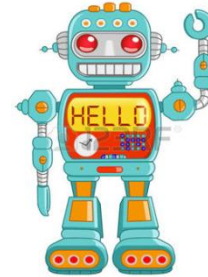


RobSPO



# Automated robotic system for high-throughput lab scale winemaking fermentation



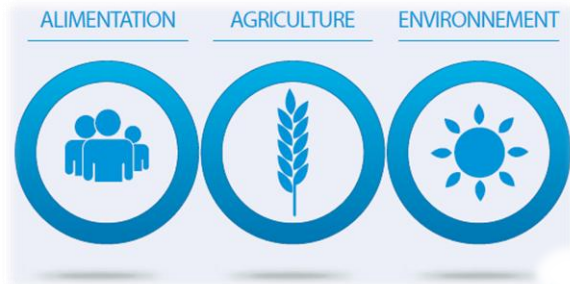
1931 CONGRESCEENTRUM  
BRABANTHALLEN • DEN BOSCH  
**LABAUTOMATION**  
DI 5 APRIL >>> 2016



# Introduction

INRA : French National Institute for Agricultural Research

2nd World Institute for publications in agricultural sciences



Food, Agriculture and Environment



*Sciences for Enology  
SPO*



## Research unit (SPO)



- Permanent staff of 63 persons including 37 scientists and engineers
- One of the most important laboratory involved in research in enology worldwide.



- Understand chemical and biological mechanisms involved in the elaboration of wine



Find new approaches in the management of the fermentation process in enological conditions



