



PIONEERING DIGITAL WATERMARKS FOR SMART PACKAGING RECYCLING IN THE EU

Digital Watermarks
Initiative HolyGrail 2.0



CIRCULAR ECONOMY

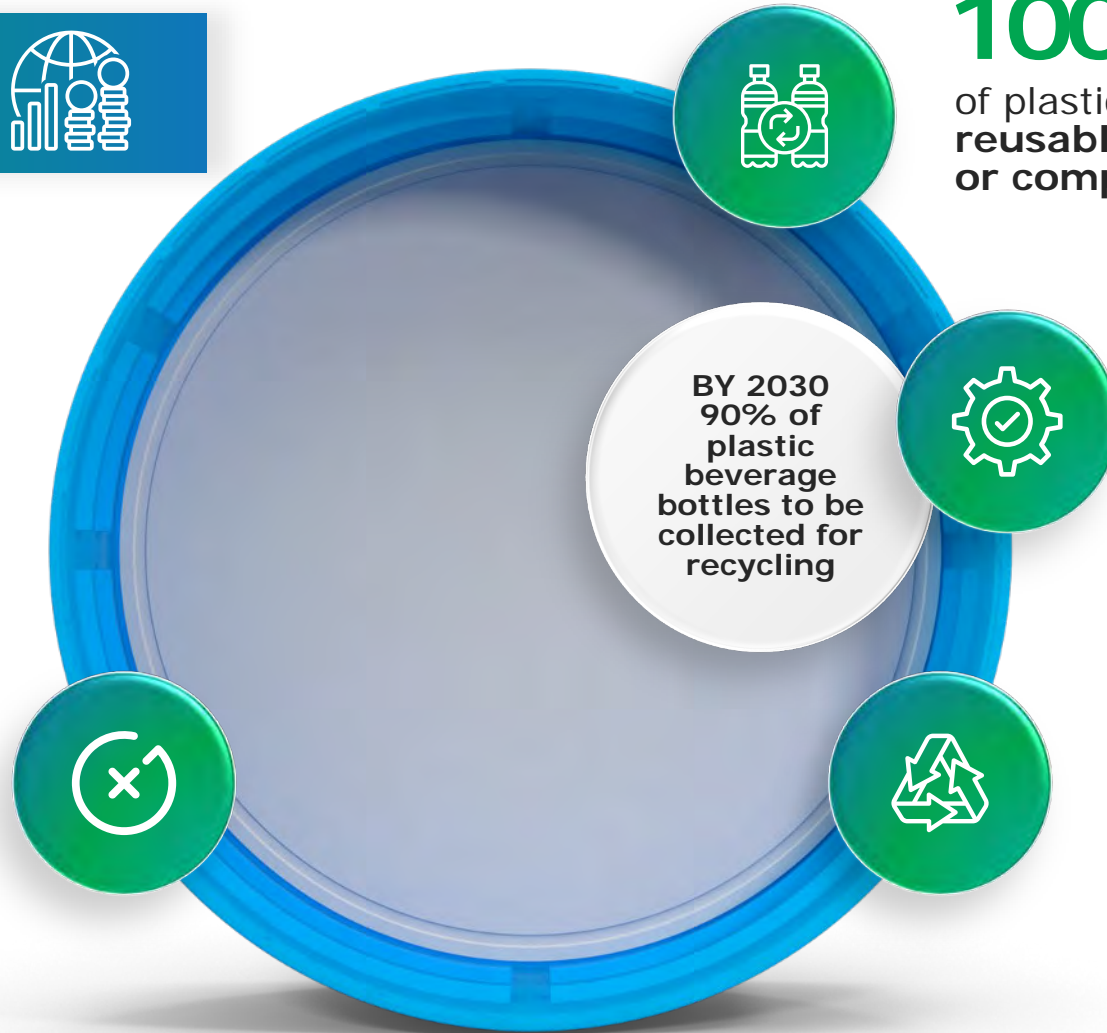
FOR PACKAGING



FACING THE NEW
CIRCULAR REALITY



Eliminate problematic
or unnecessary
**single-use
plastics**



BY 2030

100%

of plastic packaging to be **reusable, easily recyclable, or compostable**

BY 2030

55%

of plastic packaging to be **effectively recycled**

BY 2030

30%

average recycled content across all plastic beverage bottles

CIRCULAR ECONOMY

FOR PACKAGING

How can we achieve a Circular Economy for Packaging in the EU?



