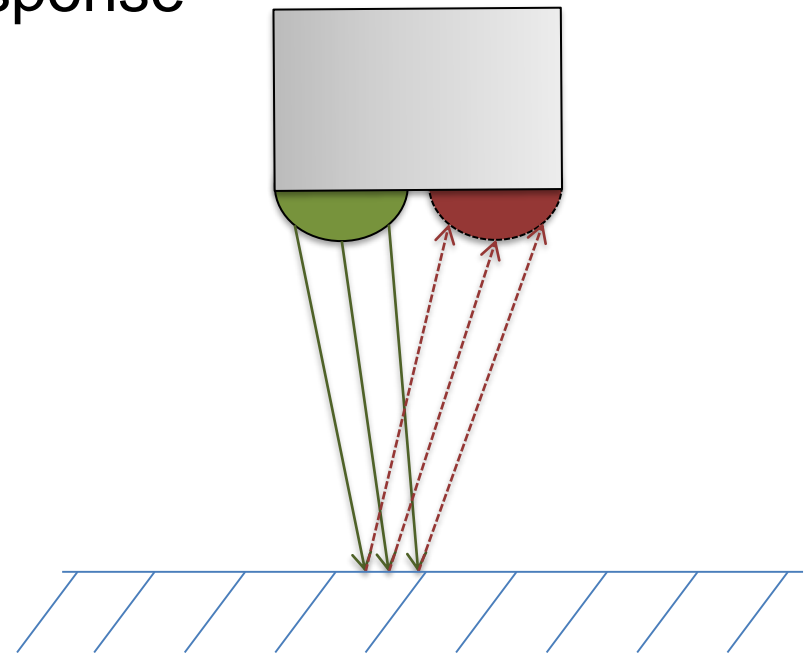# Basic Principle

- The polymer is equipped with a „fingerprint"
- The „fingerprint" is added via taggant particles in the masterbatch
- An LED illuminates the particles
- The sensor then reads the response

What are Taggants?

Definition von taggant

Englisch: taggant

taggant in British

(ˈtægənt)

Substantiv

1. electronics

   a microscopic material added to a substance to enable it to be tracked by radio frequency
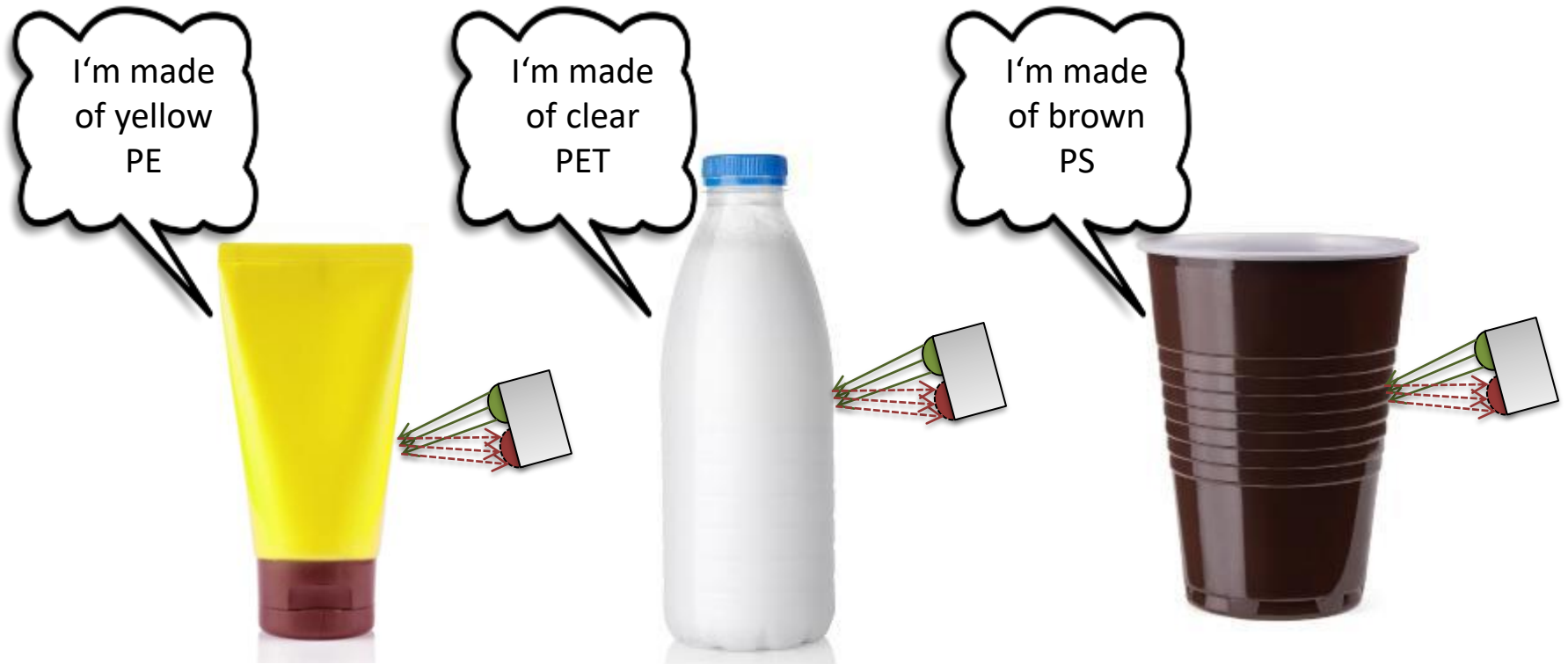
2. chemistry

