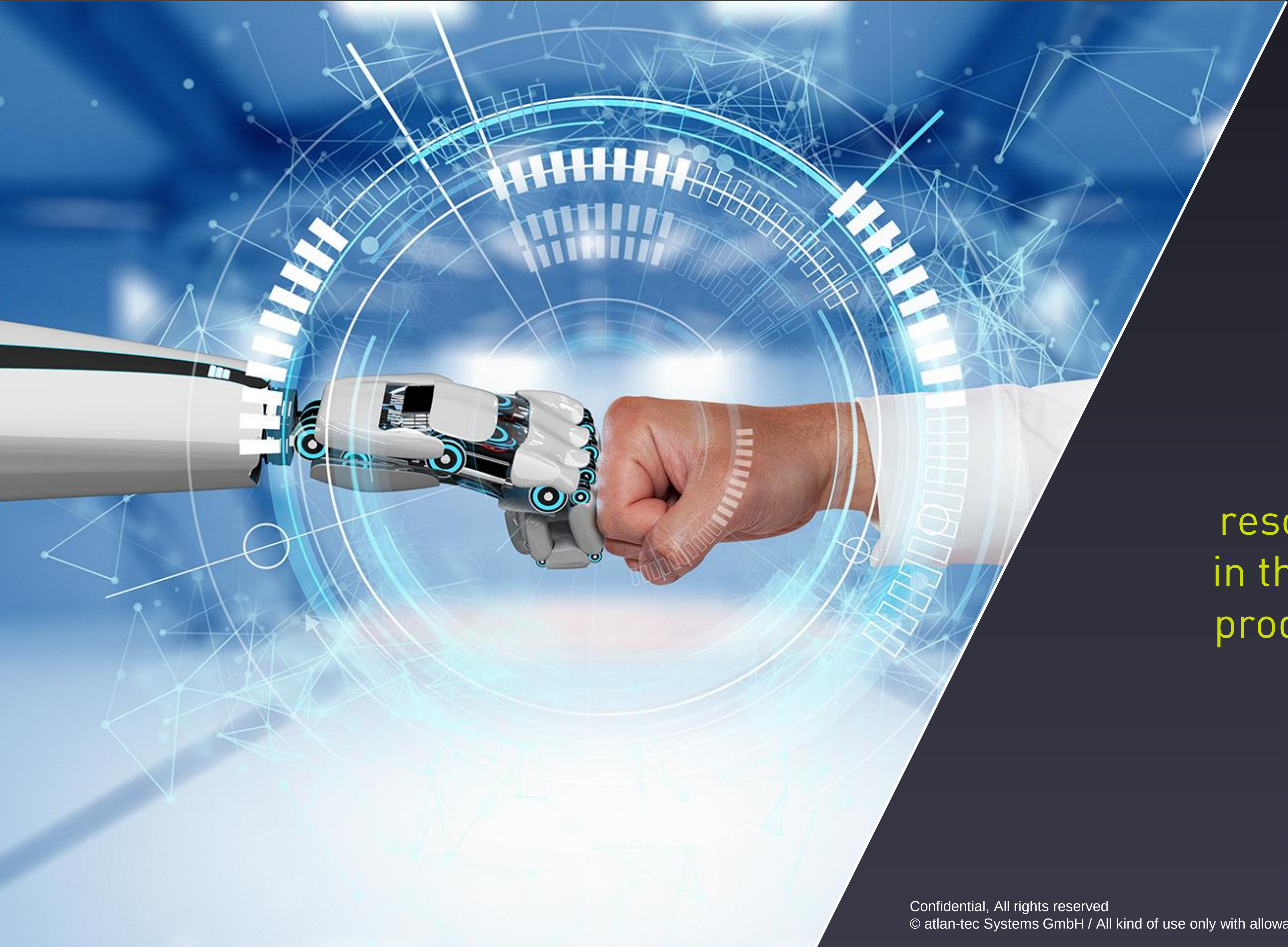

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USE CASE

AI-supported resource efficiency in the polyurethane production process

European Resources Forum 2022

atlan-tec®

ANDREAS KRÜGER

- Chemical engineer
- Head of atlan-tec's engineering team
- Joined atlan-tec in 1999
- More than 20 years of experience with data analytics, modelling, data acquisition, optimization and machine learning
- **Key clients:** Bayer AG, Huntsman, BASF, etc.
- Industry expert in different federal research projects exploring digitalization in the manufacturing industries