One of the biggest challenges is how to **maximize our resources** through optimal sorting and recycling



We need to **better sort our post-consumer waste in the EU waste management systems** by accurately identifying (plastics) packaging, resulting in more efficient and higher-quality recycling

CIRCULAR ECONOMY

FOR PACKAGING

Digital watermarks for smart packaging to **revolutionise the way packaging is sorted**

Opens **new possibilities** currently not feasible with existing technologies



CIRCULAR ECONOMY

FOR PACKAGING



September 2020: Under the auspices of AIM, European Brands Association, [85+ companies and organisations](#) from the complete packaging value chain have joined forces

Objective: Prove the viability of digital watermarking technologies for accurate sorting and the business case at large scale

Website: www.aim.be/priorities/digital-watermarks

CIRCULAR ECONOMY

FOR PACKAGING

2nd iteration of the **Pioneering Project HolyGrail 1.0** led by the Ellen MacArthur Foundation 2016-2019

HolyGrail 1.0 investigated [different innovations to improve post-consumer recycling](#) (digital watermarks & chemical tracers)



Digital watermarks were found to be **the most promising technology**, gathering support among the majority of stakeholders and passing a basic proof of concept on a test sorting line



Background



Pioneering

DIGITAL WATERMARKS

for smart packaging recycling

IN THE EU





HOLYGRAIL 2.0 Membership



WHAT ARE Digital Watermarks?

- ▶ Imperceptible codes, the size of a postage stamp, covering the surface of a consumer goods packaging
- ▶ Able to carry a wide range of attributes (e.g. manufacturer, SKU, type of plastics used and composition for multilayer objects, food vs. non-food usage)

LOOKS LIKE THIS ◀



WHAT ARE Digital Watermarks?

BEHAVES
LIKE THIS ◀

- ▶ Imperceptible codes, the size of a postage stamp, covering the surface of a consumer goods packaging
- ▶ Able to carry a wide range of attributes (e.g. manufacturer, SKU, type of plastics used and composition for multilayer objects, food vs. non-food usage)