# The alcoholic fermentation in winemaking conditions

Key step in  
winemaking process



Grapes - must



Yeast

*Saccharomyces cerevisiae*



CO<sub>2</sub>

Ethanol



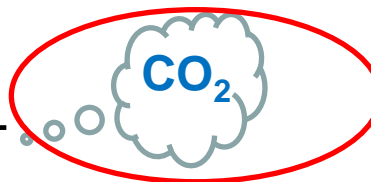
Flavour compounds

Actual challenges: **better understanding** and improvement of **quality**



# Specific and original experimental tools developed by SPO

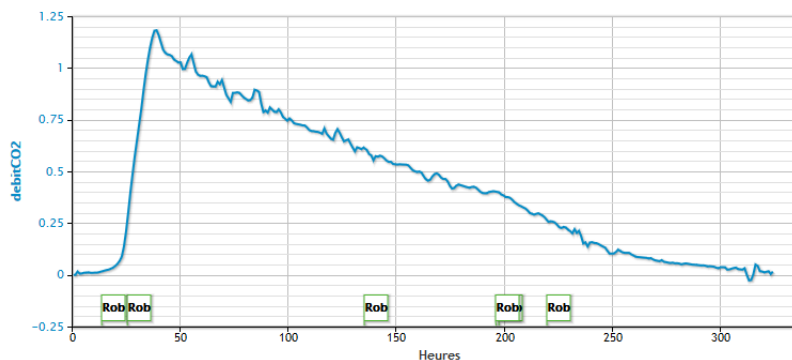
Sugars → Ethanol +



Loss weight



1 L fermentors x 36



Flowmeter



100 L tanks x 16

Associated data base

➤ more than **5000 fermentations**



→ Not suitable for high-throughput approaches



# High-throughput approaches

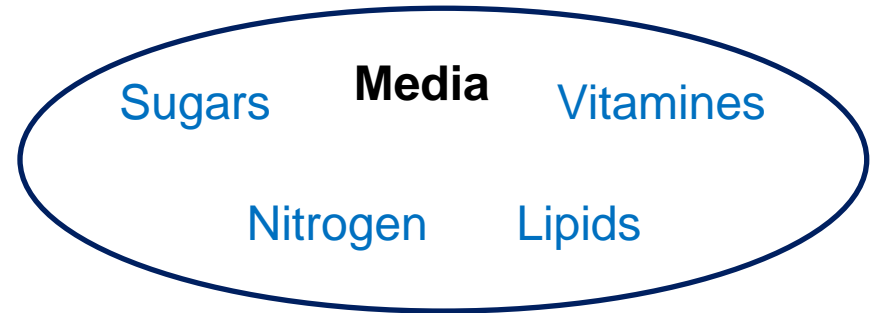
## Biodiversity



Natural  
*Ecological habitat*

Generated  
*Genetic cross*

## Yeast Environnement



Impact of different nutrients

- Necessity to develop new fermentation tools



Define the specifications



# Strategy and specifications

1- Low fermentation volume, but necessity of **sampling**

=> 300 mL, **90 simultaneous fermentations**



2- Larger series, smaller volumes, no sampling

=> 20 mL, **360 simultaneous fermentations**



3- **Robotize** the weighting step on a unique location



Close collaboration with **Lab Services** company



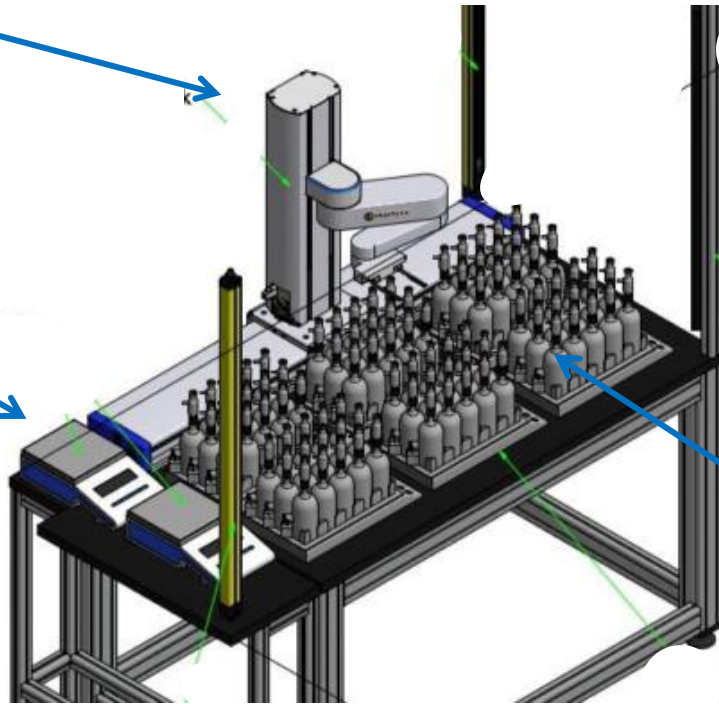
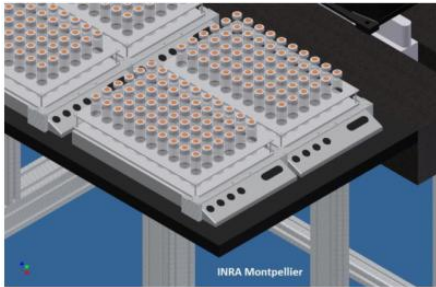
# RobSPO architecture



PreciseFlex Robot

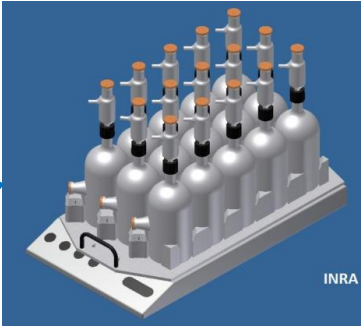
1 mg precision balance

Magnetic stirrer + 20 mL tubes rack



Safety light curtain

Magnetic stirrer + fermentors rack



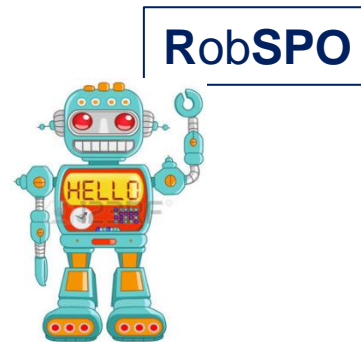
Temperature-controlled room: 14°C to 30°C