IN A NUTSHELL

- We are a leading company for advanced Big Data Analytics & data-driven process optimization
- In short: we turn raw data into **smart data**, smart insights, smart decisions & smart processes
- Based in Mönchengladbach, Germany
- On the map since 1994

We optimize technical production processes worldwide

atlan-tec®

CHEMICALS

PHARMACEUTICALS

REFINERY

PLASTICS

ENERGY

PAPER

TEXTILE

STEEL

FOOD

COSMETICS

What´s more

atlan-tec®

>1,200
SUCCESSFUL
INDUSTRY PROJECTS

30%
EFFICIENCY INCREASE

6
FEDERAL
RESEARCH PROJECTS

The basic principle of what we do

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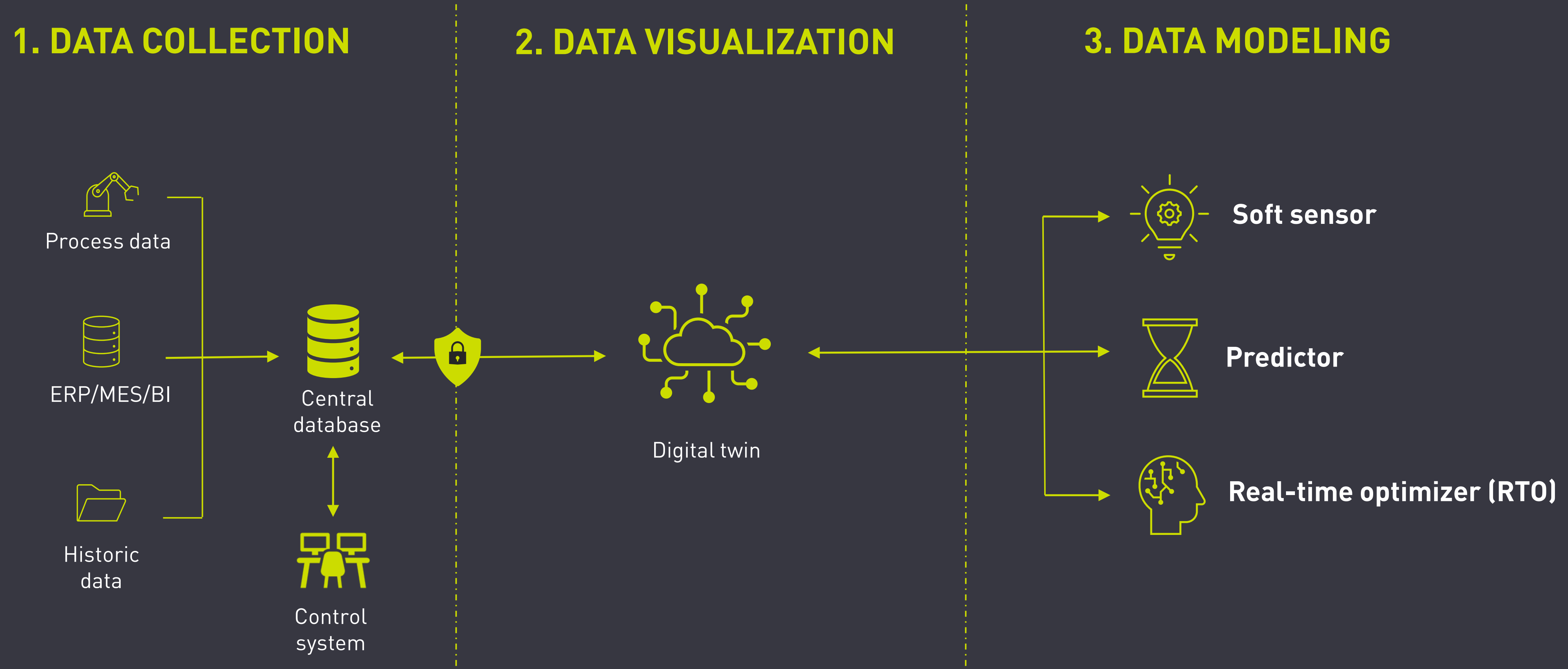

