

**Ian Smith**  
2022

A photograph of industrial machinery, likely a conveyor system or sorting equipment, with blue and yellow components. The image is partially obscured by a blue geometric overlay.

# THE SAMURAI AND THE IMPACT OF AI IN THE DESIGN OF A MRF



Business Development Manager in UK from February 2017

Worked on several multi-million-pound turnkey Material Recovery Facility (MRF) installations within Europe, including the 4.0 MRF to be delivered in Coventry.

- Consultancy work ranging from small projects for independent companies through to larger projects for major waste management companies, councils, and local authorities.
- Managing teams of project managers, engineers, and officers with a wide range of experience and ability.
- Proven ability to complete projects on time and on budget.

# SORTING TECHNOLOGY EVOLUTION

2010-2022



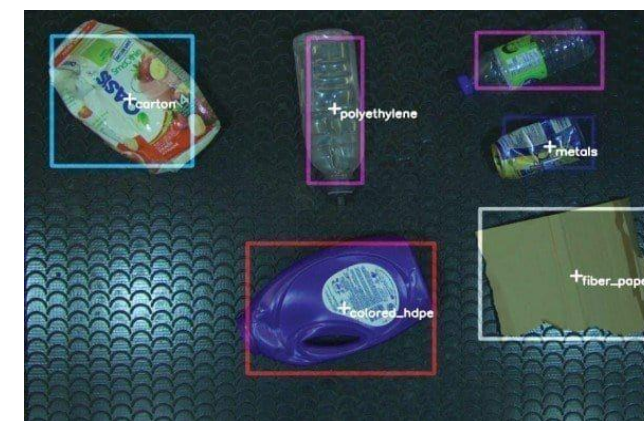
Balers



Optical sorters



Sorting robots



AI

PLANT START-UP: **Q1 2023**

## Coventry, Sherbourne Ressource Park, UK

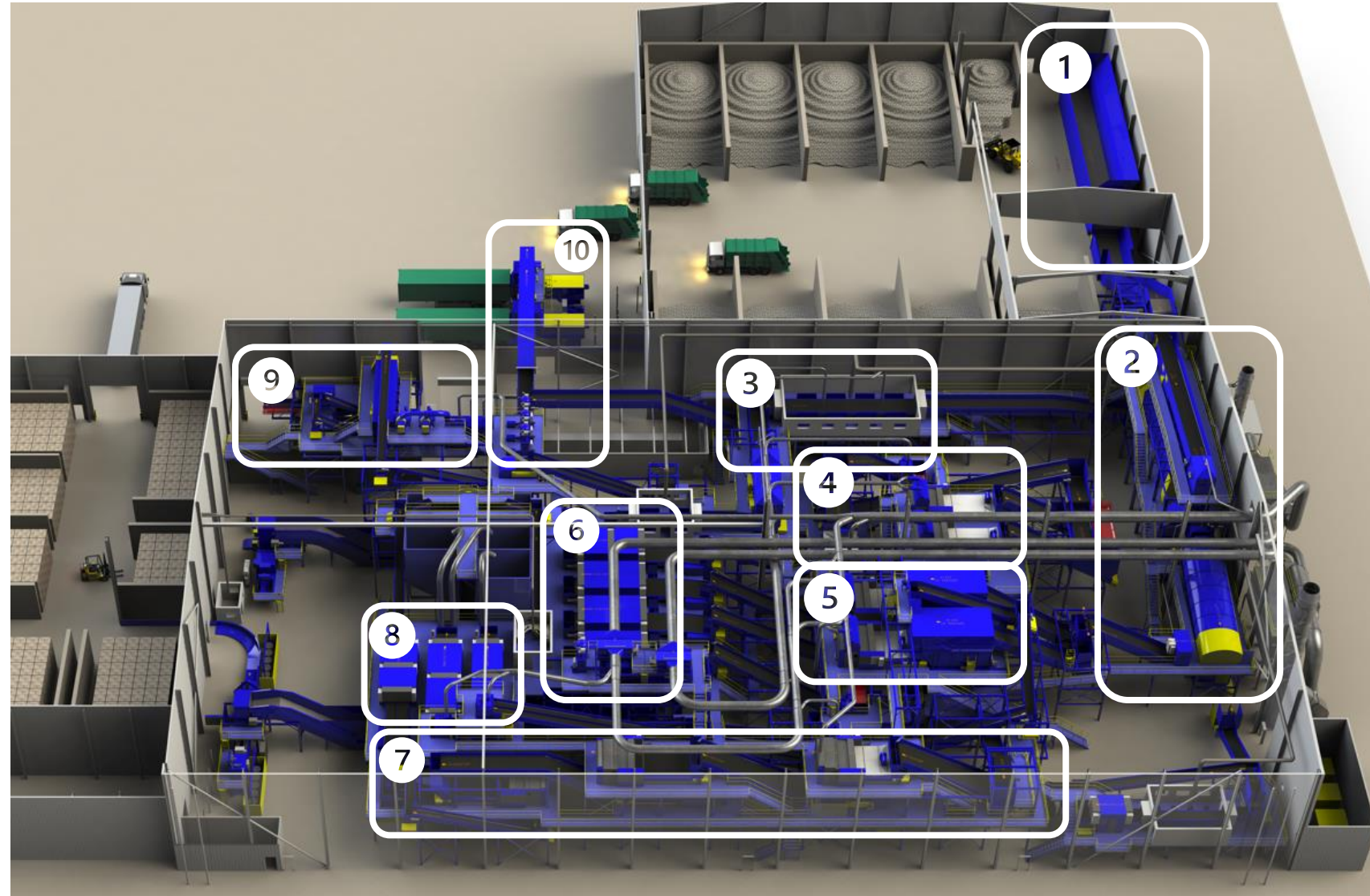
- **175,000** tonnes per year, curbside collected DMR
- **47.5 TPH**
- Equipment investment: **55M\$**
- Fibre purity: **>99%**
- Plastics and metals purity: **> 99%**
- Recyclable recovery rates: **> 95%**
- 18 robots / 14 optics/ 5 sorters
- AI at the heart of the operation



