



HOW TO IMPROVE CIRCULARITY VIA THE LATEST SORTING TECHNOLOGIES?

PolyPerception – Artificial Intelligence

Nicolas Braem

Introduction

Mission

Increase sorting performance through the power of [actionable data](#) and [automation](#) by leveraging [Artificial Intelligence](#)

Focus

Analysis of lightweight packaging for [sorting plants](#) and [recyclers](#)

When

Started in March 2021. Based in Antwerp, Belgium.

Team

3 co-founders

4 AI engineers, 1 Installation and hardware engineer, 1 Operations analyst



Why we analyze waste streams?

The value added for our customers falls across 3 broad areas: compliance, commercial decisions and improving operational efficiency.

Compliance

Complying with mandated legislation:

- food vs non-food (EFSA, FDA)
- local legislation (for e.g. Swiss legislation for PET bottles)

Value add 

Commercial

Assess the quality of material to help make purchasing or selling decisions:

- input and supplier analysis
- output quality analysis

Value add 

Operational efficiency

- Maximize purity & recovery rate (composition analysis)
- Maximize uptime and throughput (flow analysis)

Value add 

How does it work?

1

Cameras installed at key points

2

Deep Multi-Object Tracking and Classification (AI)

3

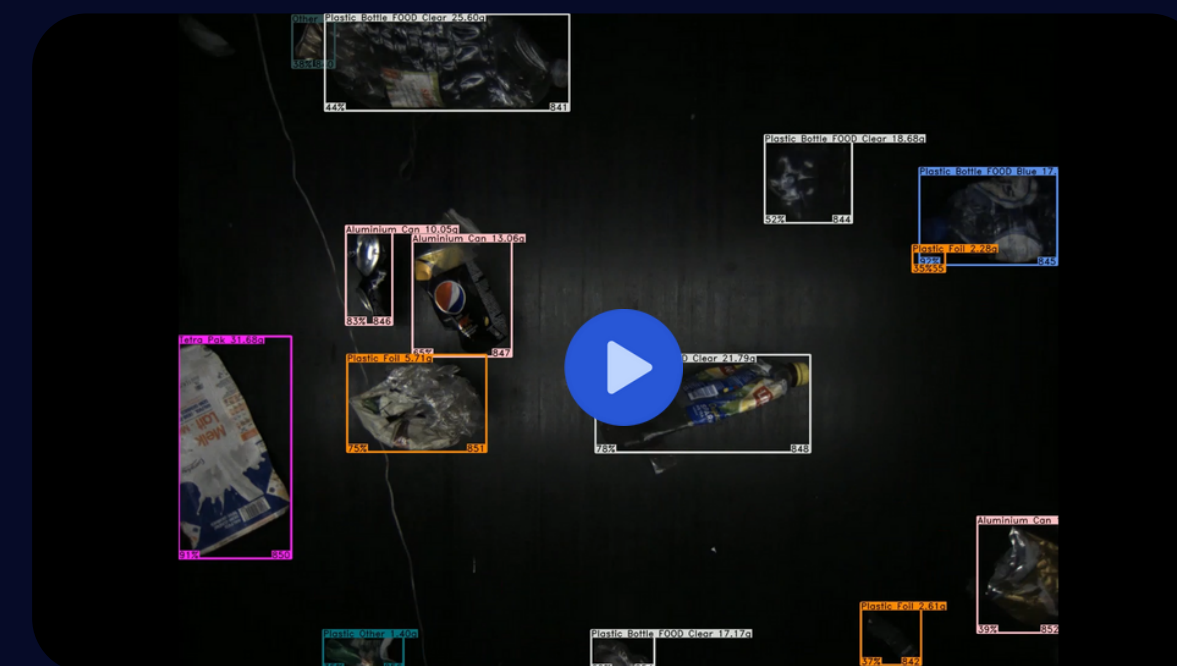
Learns continuously
(semi-supervised)

This means easy
adaptation to a new facility

Our dataset has a wide variety in material and context from all customers we already installed

Continuously collect, train and test data from each customer

Frequent validation effort where it's possible to compare data to the manual sampling