   a chemical marker used in various kinds of testing

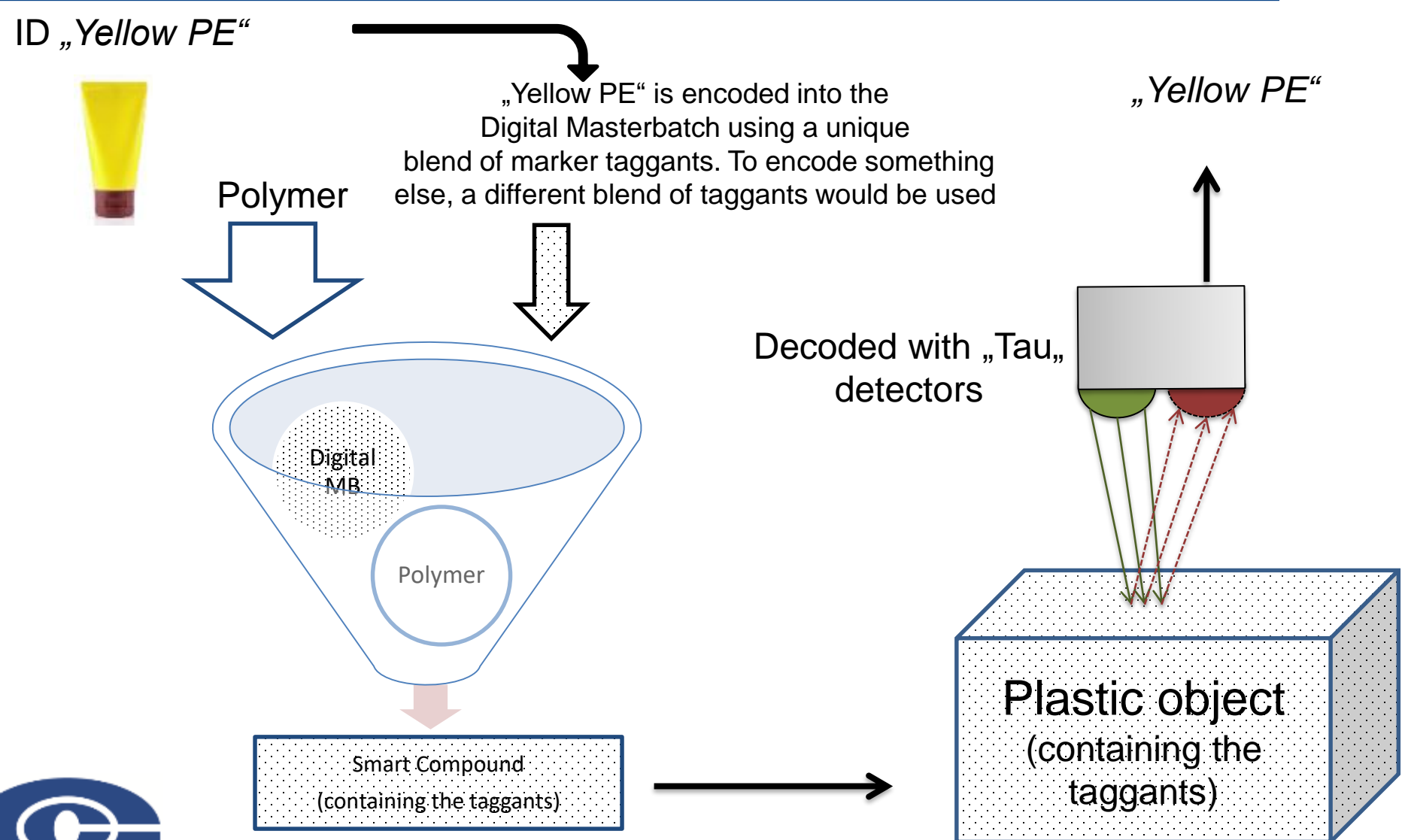*Collins English Dictionary.* Copyright © HarperCollins Publishers