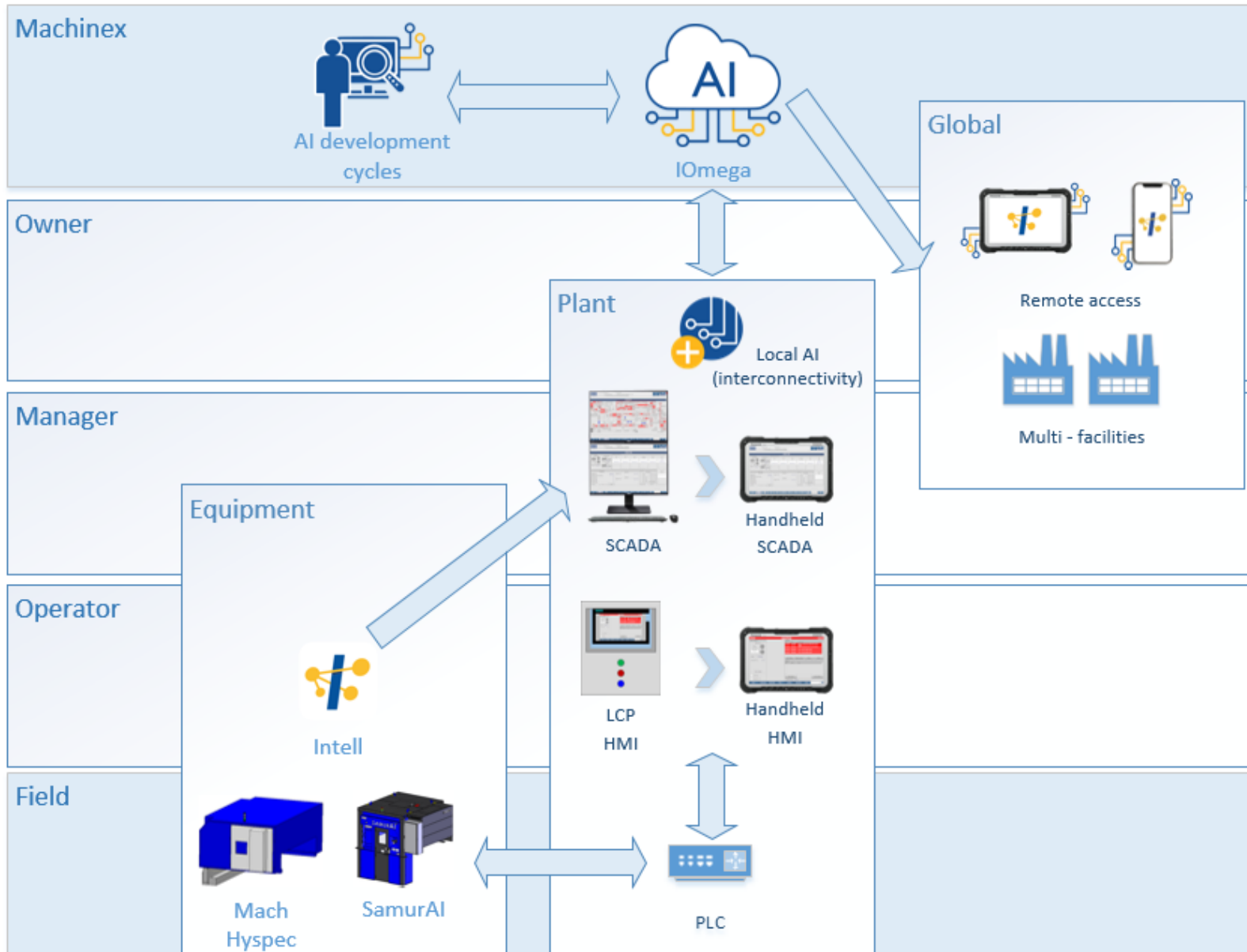
# KEY ELEMENTS OF SEPARATION



- 1) INFEED
- 2) SEPARATION BY SIZE
- 3) PRE-SORT + OCC
- 4) NEWS & PAMS (5 x OS)
- 5) MIXED PAPER (4 x OS)
- 6) FIBRE QC (10 x ROBOTS)
- 7) METALS & PLASTICS (5 x OS)
- 8) CONTAINERS QC (8 x ROBOTS)
- 9) GLASS (1 x OS)
- 10) RESIDUE MANAGEMENT