Installations and hardware



Easy to install and no
maintenance

Designed and installed by
PolyPerception

Retrofit without any
infrastructure changes

PolyPerception Platform

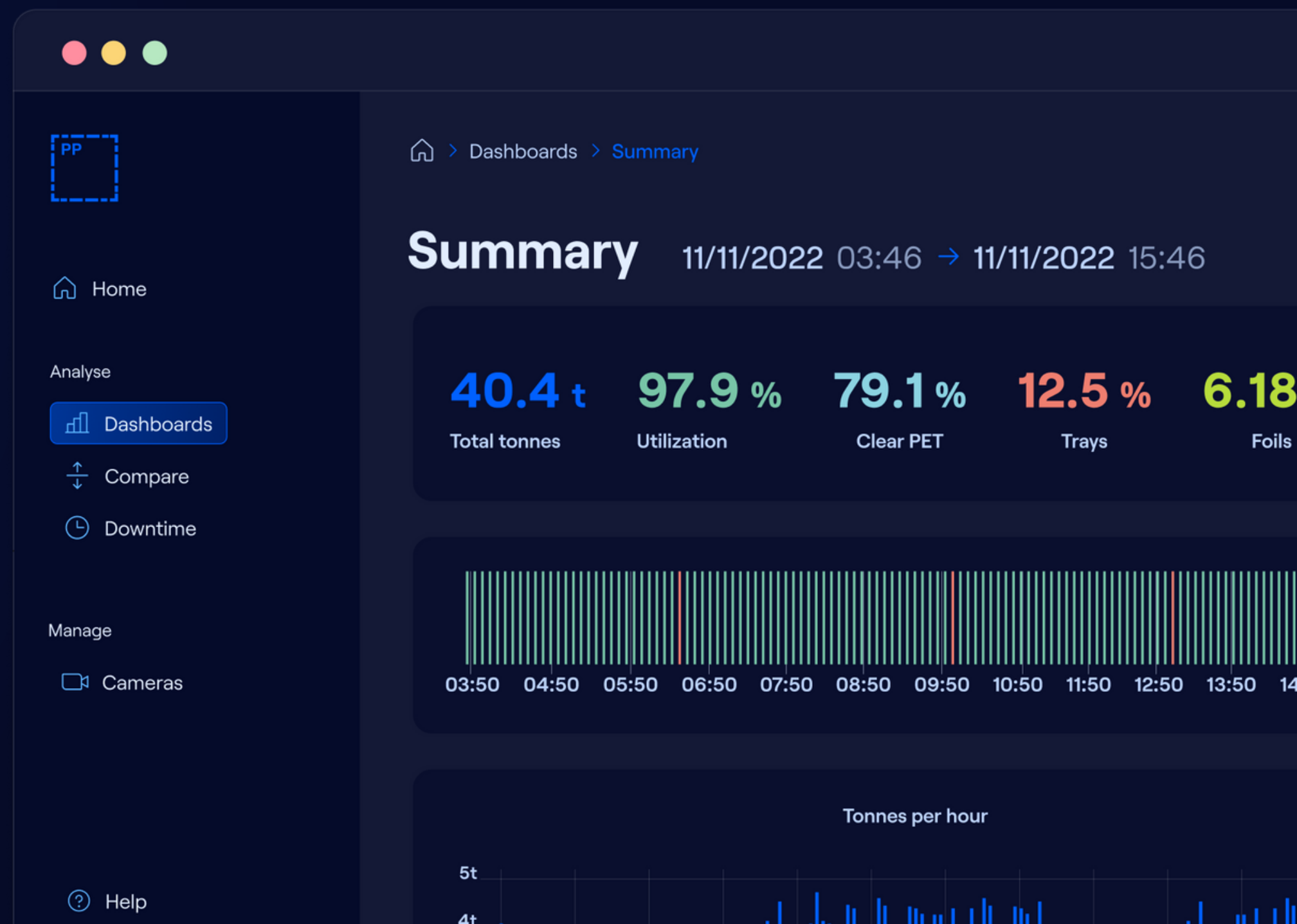
The platform has been designed to be intuitive and easy to use.

Approach

- We've built features on the platform so the customer can build trust in the data
- We iterate fast → weekly over-the-air updates
- Cloud infrastructure to support growth

Key features

- Real-time dashboards
- Alerts and reporting
- View stream recordings
- Object-level search
- Mass estimation using ML