# RobSPO running !

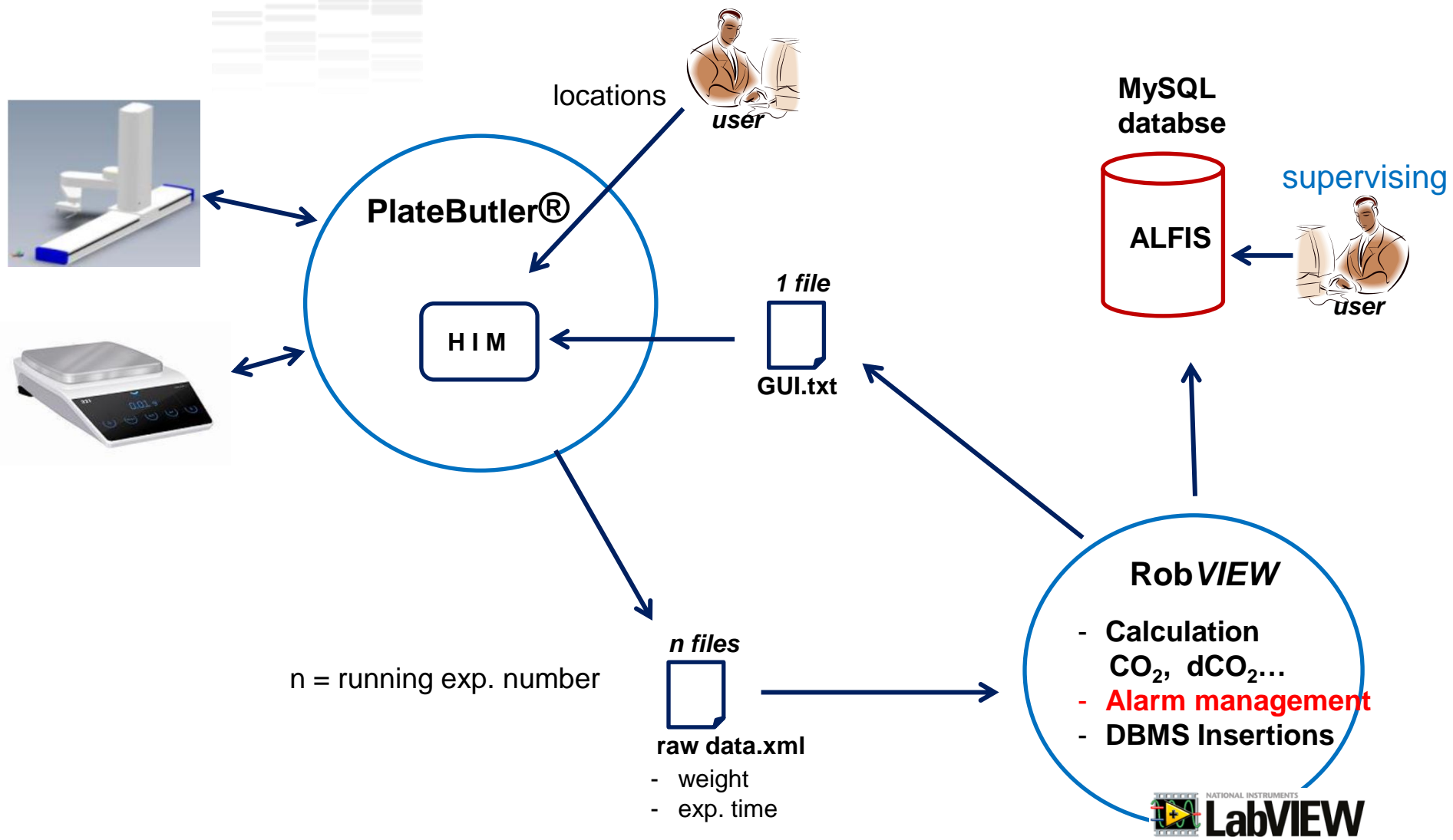
RobSPO\_20mL



RobSPO\_300mL



# Software architecture



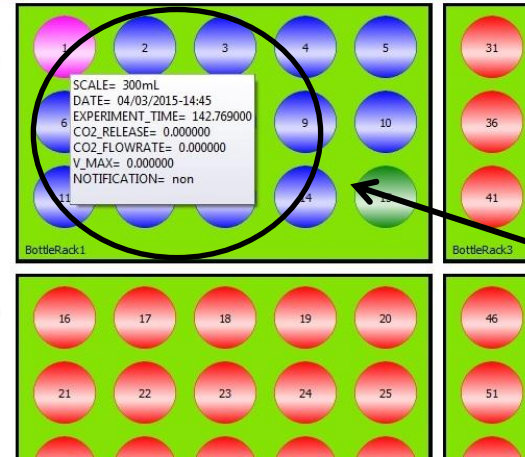
# Plate Butler® interface

- HMI designed specially to manage both configurations



300 mL fermentors view

- status of the system  
→ easily readable



- raw data,