Function 1 – Material Identification

- What are you made of ?

Function1: How It Works

ID „*Yellow PE*"

Polymer

„Yellow PE" is encoded into the
Digital Masterbatch using a unique
blend of marker taggants. To encode something
else, a different blend of taggants would be used

„*Yellow PE*"

Digital MB

Polymer

Decoded with „Tau„
detectors

Smart Compound
(containing the taggants)

Plastic object
(containing the
taggants)

Function 1 – Material Identification

- This functionality works on granules, profiles, containers and also on undefined shapes
- All of the products made with the „intelligent polymer" give the same answer (i.e. thousands of products can give exactly the same signal)
- The response signal is dependent on the „intelligent compound „ used. Any part of the object can be tested and all parts will give the same signal (e.g. top, bottom, sides).
- Possible applications:
  - Dosage control (e.g. how much UV masterbatch is dosed?)
  - Process control (e.g. material flow rate)
  - Function control (wall/layer thickness, stretching/wear control)
  - Material control (correct raw materials, co-ordinating material use on multiple production sites)
  - Recycling material separation
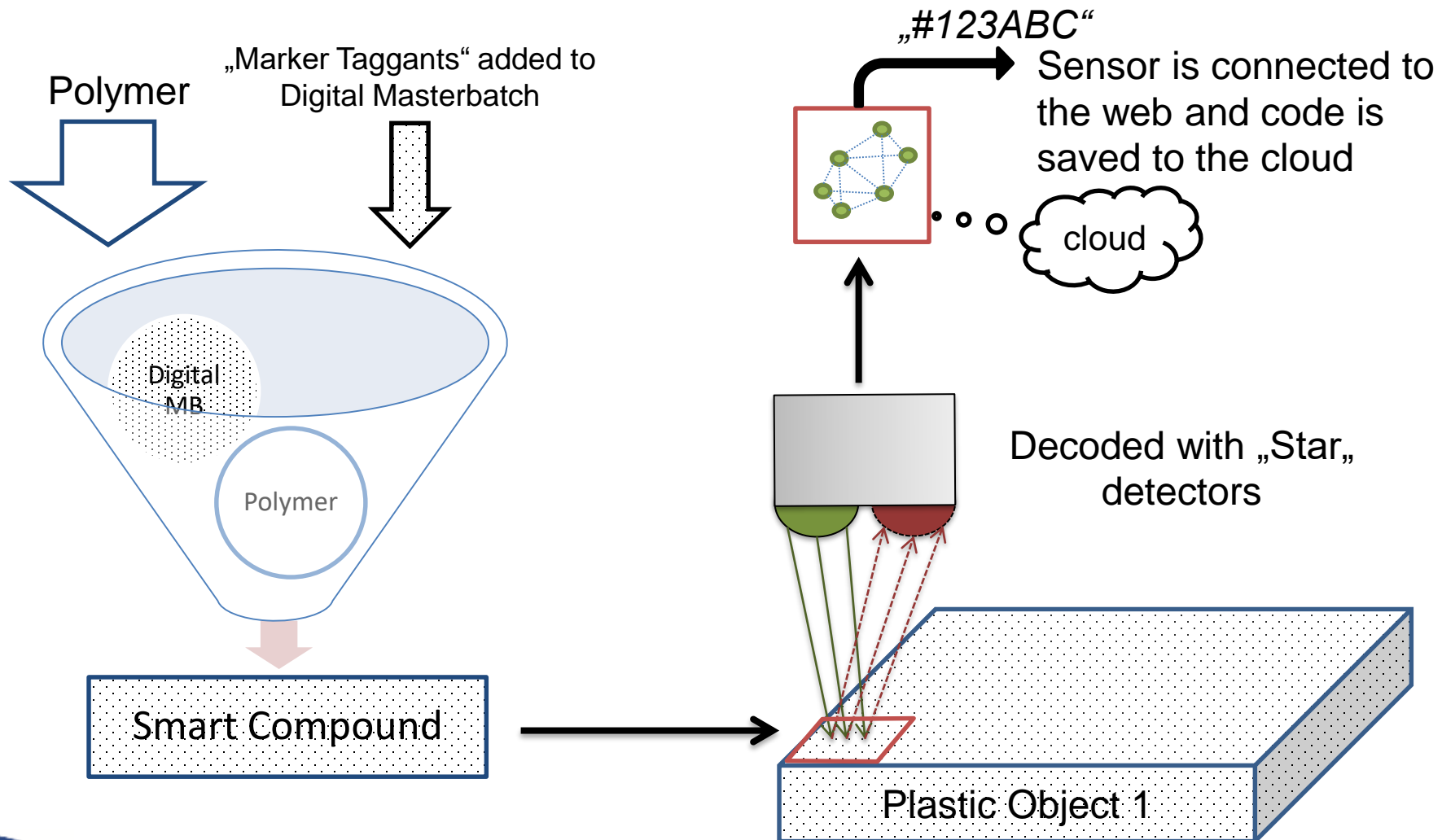 - Simple Anti-Counterfeit (is that my film or not?)
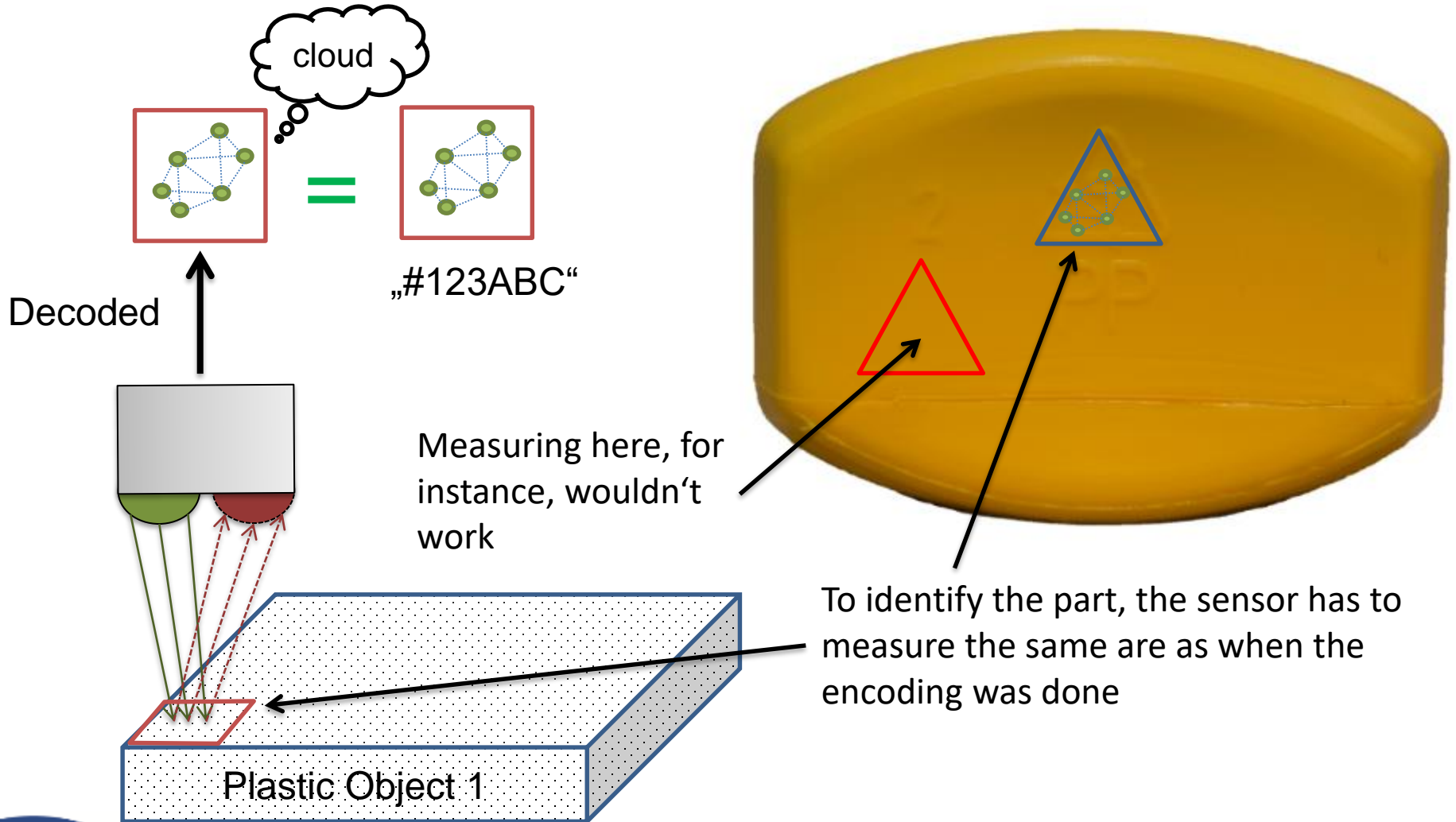
Function 2: Individual Part Identification