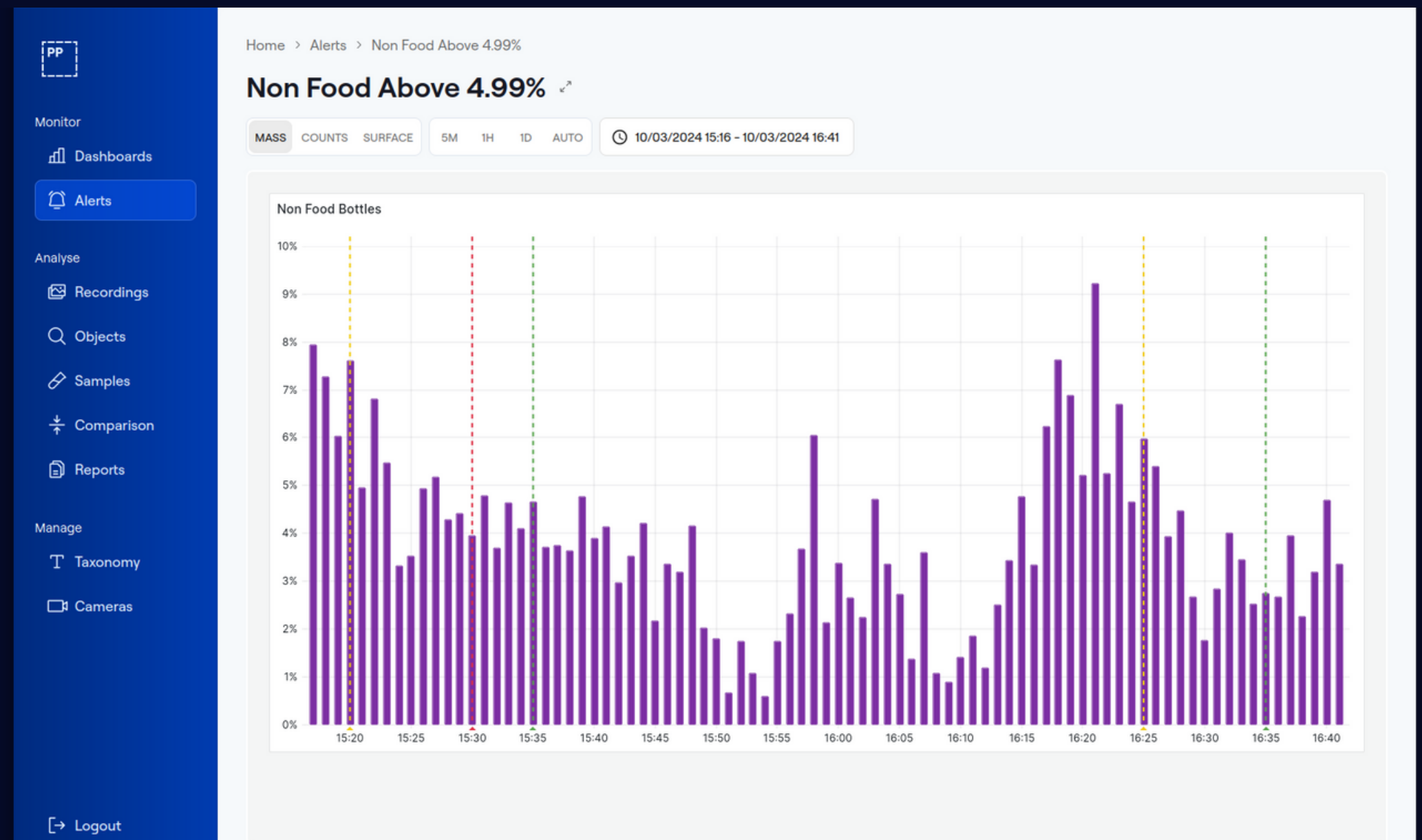
Use case: Compliance

Use the PolyPerception platform to easily measure and comply with food vs non-food regulation (EFSA, FDA) or regional legislation.

Food vs non-food

Pain points of today's solution:
manual sampling is slow and expensive, and small samples are not representative.

Dutch recycler mixing DRS stream
with curb-side material to target 95%
food content



Use case: Commercial

Easily assess the quality of material by supplier to help with commercial decisions, and to influence a stable mixing process.

Assess supplier material

Pain points of today's solution:
manual sampling is slow and
expensive, and small samples
are not representative.

Swiss recycler expanding to non
Swiss material needs to assess new
suppliers.

Monitor increasing White Opaque
PET in Clear PET stream.

The screenshot displays the PP (Perception) web application interface. On the left is a dark blue sidebar with a 'PP' logo and a menu structure:

- Monitor
 - Dashboards
 - Alerts
- Analyse
 - Recordings
 - Samples
 - Comparison
 - Reports
- Manage
 - Taxonomy
 - Cameras
- [→] Logout

The main content area is titled 'Objects' and shows a grid of 24 images of waste material. Each image has a white bounding box around a detected object. Above the grid, there is a header with the following elements:

- Breadcrumbs: Home > Objects
- Search/Filter: 279 objects found
- Filter: Bottles White Opaq
- Camera Selection: All cameras
- Time Range: LAST 12 HOURS