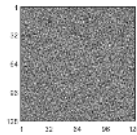
Digital Watermarks @work

FOR PRINT



01

Repeated Tile



02

Pieces of multiple tiles can be combined to recover a Barcode

03

The encoder applies the tiles to graphics in a mosaic manner

04

Uses existing pixels
No special inks
No special printing process



Exaggerated view for illustration purposes

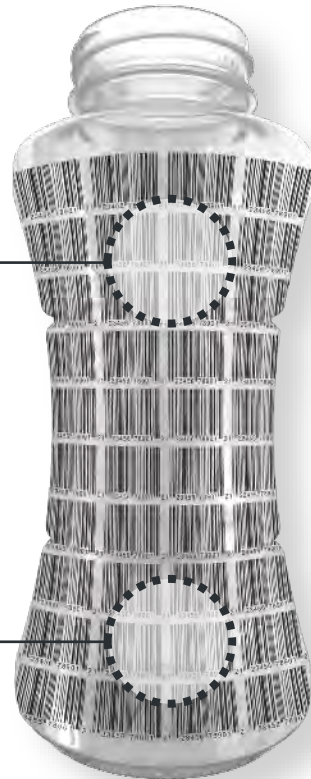
Digital Watermarks @work

FOR MOLDS



Micro-topological variations in substrate create signal tiles

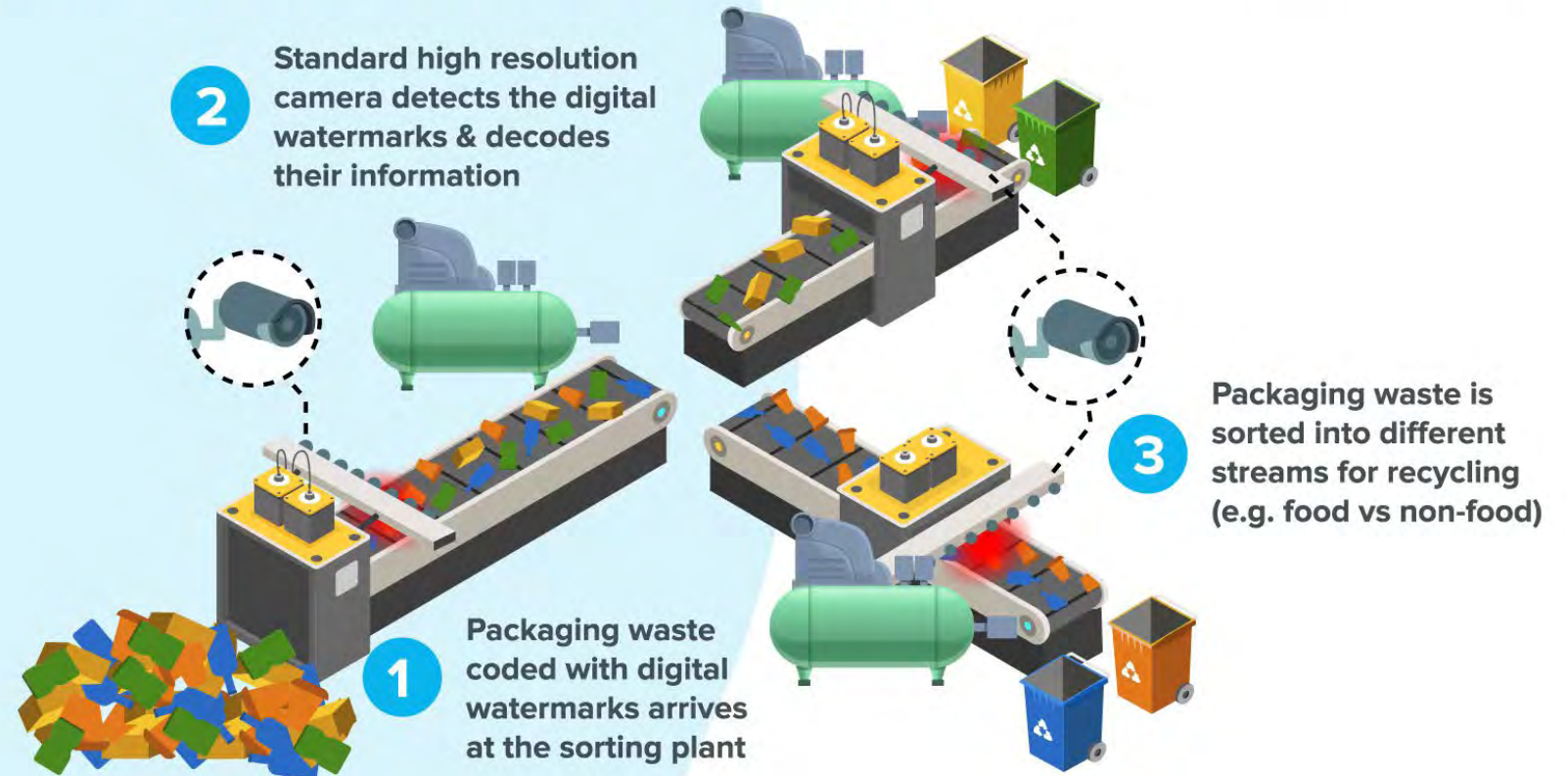
Works in variety of mold types



HOW DO DIGITAL WATERMARKS WORK ON A SORTING LINE?