- CO<sub>2</sub> released
- fermentation rate



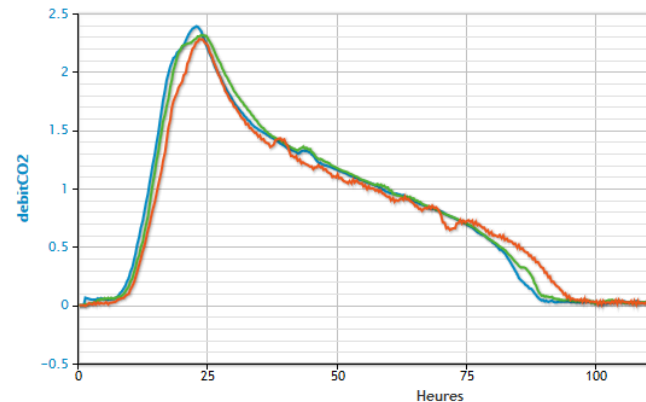
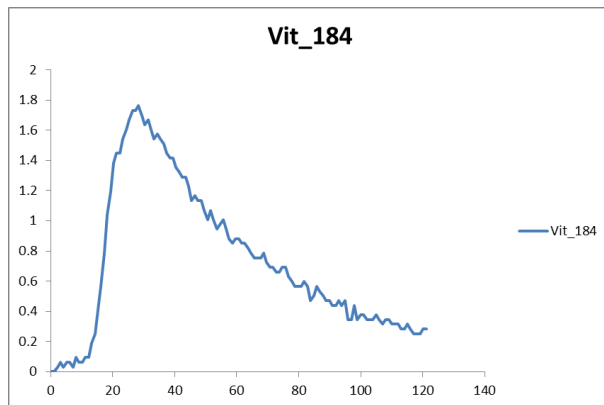
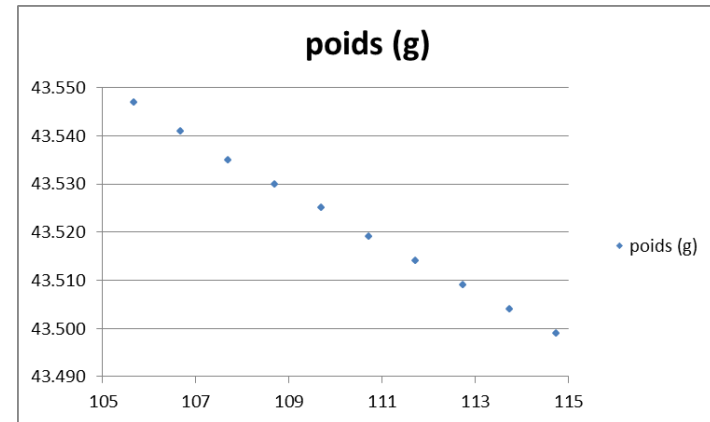
# Experimental results

20 mL tubes : resolution of mg balance

Final step of fermentation



➤ Able to measure loss of **50 mg** of CO<sub>2</sub> released in 10h !