- Every individual part has a unique ID
- A „reference area" is a defined surface area on the part
- The reference area has to be the same for both encoding and decoding

Reference area could be e.g. the recycling symbol

I'm bottle #456XYZ

I'm bottle #123ABC

Function 2: Part ID - Encoding

Polymer

„Marker Taggants" added to Digital Masterbatch

Digital MB

Polymer

Smart Compound

„#123ABC"

Sensor is connected to the web and code is saved to the cloud

cloud

Decoded with „Star„ detectors

Plastic Object 1

Function 2: Part ID - Decoding

cloud

=

„#123ABC"

Decoded

Measuring here, for instance, wouldn't work

To identify the part, the sensor has to measure the same are as when the encoding was done

Plastic Object 1
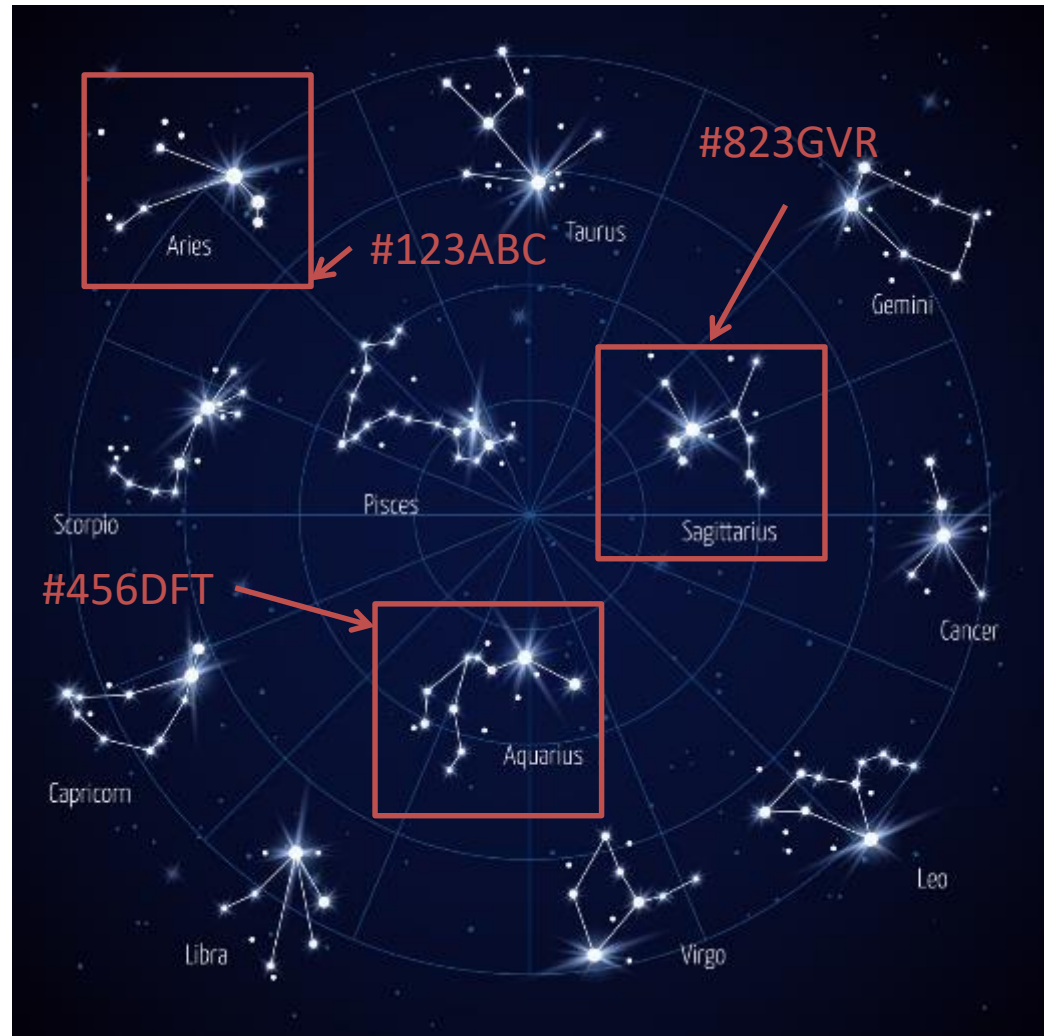
Function 2: Individual Part Identification

