CASE STUDY: HUNT BIOBANK

## TUBEEYE ON TECAN FREEDOM EVO® USED FOR LARGE SCALE BIOBANKING SURVEY

A successful collaborative project between SciRobotics and Bergman Diagnostika to automate blood tube fractionation at the HUNT4 project in NTNU, Norway.

BACKGROUND

The HUNT biobank at the NTNU in Norway is a concerted effort to collect biosamples of up to 70,000 individuals. The goal of this project is to provide different sample material from the same individual for scientific and clinical research projects worldwide. Also part of the project is the collection of relevant background information on the participants with a questionnaire, enabling a better understanding of data retrieved in a potential future study or research project. Samples and the rich dataset including biochemical analysis and extracted DNA is made available for research worldwide.

In 2016 Bergman Diagnostika together with SciRobotics had won a tender to automate blood tube fractionation of the 4th iteration of the HUNT biobanking survey project (HUNT4).
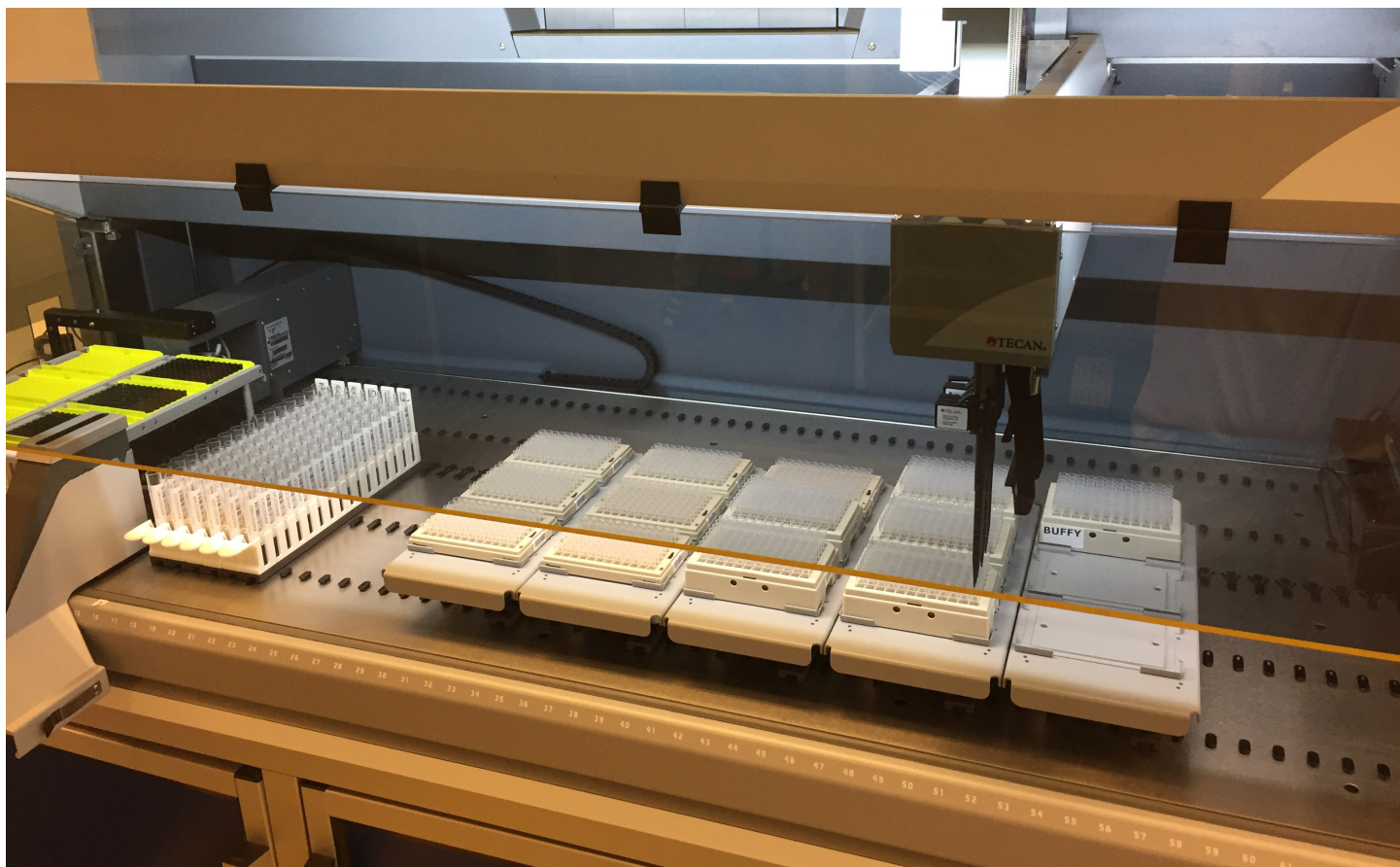
The system is composed of a Tecan Freedom EVO with POSID™ for
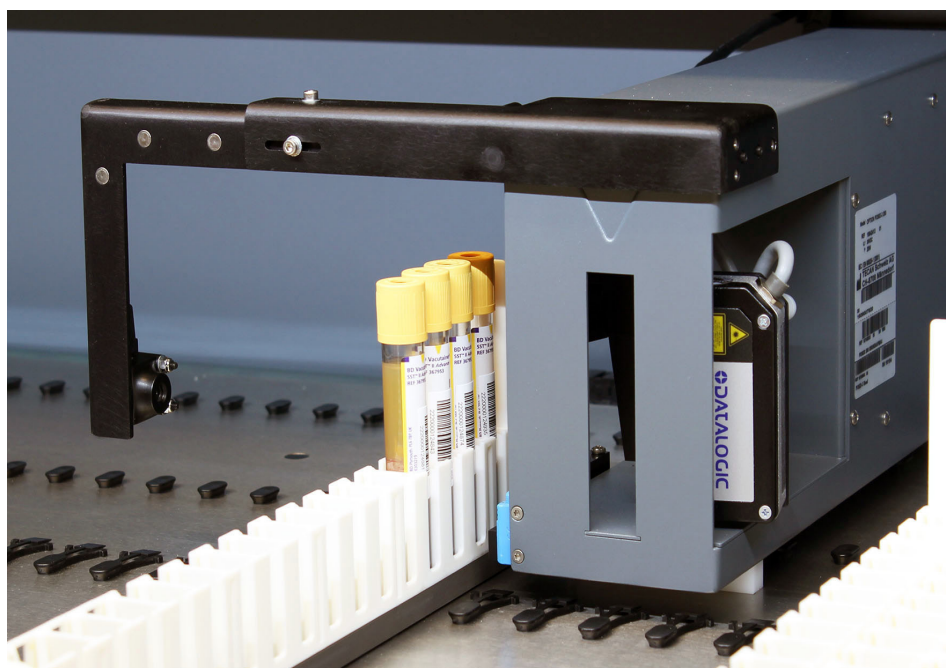
1 TubeEye module attached to the barcode reading PosID module. Barcode labels are read on the right side while the camera images the tubes on the left side.