The use case at a glance

INDUSTRY:

Chemical industry

CUSTOMER:

Huntsman, leading producer of polyurethanes

PROCESS:

Separation line for an isocyanate precursor clean-up

GOAL:

- Efficient use of steam
- Eliminate bottlenecks in process
- Meet quality and environmental standards

Process Flow Diagram (Simplified)

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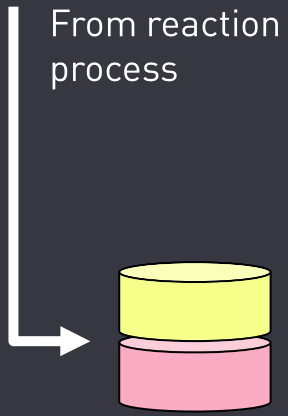
1. SEPARATION

2. EXTRACTION

3. DISTILLATION

Process Flow Diagram (Simplified)

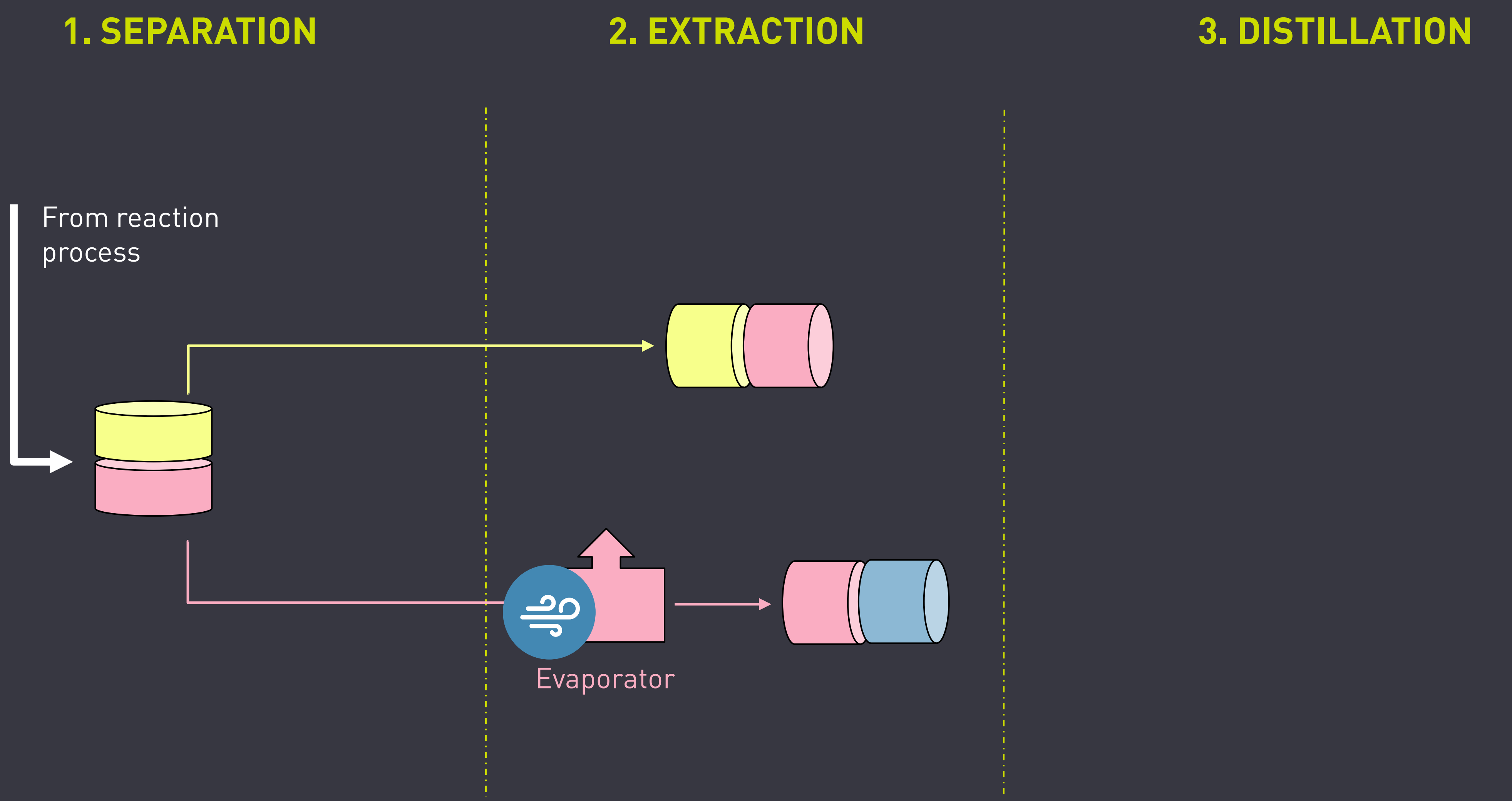
1. SEPARATION