- The technology is similar to looking at the night sky
- The stars (marker pigments) are randomly distributed
- By looking in a specific location a unique pattern can be detected and named (encoded) e.g. Aquarius
- Looking in the same location at a later date, the pattern can be recognized again (decoded) e.g. Aquarius

Function 2: Individual Part Identification

cloud

=

Decoded

„Bottle #123ABC "
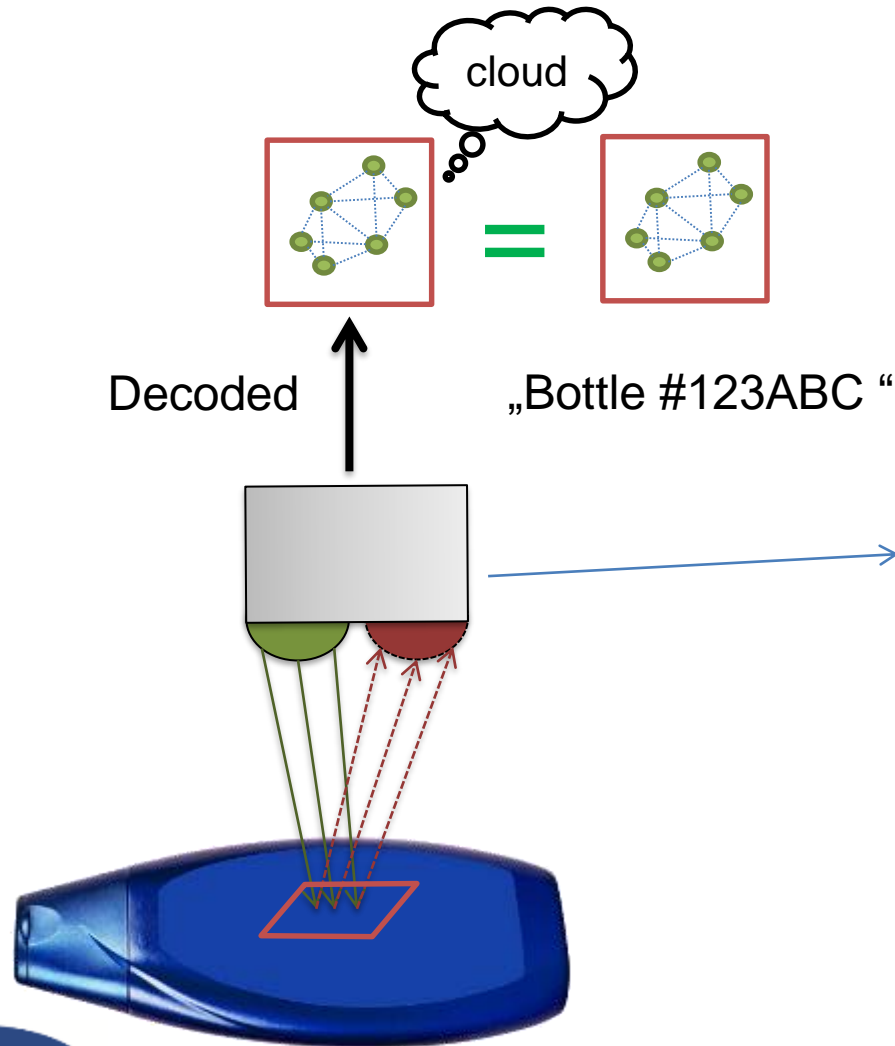
- A real world example using the available smartphone sensor