aliquoting and sample identification and SciRobotics' TubeEye for imaging-based fraction analysis of the blood samples. With up to 70,000 participants in the project, more than 200,000 blood tubes will be analyzed for fractionation over a period of 18 months.

The system is used with SST tubes for serum collection as well as with EDTA tubes, where plasma and buffy coat are collected separately. The buffy coat is then used for DNA extraction (not part of the described system).

MATERIALS & METHODS

The system is comprised of a Tecan Freedom EVO200 with PosID™ module for automatic reading of tube barcodes and the TubeEye module for imaging blood tubes and automatically detecting the separation layers (between the fractions) and the volume of the different blood fractions. In addition the system includes a Ziath 2D barcode reader for tracking secondary tubes. The system processes around 250 EDTA tubes daily in batches of 96 tubes for the separation of buffy coat and plasma and around 100 SST tubes a day.

Before the run start, the user loads 96 de-capped tubes onto the system as well as all secondary tubes – with up to 12 secondary tubes for every primary tube – and selects the profile to be used for processing, either SST tubes or EDTA tubes.

The POSID on Freedom EVO reads the barcodes of all tubes and TubeEye is used to image all tubes. Tube images are analyzed according to the selected profile and the different fractions in the tube are identified and measured. This is used to determine the volume of the serum or plasma fraction which later dictates the number of aliquots prepared. In addition the exact location of the buffy coat is determined to allow its accurate collection with minimum contamination by neighboring fractions.

The user is presented with the images and the results of the analysis and is given the chance for inspection and manual intervention.

Once approved, up to 12 aliquots are made from the plasma or the serum fraction, depending on the available volume.

With EDTA tubes, buffy coat is aspirated using a special technique which moves the tip laterally in a spiral motion while aspirating to collect the buffy coat from the entire surface of it, mimicking the technique used manually. This spiral motion is repeated at various heights inside the buffy coat.

