



Automated dosing and testing bench

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Automated dosing and testing bench

→ Current situation and needs

✓ On users' side

24 / 7 running complicated to set up in laboratories

Need to speed up development (alternative fuels / drugs / food / ...)

Laboratory technicians or scientists are not robotics specialists

✓ On JAG's side

Specialist in process automation

Robotic specialist (industrial, collaborative, mobile robots)

Automated dosing and testing bench

→ JAG vision for the future

- ✓ Combine process automation and robotics to automate production & laboratory control tasks
- ✓ Simplify equipment control to facilitate access to technology
- ✓ Use artificial intelligence (AI/ML) to support R&D

Automated dosing and testing bench

➔ Introduction to Application

- ✓ A compact, versatile and automated dosing station for liquids and powders



Automated dosing and testing bench

→ Introduction to Application

*** *Video* ***

Automated dosing and testing bench

➔ Introduction to Application

- ✓ Standard setup : design for producing and testing simple products
 - From 0.1mL to 500mL (liquids) and from 0.1g to 100g (powders) dispensing
 - Up to x15 raw materials (in 400mL bottles)
 - 6 axes collaborative robotic arm with 5kg payload (FANUC)
 - Precision scale (Mettler Toledo)
 - Stirring device (IKA)
 - Measuring probes for pH, redox potential, conductivity, temperature (Mettler Toledo)
 - JAG MES interface allowing recipes from : manual input, ERP, LIMS, ...

Automated dosing and testing bench

➔ Introduction to Application

- ✓ **Advanced setup : design for advanced R&D and production**
- **Accuracy down to 1uL (liquids) and 10mg (powders)**
- **Unlimited number of raw materials : with conveyor or Mobile Manipulator service**
- **Additional measuring probes (depending on application)**
- **Additional devices and operations : shaking, heating, cooling, filtering, quality control, cleaning, packing, larger cobot range, dedicated grippers, ...**
- **JAG MES interface with Atinary SDLabs allowing AI/ML computed recipes**

Automated dosing and testing bench

➔ Introduction to Application

✓ Articles management :

„No need for JAG
to define components”









Number	Version	Nom	Recette	Catégorie
1	001	Salt		Powder component
1	060	Article 5 (WW)		Liquid component
1	061	H2O (Demineralized water)		Liquid component
1	062	NaCl (Saline solution)		Liquid component
1	063	NaHCO3 (Bicarbonate solution)		Liquid component
1	064	H2O (For saline solution)		Liquid component
10	001	100uL		Syringes
11	001	200uL		Syringes
12	001	500uL		Syringes
13	001	1mL		Syringes
14	001	2.5mL		Syringes
15	001	5mL		Syringes
16	001	10mL		Syringes
17	001	50mL		Syringes
30	001	25mL		Beakers
31	001	100mL		Beakers
32	001	250mL		Beakers
64	001	CH3COOH (Acid solution)		Liquid component
70	001	Parfum-33-17	000011 - Mixture-20-30-50	End product
71	001	Parfum-24-21	000012 - Mixture-5-5-10-80	End product

Automated dosing and testing bench

➔ Introduction to Application

✓ Articles parameters :

„ No need for JAG to define parameters”

Paramètres		Enregistrer		
Nom	↑ Valeur	Unité	min	max
 External diameter	52	mm	0	80
 Height	155	mm	0	200
 Sampling depth	30	mm	0	150
 Capacity	250	ml	0	250
 Cap diameter	30	mm	0	150
 Volumic mass	0.997	g/cm3	0	10
 Price per liter	0.1	CHF	0	
 Dispensing max value	30	mL	0	

Automated dosing and testing bench

➔ Introduction to Application

✓ Recipes management :

„Independence in
recipe creation“

Automatic dosing open loop (4)	
Text MMI	
Component	Article 5 (WW) - 1.060
Set point	10

Automatic dosing open loop (5)	
Text MMI	
Component	NaHCO3 (Bicarbonate solution) - 1.063
Set point	10

Cleaning (2)	
Flushing (1)	
Text MMI	

Mix (3)	
Grinding (1)	
Text MMI	
Powder component	Salt - 1.001
Set point	5

Mixing products (2)	
Text MMI	
Duration	10 s
Speed of rotation	1000 RPM

Quality control (4)	
PH control (1)	
Text MMI	
Goal	Target
Set point value	7
Tolerance min	5.9
Tolerance max	6.1
Stabilization time	20 s

Conductivity control (2)	
Text MMI	
Goal	Max
Set point value	0.2
Tolerance max	0.1
Tolerance min	0.5
Stabilization time	20 s

Redox control (3)	
Text MMI	
Goal	Max

Automated dosing and testing bench


➔ Introduction to Application

✓ Test results on HMI :

 Dosing details

Actual Iteration : 4
Displayed Iteration : 3

Step	Action	Name	Value	Unit
1	Price	Price	0.09	CHF
2	Redox Control	Redox	-0.05	mV
3	Conductivity Control	Conductivity	53.67	mS * cm-1
4	Ph Control	PH	8.07	PH
5	Mixing product		0.00	