# MACHINEX VISION - MRF 4.0



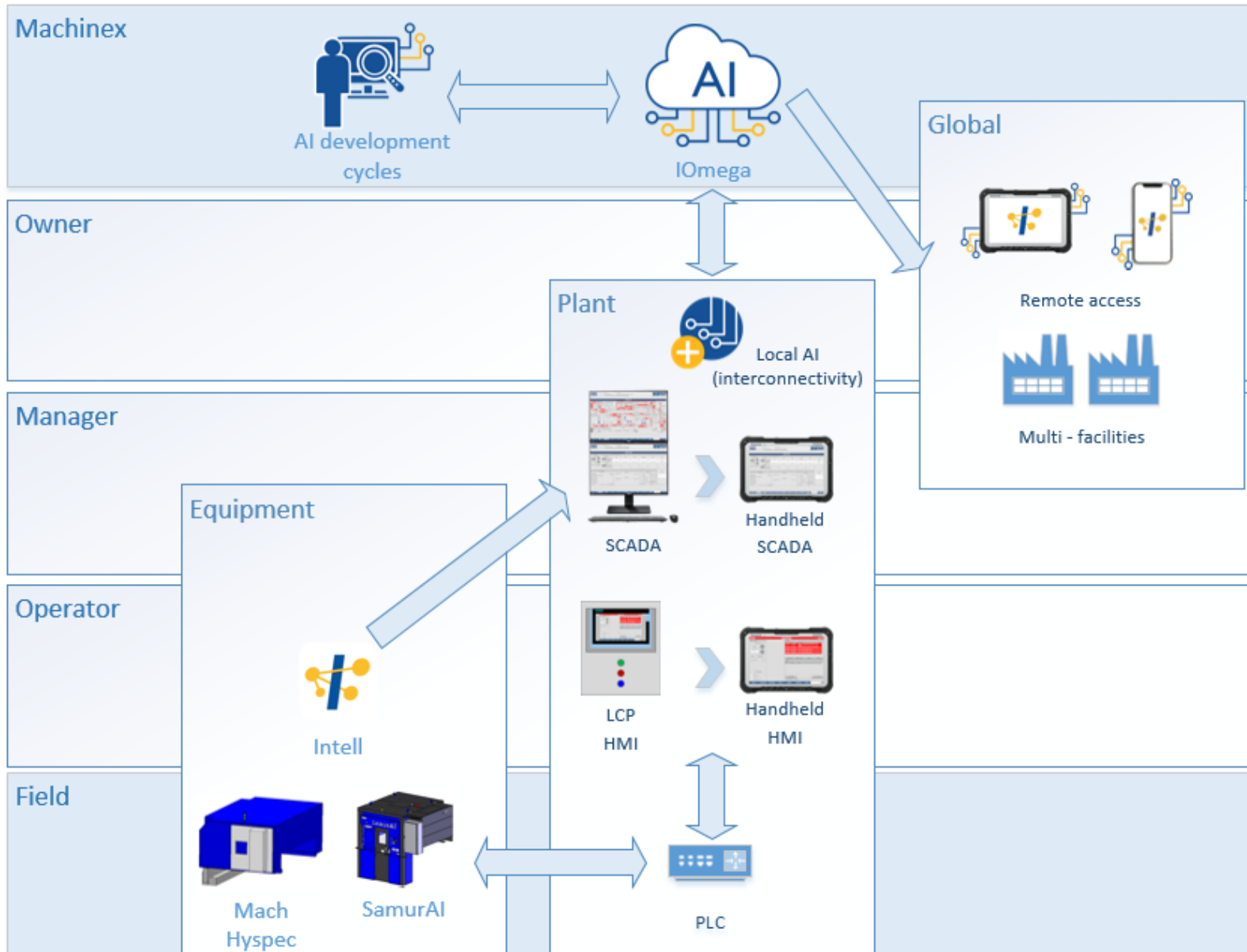
## FULL SCADA SYSTEM



## MACH PAD CONTROL



# MACHINEX VISION - MRF 4.0



## FULL SCADA SYSTEM



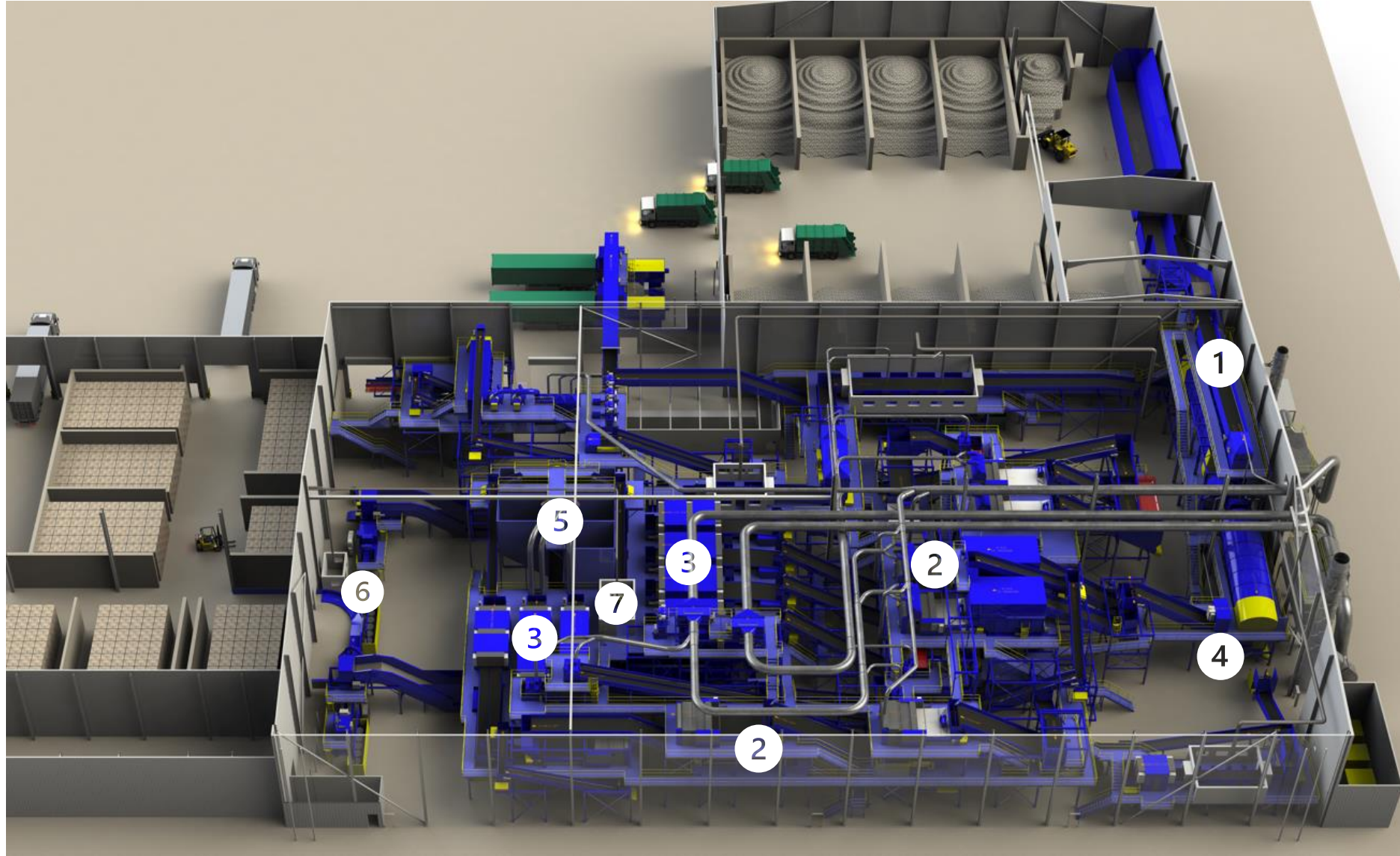
## MACH PAD CONTROL



# WHERE / HOW TO CAPTURE INFORMATION?



- 1) SCALE
- 2) HYSPEC INTELL