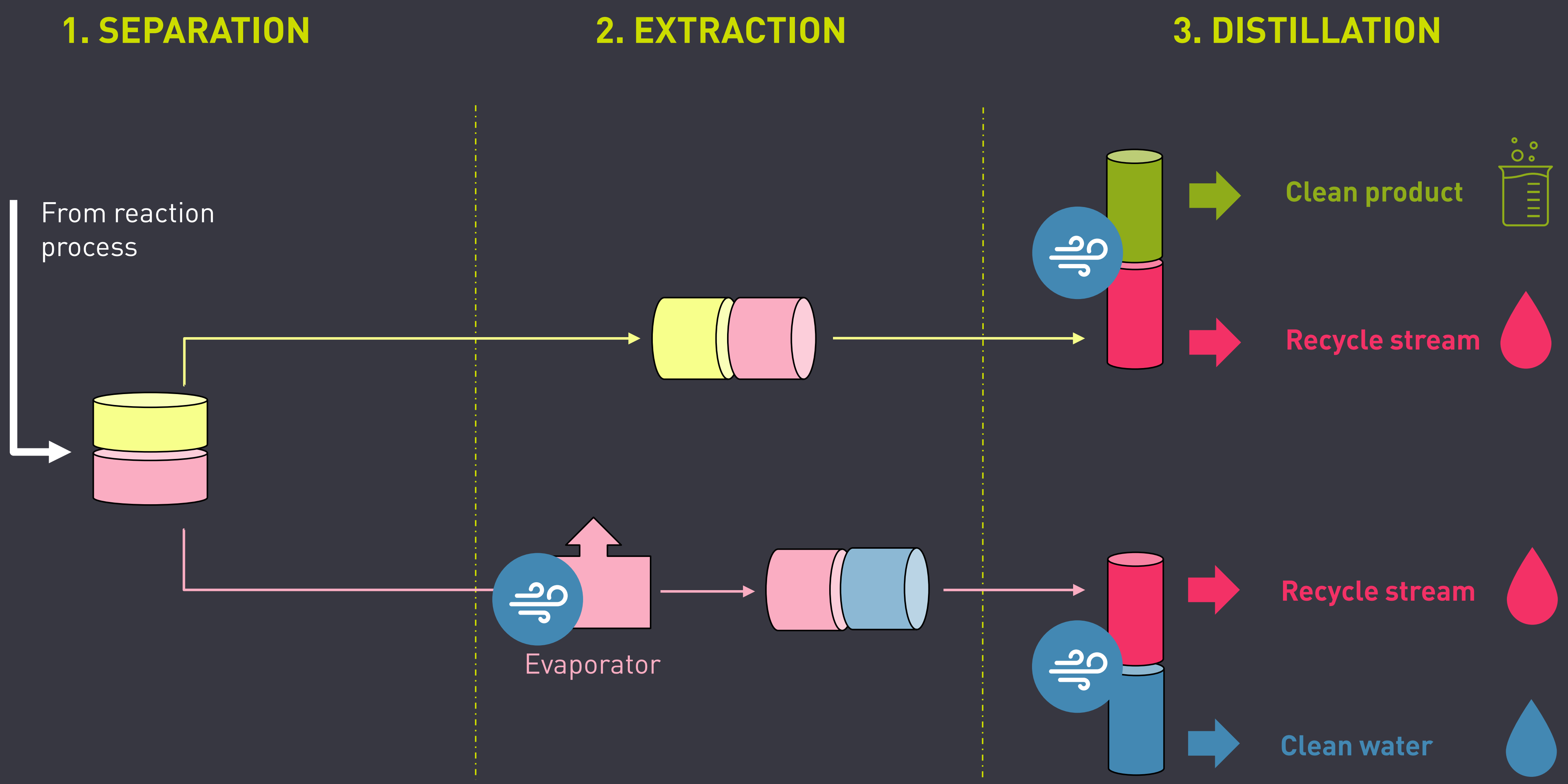
2. EXTRACTION

3. DISTILLATION

Process Flow Diagram (Simplified)



Process Flow Diagram (Simplified)



Process Flow Diagram (Simplified)

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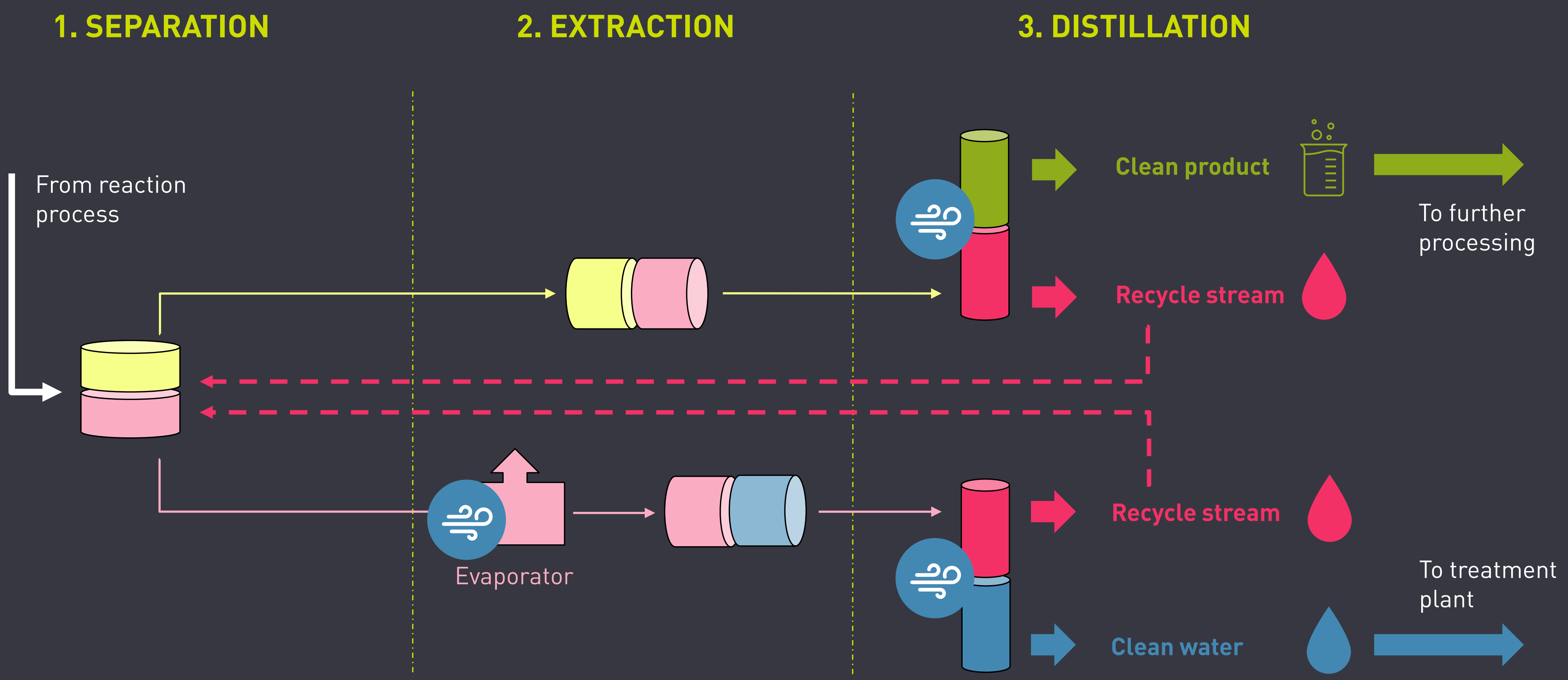