SMART PACKAGING SORTING FOR A CIRCULAR ECONOMY



HOLY GRAIL 2.0



3 FOCUS AREAS

01

A close-up of a white robotic hand reaching out, with glowing orange nodes and lines representing a network or data flow in the background.

Intelligent
Sorting

Reject
Add
Divide

02

A background of vertical columns of binary code (0s and 1s) in white and blue, creating a digital data stream effect.

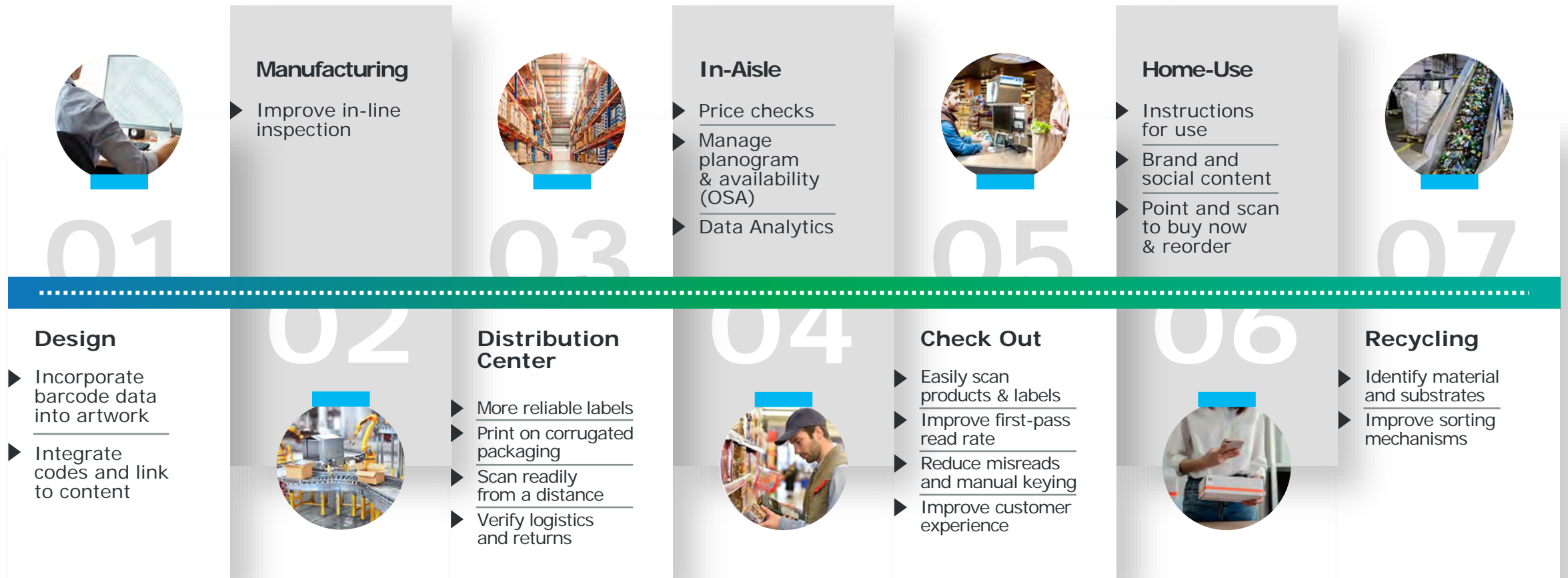
Data
Mining

03

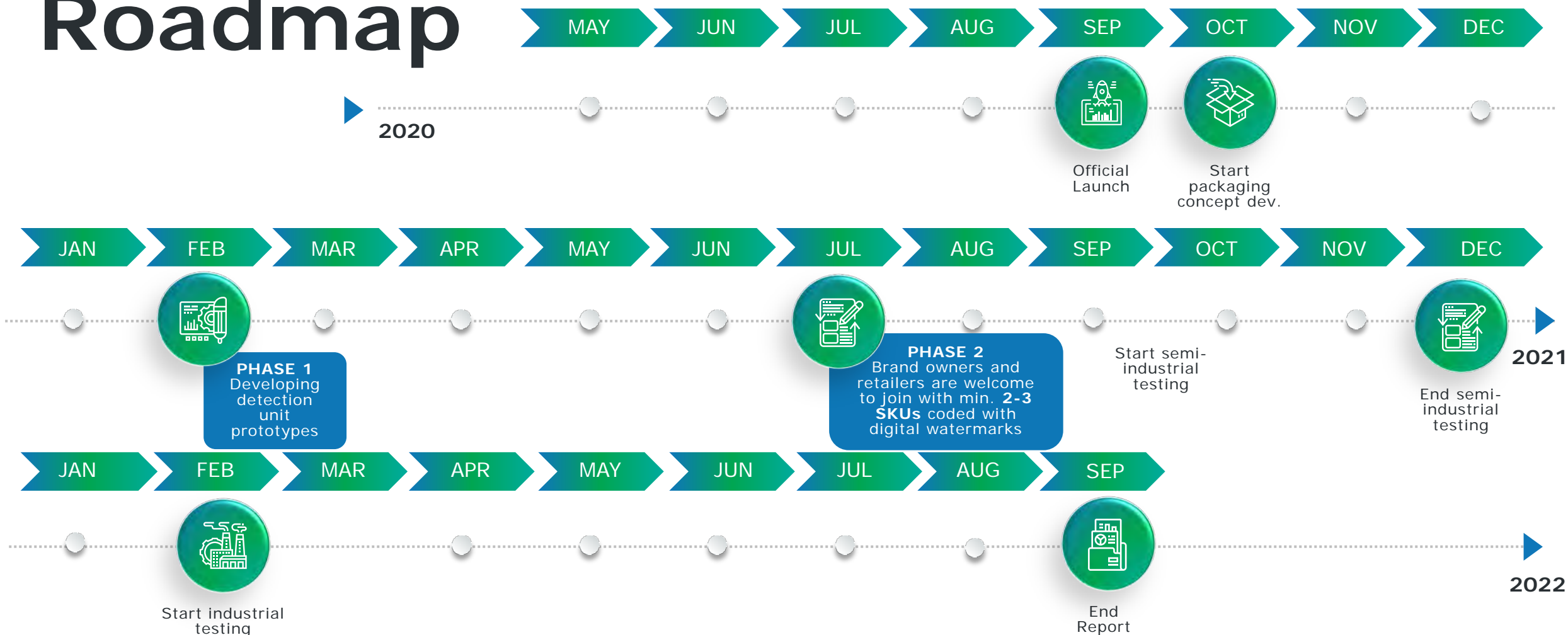
Two women, one with dark hair and glasses, the other with blonde hair and glasses, are looking at a laptop screen together in an office setting.