- 3) SAMURAI INTELL
- 4) MACH VISION
- 5) STORAGE BUNKERS
- 6) BALE MANAGEMENT
- 7) SCADA



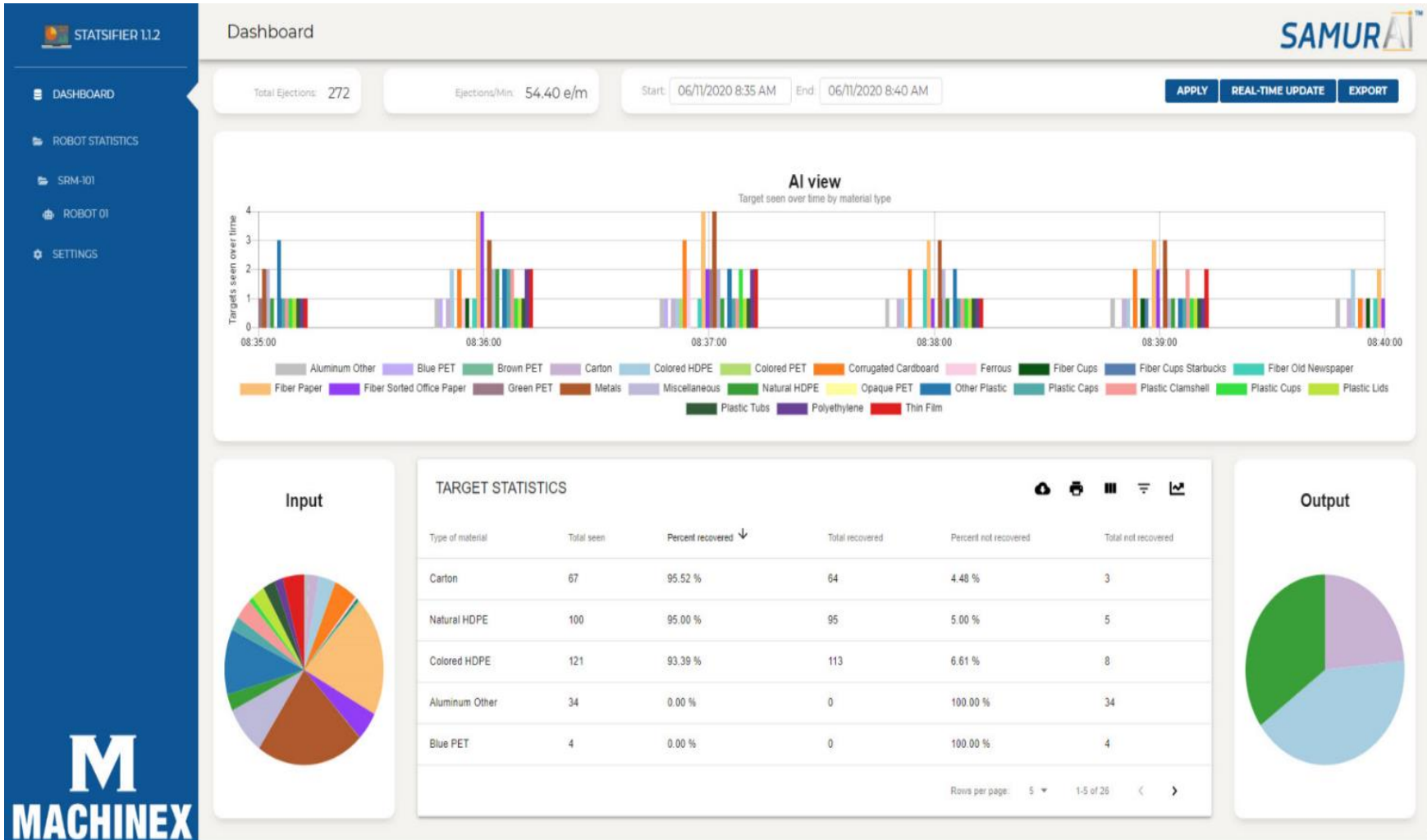




**COMPOSITION OF INPUT MATERIALS**

## BELT COVER





## INFORMATION CAPTURED

- Incoming material composition
- Outgoing material composition (in bunkers)
- Robots performance (pick/min, % recovery, etc.)

## OBJECTIVES OF SCADA

- **Gathers all information captured** by different platforms
- **Generates dynamic information** (power monitoring, equipment status, belt speed, etc.)
- **Generates production reports**
- **Generates alarms** and is the cornerstone of machine control