The challenge

- Operators use excessive steam to safely avoid quality and environmental problems
- Steam use not proportional to level of contamination
- Every tonne of steam used also turns into a tonne of recycle stream
- The recycle stream also requires steam to be cleaned
- Excess steam leads to bottlenecks in the separation lines
- **Bottleneck:** more recycle stream means less product can be cleaned

Our solution approach

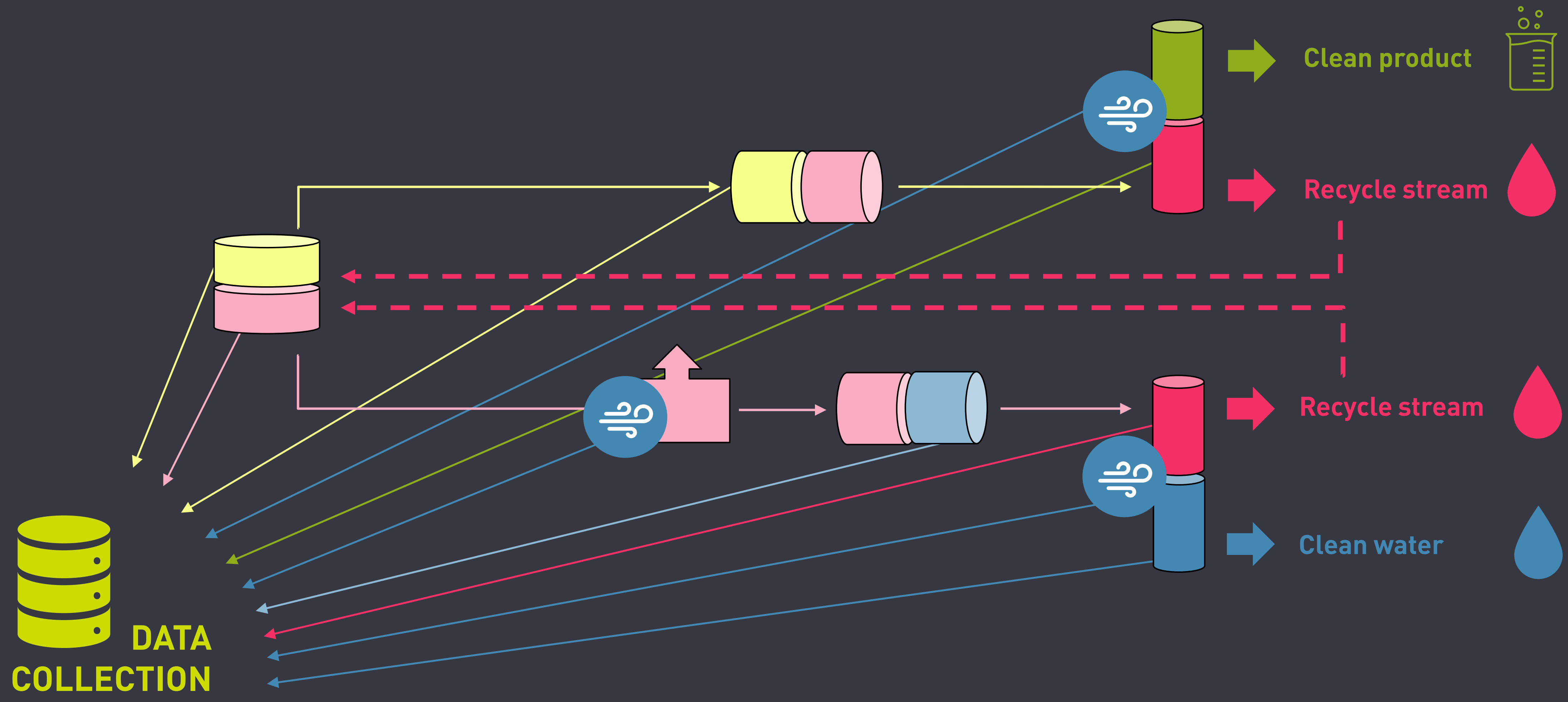
1) Prediction of level of impurity in product after reaction process