All liquid transfers and sample IDs are tracked and all images are saved and are available for auditing.
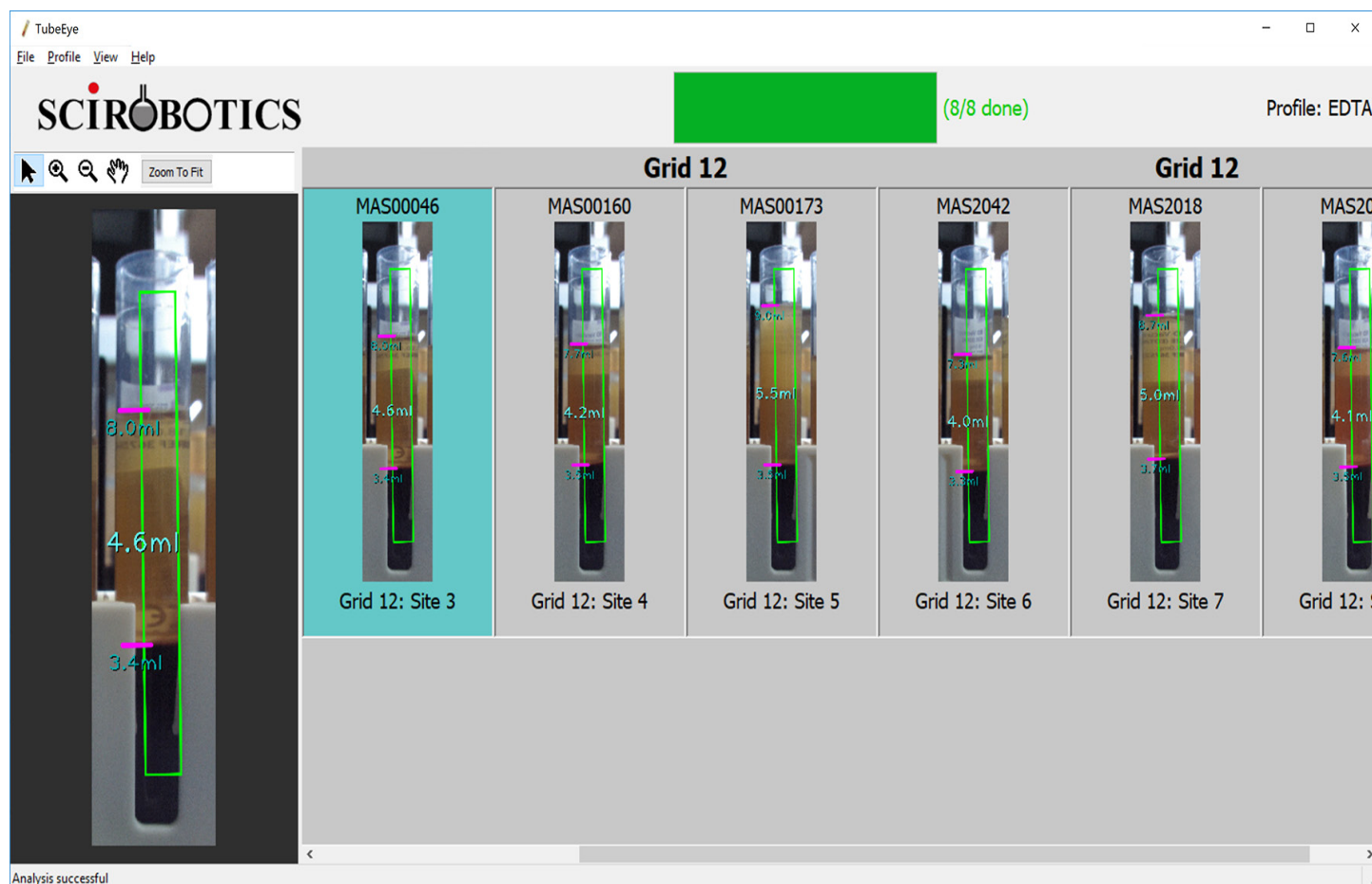
RESULTS

The system finished validation and entered production mode in September 2017 and in the 9 months to May 2018 30,000 participants and around 90,000 tubes have been processed. By February 2019 the project goal is to finish surveying 70,000 participants.

The automatic analysis of the tube images is fast and reliable. Reading and analyzing 96 tubes takes less than 5 minutes after which the user is presented with the results before proceeding to the sample distribution. The process is reliable and users report 99% of the tubes are analyzed correctly with the rest adjusted manually during the inspection phase.

An entire run to process 96 samples of EDTA tubes including plasma aliquoting and buffy coat separation takes around 90 minutes. Processing of 96 SST tubes for serum separation takes only 60 minutes per run.

DNA extractions from buffy coat collected yielded an average of 13µg of DNA/ml.

3 TubeEye software showing multiple tube images with the results of the analysis. The user can manually adjust the automatic analysis where needed. All results and manual interventions are recorded.

CONCLUSIONS

TubeEye on the Tecan Freedom EVO platform can be used successfully for high throughput blood tube fractionation with good reliability. So far all HUNT4 project users were very satisfied with the system and the results.

Nina Hammer and Elin Kyllo have validated the system and have been using it for the last 9 months.

"The Tecan system with the TubeEye module have been performing great, processing all samples with hardly any problem. We have had very little issues throughout. It's really easy to work with and really, we have no complaints." Elin concludes.

The TubeEye* is a SciRobotics product. The Freedom EVO is provided by Tecan.

*For Research Use Only

Not all products might be available in all countries.