# WHAT TO DO WITH THE INFORMATION?

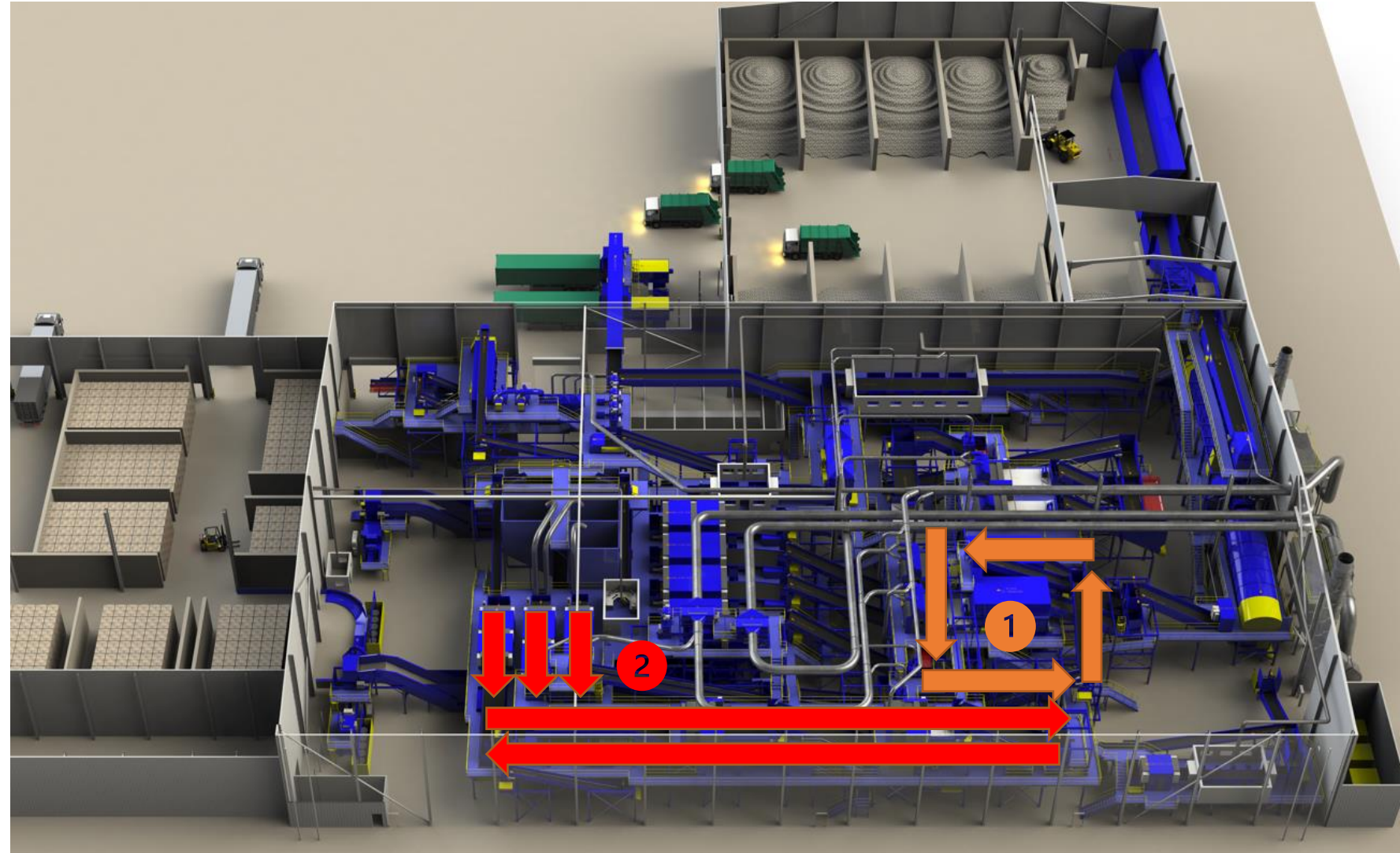


## MACHINE CONTROL (3 DEVELOPMENT LOOPS)

- **Phase #1** = Decision support/alarms
- **Phase #2** = Automation programming (local AI)
- **Phase #3** = AI machine control (IOmega)

## AUTOMATION OF THE 5 RECIRCULATION LOOPS

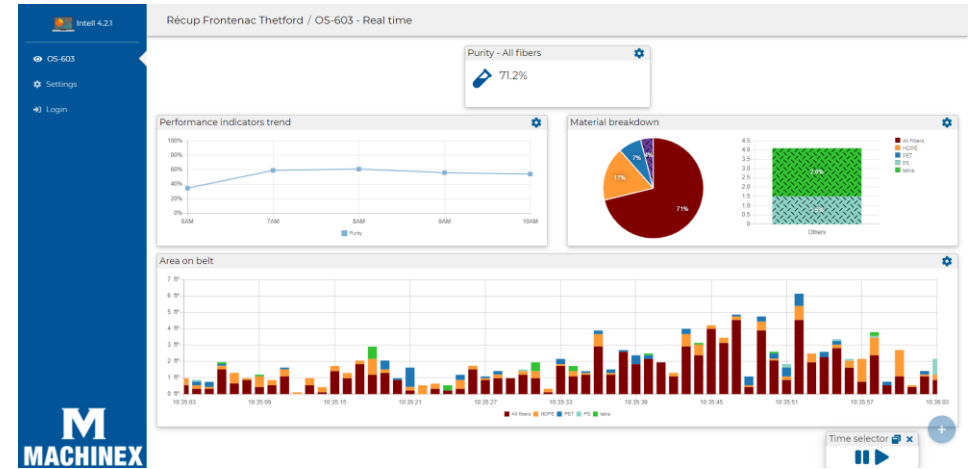
- **#1** = Fibre loop
- **#2** = Containers loop