2) Prediction of level of recycle stream impurity in the separation line

3) AI-supported setting of process parameters

4) **The result:** The amount of steam used is proportional to the levels of impurity

How we did it



Clean product
Recycle stream
Recycle stream
Clean water
DATA
COLLECTION

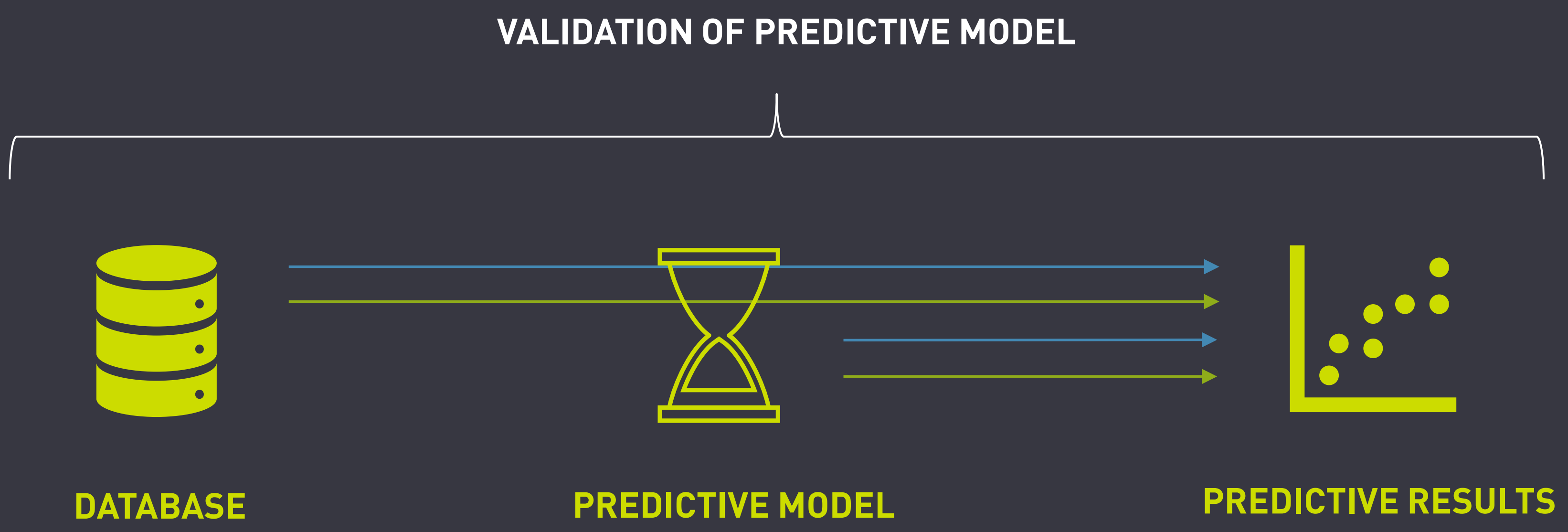
How we did it

1. CREATED A SINGLE DATABASE

2. IDENTIFIED PARAMETERS THAT ARE CRITICAL TO LEVEL OF IMPURITIES

3. CREATED A DATA-DRIVEN MODEL THAT PREDICTS THE LEVEL OF IMPURITIES

How we did it


VALIDATION OF PREDICTIVE MODEL
DATABASE
PREDICTIVE MODEL
PREDICTIVE RESULTS

How we did it

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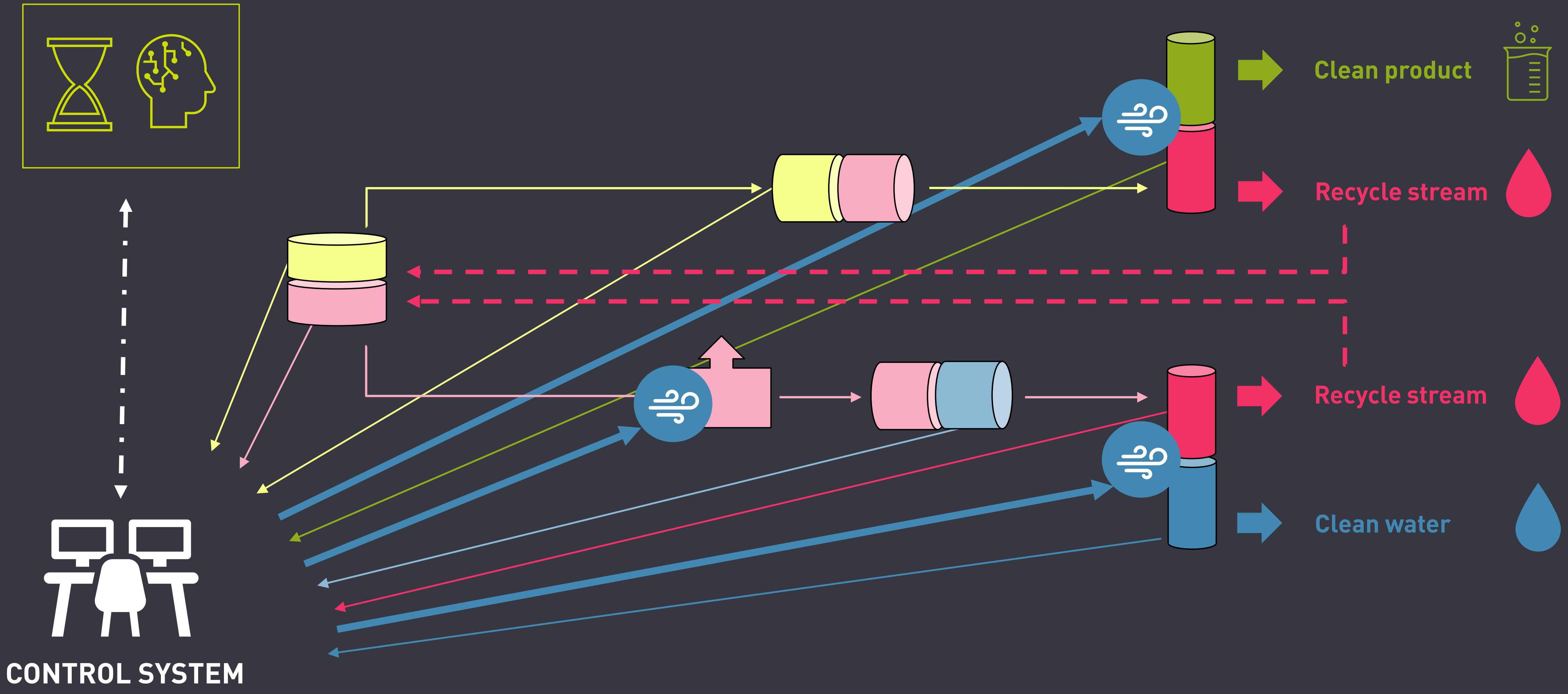
PREDICTOR
(Predictive model)

+

REAL-TIME OPTIMIZER
(Genetic algorithm)

How we did it


Clean product
Recycle stream
Recycle stream
Clean water
CONTROL SYSTEM

How we did it

1) Recording and collection of process values with timestamps during normal production.
2) Identification of relevant parameters that are critical to level of impurities.
3) Created a data-driven model that predicts the level of impurities (**Predictor**).
4) Validation of the **Predictor** with unknown data.
5) Linking the **Predictor** (Data Model) with a **Real-Time Optimizer** (Data Algorithm).
6) Connection to the control system and live process.
7) **The result:** AI-supported recommendations for the optimal steam amount needed.

Our results

- Steam consumption **reduced by 12%**
- **Bottleneck removed**
- Productivity **increased by 11%**

MANY THANKS FOR YOUR ATTENTION

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