The visible green spots are „illuminated" marker particles
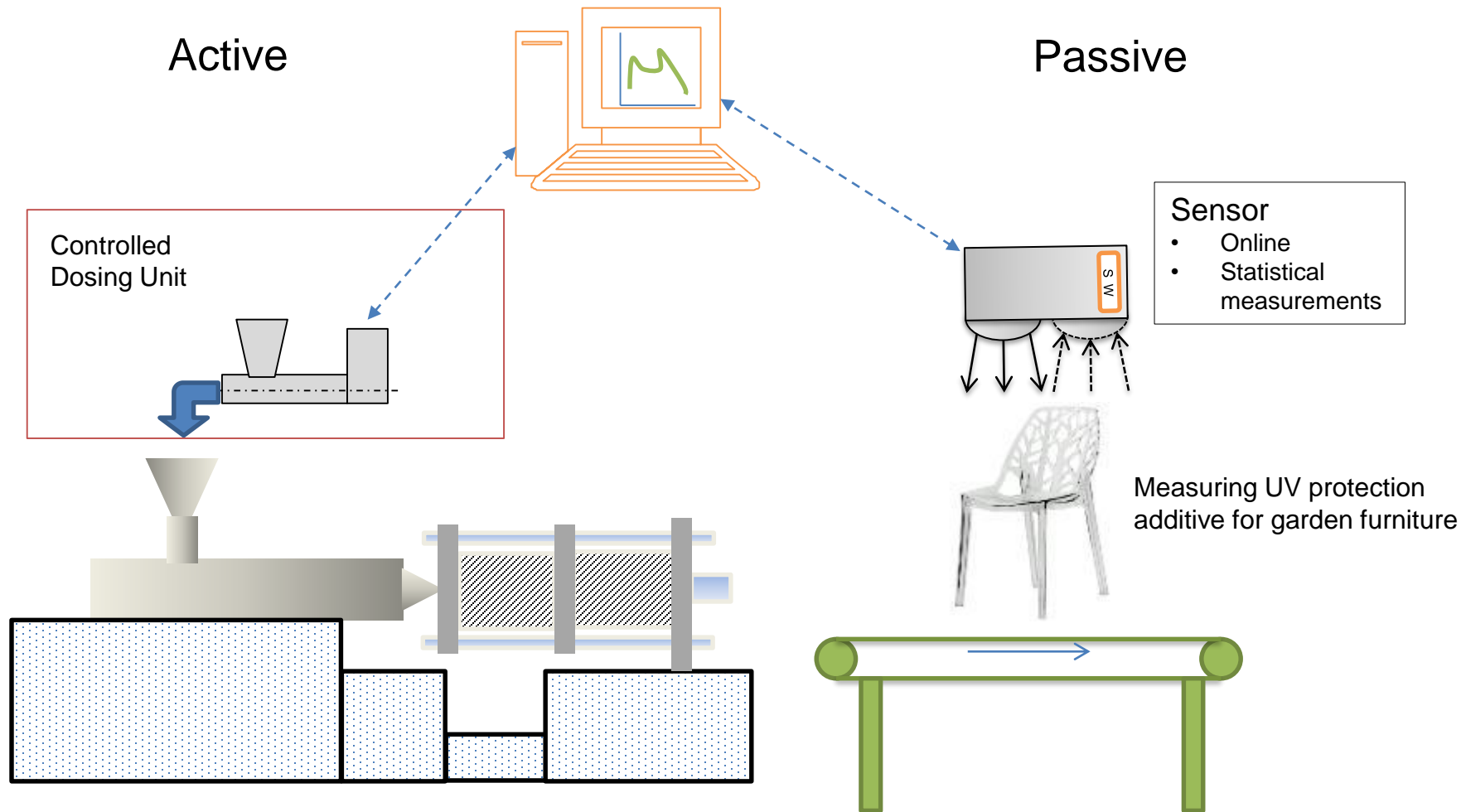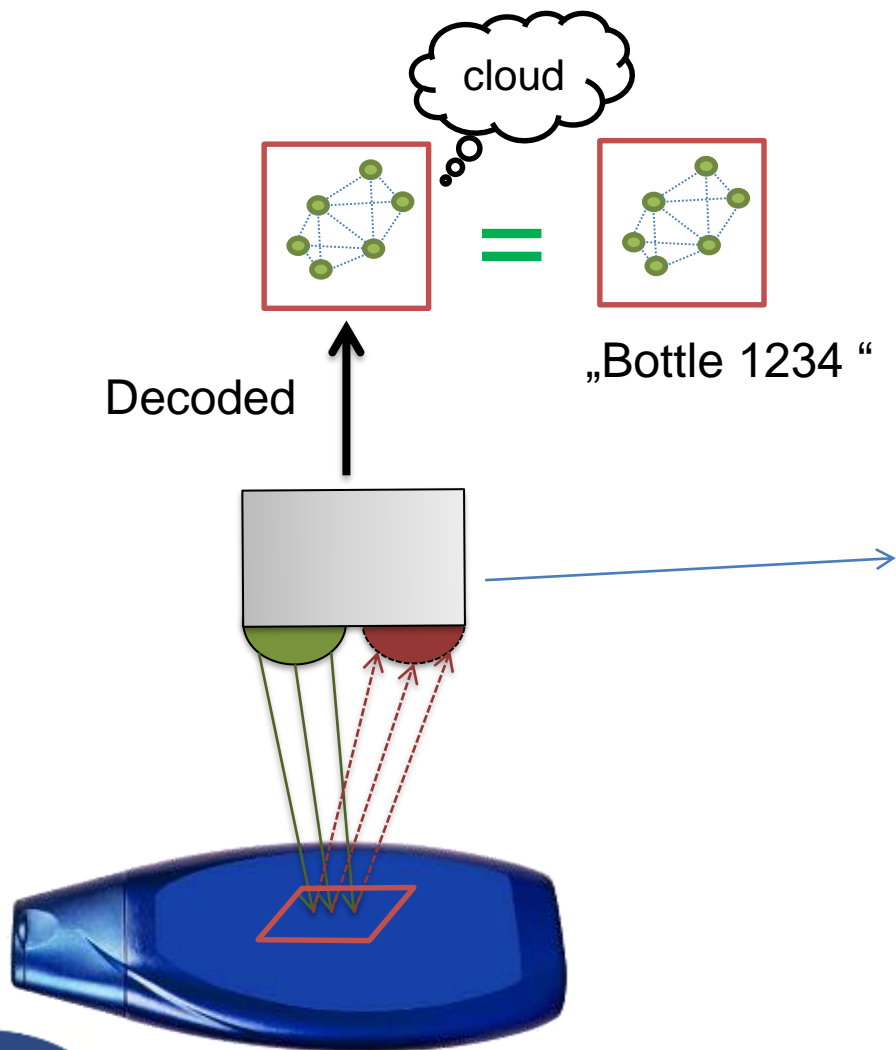
Taggant Technology