## MACH VISION



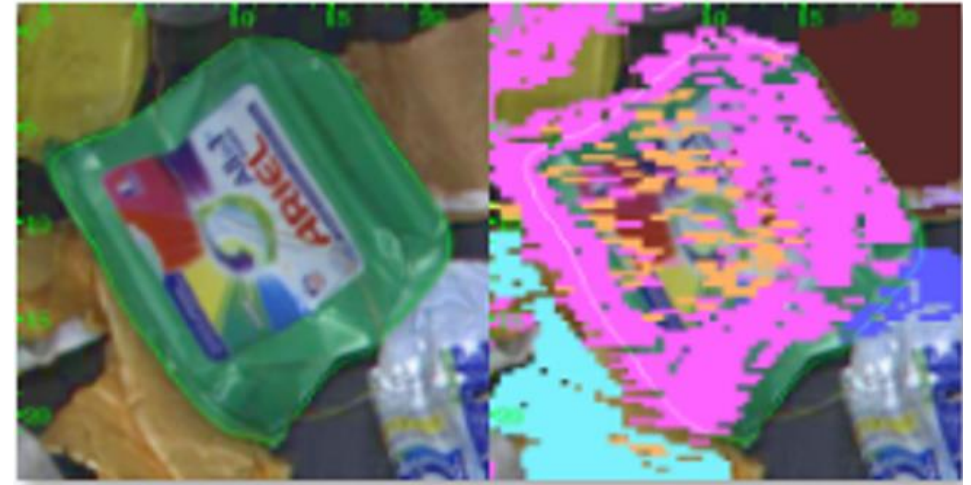
UNDERSTAND YOUR  
MATERIAL STREAM  
COMPOSITION  
IN REAL TIME



- Flow composition
- Volume per material type
- Material trends per given period
- Total material seen

## MACH HYSPEC<sup>®</sup> (VIS/NIR + IA)

3 TYPES OF TECHNOLOGY COMBINED TO  
OBTAIN INCREASED PERFORMANCE



- Artificial intelligence integrated into optics:
  - **Deep learning** (image recognition)
  - **Machine Learning** (material recognition)

## SAMURAI<sup>®</sup>

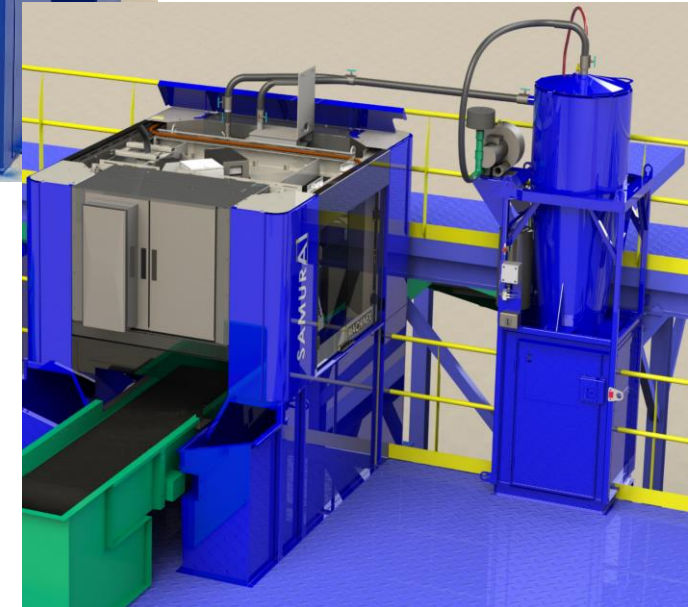
- Reduced labour, managing costs & HR challenges
- Up to 70-80 picks per minute, nearly double the average pick rate of a human sorter
- Up to 90-95% efficiency of targeted products, recognition & recovery
- Ongoing evolution & optimisation of the AI material recognition



## LATEST UPDATES SAMURAI – ROBOTS

- Continuous improvement of **neural networks** (280 million images captured in the last year)
- New hose holder design
  - Increased life cycle (300k to 5.0M cycles)
- New **air cannon** design
  - Reduces down time & increases availability
- **Remote control panel**
- **Moving optimisation** (70-80 ppm)
- Connection of **2 robots / cyclone**
- Supply of an **endless screw** for the cyclone