Consumer
Engagement

POTENTIAL BENEFITS OF DIGITAL WATERMARKS across the package life



Roadmap

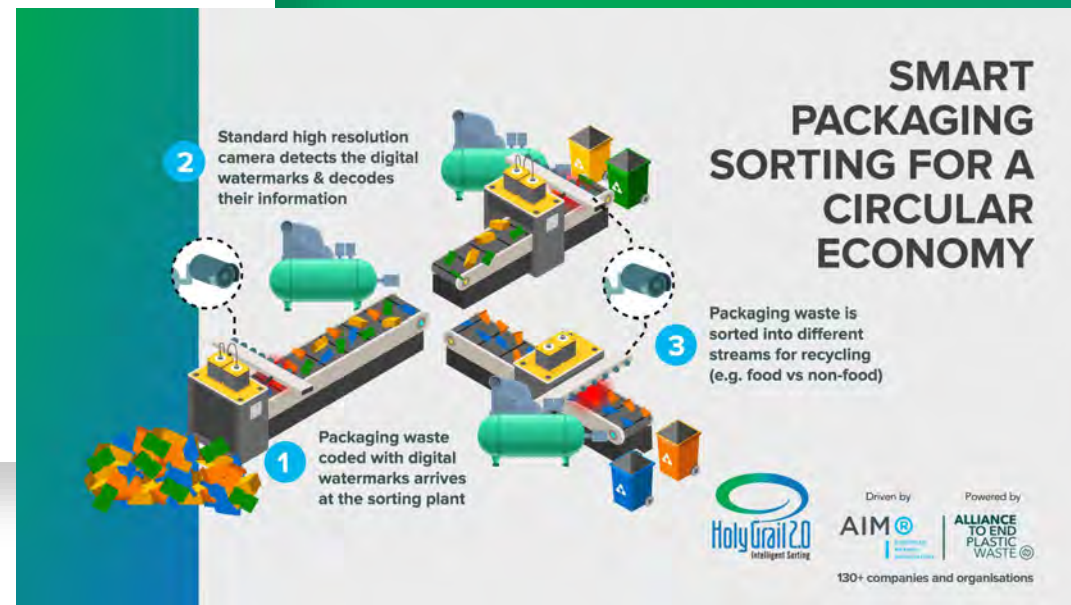


PHASE 3
Brand owners and retailers that are operating in the chosen test market are expected to participate with a minimum of **10 SKUs** coded with digital watermarks

Phase I

Prototype
Development
Feb – Nov 2021

- ▶ Focus on **functional add-on module for the detection sorting unit** – combined with existing NIR sorters – developed by the machine vendors **Pellenc ST** and **Tomra**, in combination with **Digimarc** (digital watermarks technology provider).
- ▶ Success criteria: unit's ability to detect and sort digitally watermarked packaging of various sizes. The Technical Project Manager overlooks and validates the prototypes.
- ▶ The prototypes will be used for the (semi-)industrial testing phase.
- ▶ Successful completion of Phase 1 will bring the Technical Readiness Level (TRL) to TRL 6 – *technology demonstrated in relevant environment*.



Phase II

Semi-industrial testing

July 2021 – Q1 2022

- ▶ **Software model & identification parameters are developed and tested** for sorting based on digital watermarks detection.
- ▶ System is tested for speed, accuracy, and detection efficiency.
- ▶ **2 test locations for semi-industrial trials** of the detection sorting units:
 - Pellenc ST/Digimarc module:
Sep - Dec 2021 at the **Amager Resource Centre, Copenhagen**
 - Tomra/Digimarc module:
Q4 2021 - Q1 2022 in Germany
- ▶ Successful completion of Phase 2 will bring the Technical Readiness Level (TRL) to TRL 7 – *system prototype demonstration in operational environment* and TRL 8 – *system complete and qualified*.



Phase III

Industrial tests
Q1 2022 – Q3 2022

- ▶ Functional prototypes now **deployed in commercial sorting and recycling facilities under normal operational conditions on a large-scale.**

5 locations in France and Germany, includ. MRFs, PRF, recycling plants. Partners include e.g. SUEZ, PreZero, Indorama, Tomra/Borealis/Zimmermann, Paprec.

- ▶ Brand owners and retailers bring their enhanced products commercially to market in Denmark, France and Germany.
- ▶ Consumers can buy on-shelf products with digitally watermarked packaging, which will enter the waste stream after consumption.
- ▶ Objective: test system's reliability to ensure optimum performance.
- ▶ Successful completion of Phase 3 will bring the TRL to TRL 9 – *actual system proven in operational environment.*



HOLY GRAIL 2.0

WORK PACKAGES



HolyGrail 2.0 Structure

HG2.0 STRUCTURE BASED ON [HOLYGRAIL 2.0 CHARTER](#) UNDER THE AUSPICES OF AIM, EUROPEAN BRANDS ASSOCIATION:



MEMBERSHIP

HG2.0 Membership Associate & Full Initiative Members

- ▶ **Technical Work Packages:**
Involvement of all members based on expertise and knowledge
WG leaders appointed
Under supervision of Technical Project Manager
- ▶ **Leadership Team:**
= Core members representing each of the sectors engaged in the initiative
Leads, coordinates and manages the activities of the initiative
Ensures effective use of membership fees and involvement of member companies
Overlooks the activities and decides on the set-up of technical work packages



HOLY GRAIL 2.0

LEADERSHIP TEAM

 <p>Brand manufacturers (4/4)</p>	 <p>Retailers (4/4)</p>	 <p>MRFs: Materials Recovery Facilities (2/2)</p>
 <p>Converters (2/2)</p>	 <p>Extended Producer Responsibility Organisations (2/2)</p>	 <p>Recyclers (2/2)</p>

► **Elected LT Chair:** Gian de Belder, Procter & Gamble

HolyGrail 2.0 Structure

HG2.0 STRUCTURE BASED ON [HOLYGRAIL 2.0 CHARTER](#) UNDER THE AUSPICES OF AIM, EUROPEAN BRANDS ASSOCIATION:



MANAGEMENT

- ▶ **Secretariat – AIM as Initiative Facilitator:**
 - Overall management of initiative
 - Contact point for members & external stakeholders
 - Ensuring regular updates / information flow to all HG2.0 members
- ▶ **Technical Project Manager – An Vossen (Plarebel):**
 - Drafting a technical test plan
 - Coordinating the different technical working groups
 - Overseeing the work on the test sorting line
 - Supporting members with technical expertise & in their work with technology suppliers
- ▶ **Legal Counsel:**
 - Present at all meetings of leadership team and HG2.0 members



HolyGrail 2.0 Structure



PARTNERSHIPS FOR HG2.0 (SEMI-) INDUSTRIAL TRIALS



Alliance to End Plastic Waste



City of Copenhagen

➤ More information in our press release [here](#)



HolyGrail 2.0 Structure

HG2.0 ADVISORY GROUP
STRUCTURE BASED ON
[HOLYGRAIL 2.0 ADVISORY
GROUP CHARTER:](#)



ADVICE

● ► Advisory Group:

Panel for dialogue, exchange and input into both the operational implementation of key activities and the overall strategy of HG2.0.

Provides advice to HG2.0 Leadership Team, constituting the public and policy complement to the cross-value chain initiative HolyGrail 2.0.

Comprised of key stakeholders in the Circular Economy debate, including representatives from NGOs, Media, European and national public agencies, European and national policy-makers, other key stakeholders





Innovation, sustainability and digital are the **3 key ingredients** we are combining with smart packaging through **digital watermarks** to achieve the objective of the **Green Deal** towards a **clean, circular and climate neutral economy**.



MICHELLE GIBBONS
DIRECTOR GENERAL, AIM



Digital Watermarks Initiative HolyGrail 2.0



The Digital Watermarks Initiative HolyGrail 2.0 – driven by AIM, the **European Brands Association** and powered by the Alliance to End Plastic Waste – is a pilot project with the objective to prove the **technical viability** of digital watermarks for accurate sorting of packaging waste as well as the **economic viability** of the business case at large scale.



Digital watermarks are **imperceptible codes**, the size of a **postage stamp**, covering the surface of a consumer goods **packaging** and carrying a wide range of attributes. The aim is that once the packaging has entered into a **waste sorting facility**, the digital watermark can be detected and decoded by a **standard high resolution camera** on the sorting line, which then – based on the transferred attributes (e.g. food vs. non-food) – is able to sort the packaging in corresponding streams. This would result in better and more accurate sorting streams, thus consequently in **higher-quality recyclates benefiting the complete packaging value chain**.





CONTACT

Digital Watermarks Initiative HolyGrail 2.0

AIM – European Brands Association

Avenue de Gaulois 9

B-1040 Brussels, Belgium

EU Transparency register ID no.:

1074382679-01