Taggants

- The taggants use an effect from physics called the Stokes shift/anti-stokes shift

- Light is absorbed and then emitted by the taggants and is measured by the sensor

- The taggants are long lasting and are not destroyed by the temperatures used in plastics processing

- The taggants are supplied by European suppliers, who source them globally

- EU food contact approval is ongoing and we assume it will be completed in Q4 2019

Stokes' shift

Absorption   Emission

450   500   550   600   650   700
Wavelength (nm)
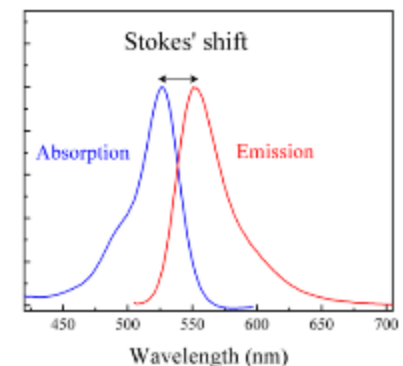
Dosage Control for Injection Moulding

Active

Passive

Controlled
Dosing Unit

Sensor
- Online
- Statistical
  measurements

Measuring UV protection
additive for garden furniture

Original Product Verification

cloud

=

„Bottle 1234 "

Decoded

Process Control for Films

Sensor
- In-line statistical measurements
- Dosage control (additives, colours)
- Dispersion control
- thickness control
- Stretching control
- …..

Production process monitors many quality relevant aspects

Sensor
- In-line statistical measurements
- Product verification (e.g. right material, right dosage UV, … or colour MB)
- …..