(280

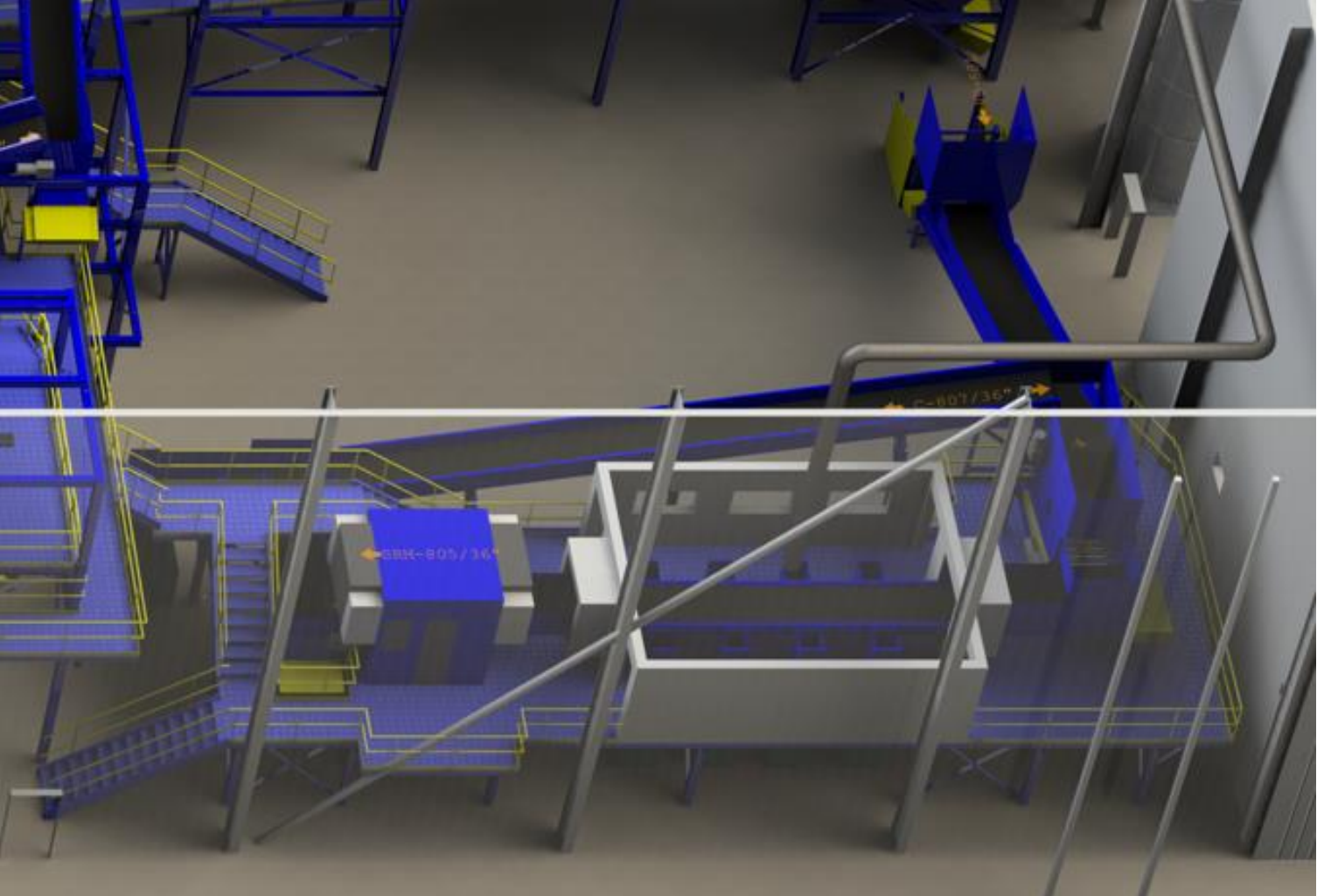




# MACHINEX NEW PRODUCT IN COVENTRY



## SEMI-AUTOMATIC SAMPLING LINE



# WHY INVEST IN 4.0?



## CHANGES IN STRATEGIES

- Extended Producer Responsibility (EPR)
- Deposit Return Scheme (DRS)
- New outlets

## COMPOSITION CHANGES

- Amazon effect / COVID-19 / new packaging

## LACK OF LABOUR

- Job positions difficult to fill

## CONSISTANCY OF PRODUCTION

- Outgoing quality and recovery rates optimised & stable over time
- Less expertise required to optimise MRF operation
- Better predictability and scheduling of required maintenance





## UTLIMATE GOAL: 24/7 FACTORY OPERATION WITHOUT MANUAL SORTING OR HANDLING

### Full automated plant requiring little labour

- Interconnectivity and automatic plant adjustments
- Analysis of data flow and system performance
- Predictive maintenance for upkeep and breakdowns.
- Brands and logo recognition.
- Automation of manual operations (including pre-sorting, bales management and incoming materials, etc...)
- Temporary buffer zones to regulate equipment's tonnage



## THANK YOU FOR YOUR ATTENTION

For any questions or further information, or if you are interested in joining the team, please do not hesitate to contact me directly.

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