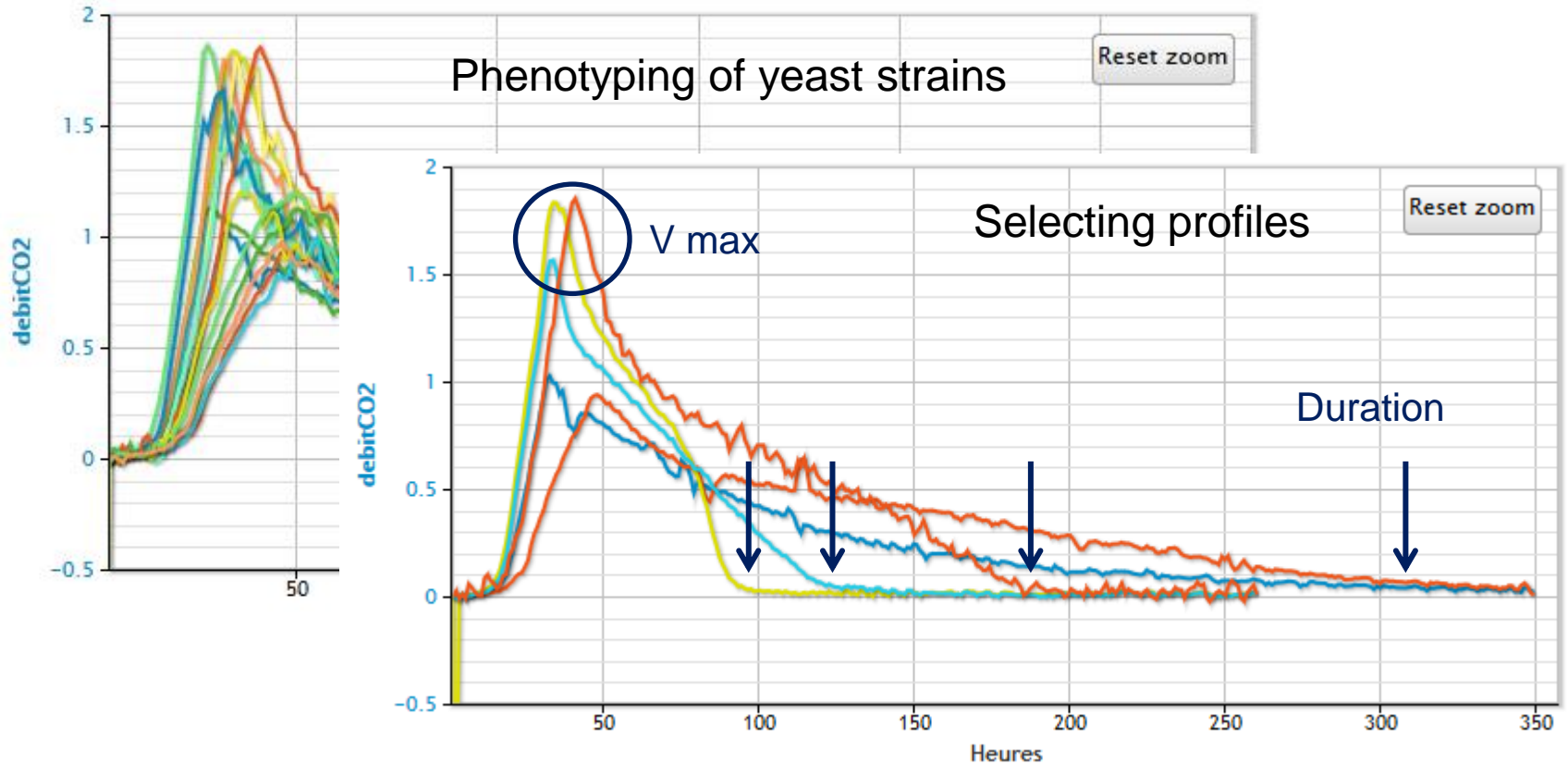
**No scale effect**

→ comparable results with 1L lab scale and 100 L pilot scale



# Experimental results

- Experiment in 300 mL fermentors



# Conclusion and outlook

- Validation - setting and adjusting on hardware and software,
  - RobSPO works perfectly
  - successful results
- More than **1000 fermentations** carried out in one year
- **5 research programs** actually using RobSPO
  - **3 PhD thesis** projects, included European collaborations



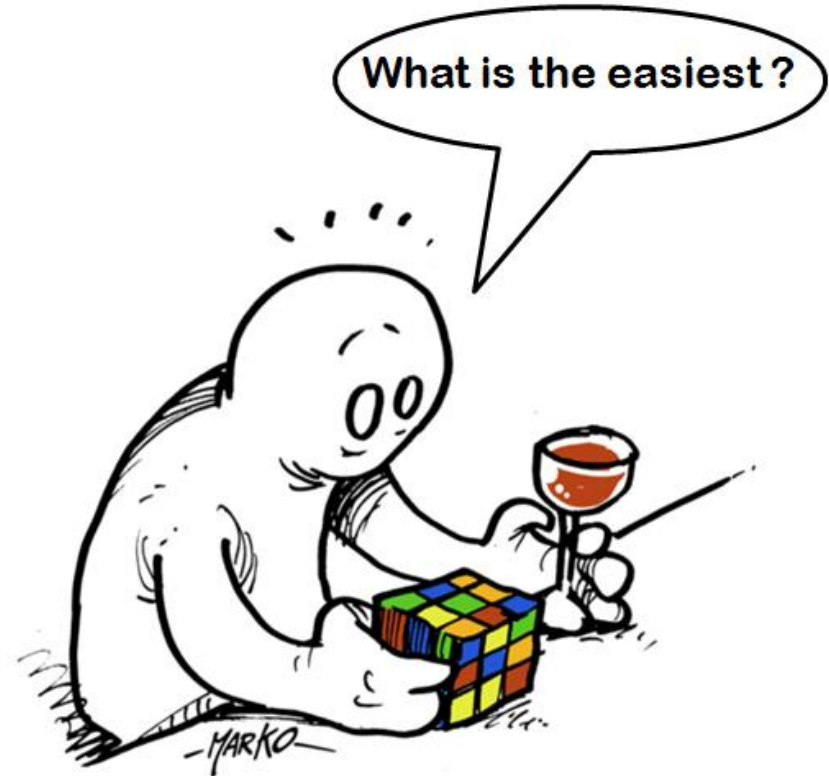
New challenges → automation of the previous steps  
Setting up the fermentors (filling, inoculating...)



# Thank you for your attention

Many thanks to : C. Picou,  
C. Camarasa, J.R. Mouret,  
A. Charleroy

...and whole **LabServices** team



**Lab Services**  
laboratory automation

1931 CONGRES-CENTRUM  
BRABANTHALLEN • DEN BOSCH  
**LABAUTOMATION**  
DI 5 APRIL >>> 2016