Use case: Operational Efficiency

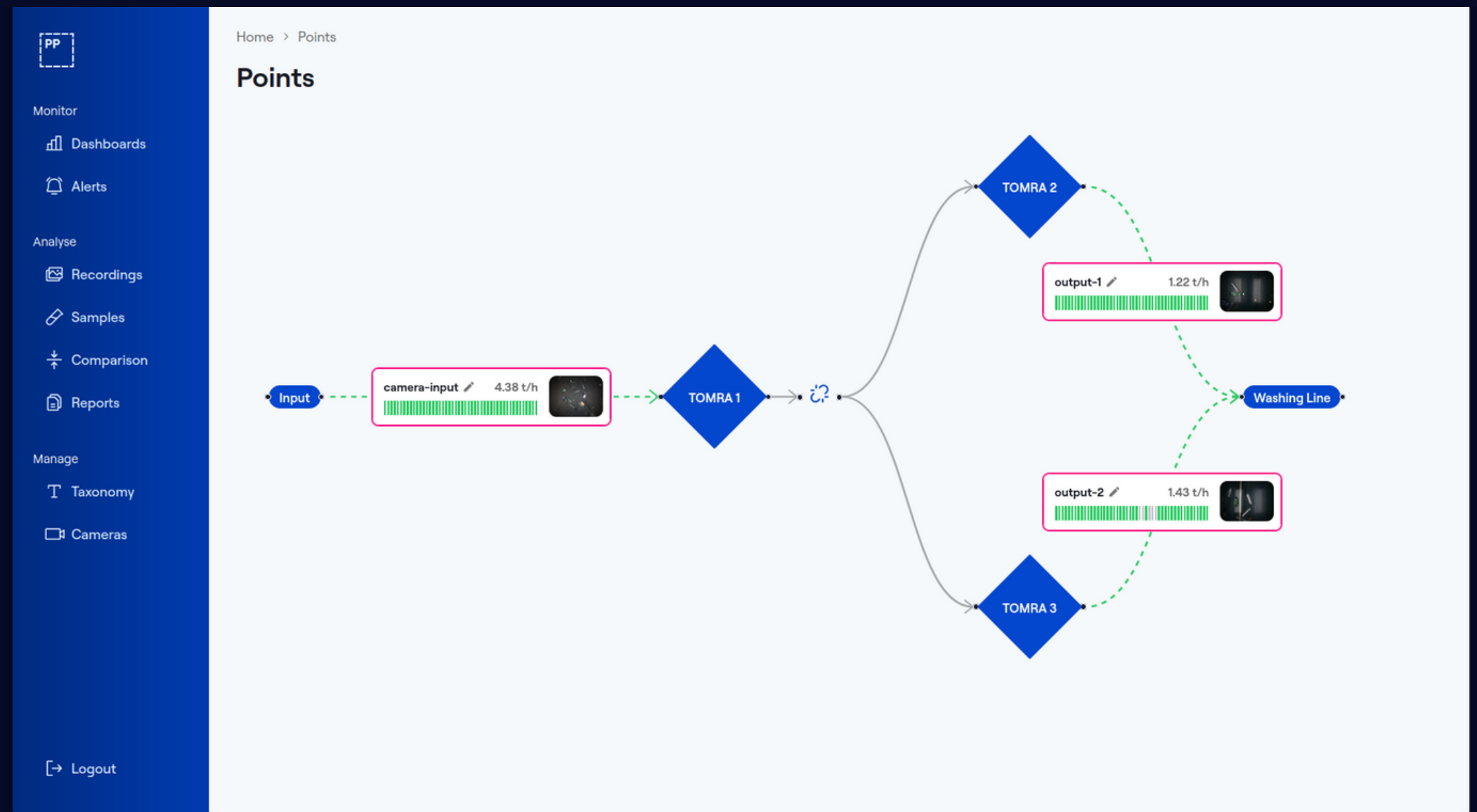
Measure output quality and yield loss to calculate sorting efficiency. Use these insights to improve the sorting performance of the optical sorters.

Maximize purity & recovery

In development

Pain points of today's solution:
no easy way to measure purity,
yield loss and recovery rate, and
to adapt the sorters.

Swiss recycler has 1 system at the
input and 2 at each output before
washing line.



Accuracy and Limitations



Accuracy of existing installations

At current installations, we have been able to achieve and validate the following performance:

tracking and detection: 95-99%

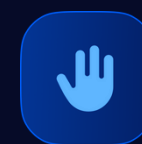
target : 99%

classification: 80-98% (depending on the material)

target : 95%

mass estimation: $\pm 10\%$ error rate

target: $\pm 5\%$



Limitations

Dense belts - If objects are completely covered, we cannot detect and identify them.

Vision vs NIR - Using vision only means that objects that look identical but are made of different materials are not differentiated by our system, for e.g. PLA and PET.

Partnership with TOMRA Recycling



In December 2022, we announced a partnership with TOMRA Recycling.

Why?

Provide customers with a holistic end-to-end analysis of their sorting processes on one platform, using data from both TOMRA machines and PolyPerception systems.

Areas of focus

TOMRA Recycling focuses DL for sorting, while PolyPerception focuses on DL for analysis.

Working towards...

Integration of the PolyPerception data in TOMRA Insights, so customers have one go-to platform with all their useful data.

Let's talk trash



+32 (0) 489 91 70 71



nicolas@polyperception.com



www.polyperception.com



Nicolas Braem
Co-founder & CEO