human IgA, anti-human IgG and anti-human IgM to identify the isotypes of antibodies that were present in the different sera spots. Binding of secondary antibodies to COVID-19 positive donor sera was compared to binding to negative control sera. All SPR data was referenced in order to compensate for common mode effects and a-specific binding. The lower limit of detection was set as the average value of the NC sera + 5 times the standard deviation of this average.

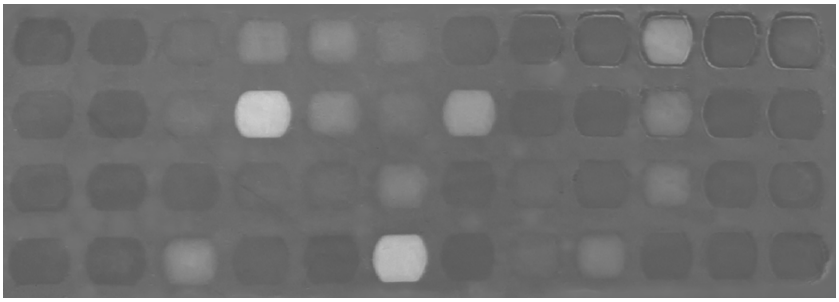
Total assay time including spotting of samples was less than 1,5 hours and the throughput of the assay can be easily increased without affecting the analysis time by increasing the number of spotted sera. Depending on the multiplicity of the spotter that is used, up to several hundreds of samples can be analyzed simultaneously.

The results of the evaluation are shown in the table and figures below. The table shows the qualitative results of both the ELISA and SPR-assay as well as the quantitative results of the SPR-assay (quantitative ELISA data was not available). A very good correlation is obtained between the qualitative results of the ELISA and the SPR results; for the IgG a 100% correlation was obtained whereas for IgM the SPR assay concluded 3 donors being positive where the ELISA had determined them IgM negative, indicating that the MX96 in combination with the SensEye® SARS-CoV-2 protein S1 sensor is more sensitive for this particular assay than the ELISA. Unfortunately, no ELISA IgA results were available for this serum panel.

*Table 1: ELISA and SPR analysis results of the 15 COVID-19 positive donors.*

| | ELISA | | SPR (SensEye G SARS-CoV-2 S1 protein) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | a IgA | | | a IgG | | | a IgM | | |
| | IgG | IgM | RU average | sd | pos/neg | RU average | sd | pos/neg | RU average | sd | pos/neg |
| NC | | | 4 | 2 | | 28 | 25 | | 11 | 3 | |
| NC av. + 5 sd | | | 14 | | | 153 | | | 26 | | |
| donor 1 | pos | pos | 9 | 2 | neg | 484 | 25 | pos | 211 | 2 | pos |
| donor 2 | pos | neg | 58 | 5 | pos | 686 | 30 | pos | 331 | 38 | pos |
| donor 3 | pos | pos | 47 | 1 | pos | 1944 | 3 | pos | 536 | 8 | pos |
| donor 4 | pos | pos | 214 | 21 | pos | 4766 | 463 | pos | 578 | 6 | pos |
| donor 5 | pos | pos | 331 | 6 | pos | 2341 | 204 | pos | 154 | 12 | pos |
| donor 6 | pos | pos | 54 | 3 | pos | 646 | 63 | pos | 1002 | 20 | pos |
| donor 7 | pos | pos | 121 | 8 | pos | 2501 | 406 | pos | 120 | 21 | pos |
| donor 8 | pos | neg | 76 | 8 | pos | 354 | 12 | pos | 56 | 4 | pos |
| donor 9 | pos | pos | 214 | 16 | pos | 1147 | 24 | pos | 296 | 5 | pos |
| donor 10 | pos | pos | 40 | 4 | pos | 590 | 54 | pos | 598 | 25 | pos |
| donor 11 | pos | pos | 87 | 7 | pos | 4916 | 10 | pos | 546 | 7 | pos |
| donor 12 | pos | neg | 4 | 0 | neg | 485 | 19 | pos | 175 | 0 | pos |
| donor 13 | neg | neg | 3 | 1 | neg | 99 | 27 | neg | 25 | 2 | neg |
| donor 14 | pos | neg | 8 | 1 | neg | 307 | 29 | pos | 18 | 6 | neg |
| donor 15 | pos | pos | 13 | 1 | neg | 2712 | 237 | pos | 208 | 0 | pos |

*Figure 1: SensEye® surface image after spotting of the different sera. Lighter spots indicate higher secondary antibody binding to the spotted sera on the sensor surface.*



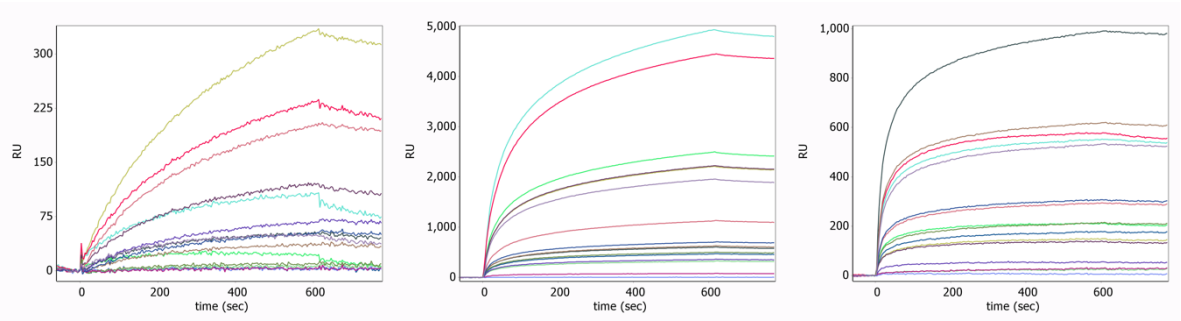



*Figure 2: antihuman Ig interactions with the spotted sera: left: a-hu IgA; middle: a-hu IgG and right: a-hu IgM.*

The results show that the SensEye® G SARS-CoV-2 S1 protein sensor is a valuable research and diagnostics tool. The combination of the IBIS MX96 and this sensor allows very fast analysis of the presence of COVID-19 antibodies in serum samples of a large number of donors. Besides qualitative information also quantitative information is obtained that can be further substantiated by including calibration samples in the analysis. In comparison to an ELISA, use of the SensEye® G SARS-CoV-2 S1 protein sensor yields results on all antibody isotypes in a single assay whereas this requires a separate ELISA for each isotype.