 Dosing details

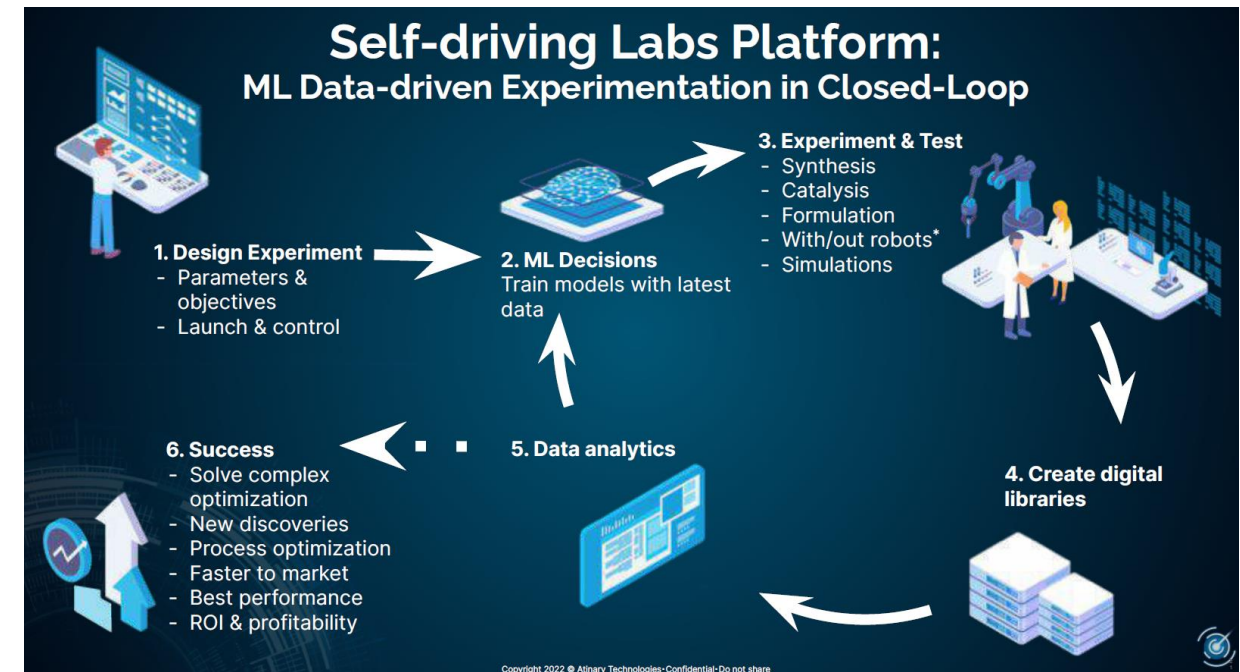
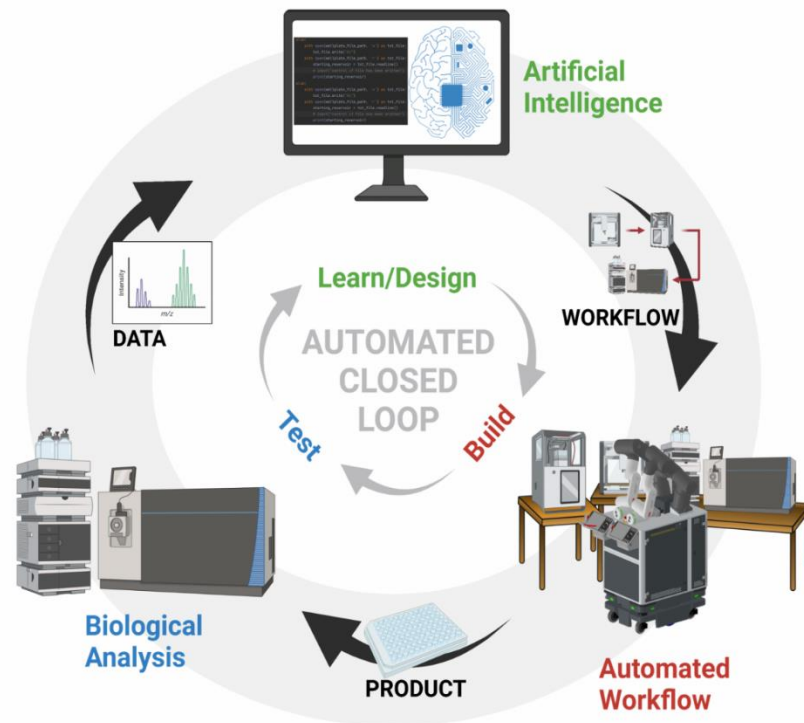
Actual Iteration : 4
Displayed Iteration : 4

Step	Action	Name	Value	Unit
3	Automatic dosing open loop	NaHCO3 (Bicarbonate solution)	3.00	mL
4	Automatic dosing open loop	Article 5 (WW)	17.00	mL
5	Automatic dosing open loop	H2O (For saline solution)	30.00	mL
6	Automatic dosing open loop	H2O (Demineralized water)	2.00	mL
7	Automatic dosing open loop	CH3COOH (Acid solution)	13.00	mL

Automated dosing and testing bench

➔ Introduction to Application

- ✓ UP & DOWN link with Atinary SDLabs (AI/ML formulation – closed loop laboratory – self driving lab) :



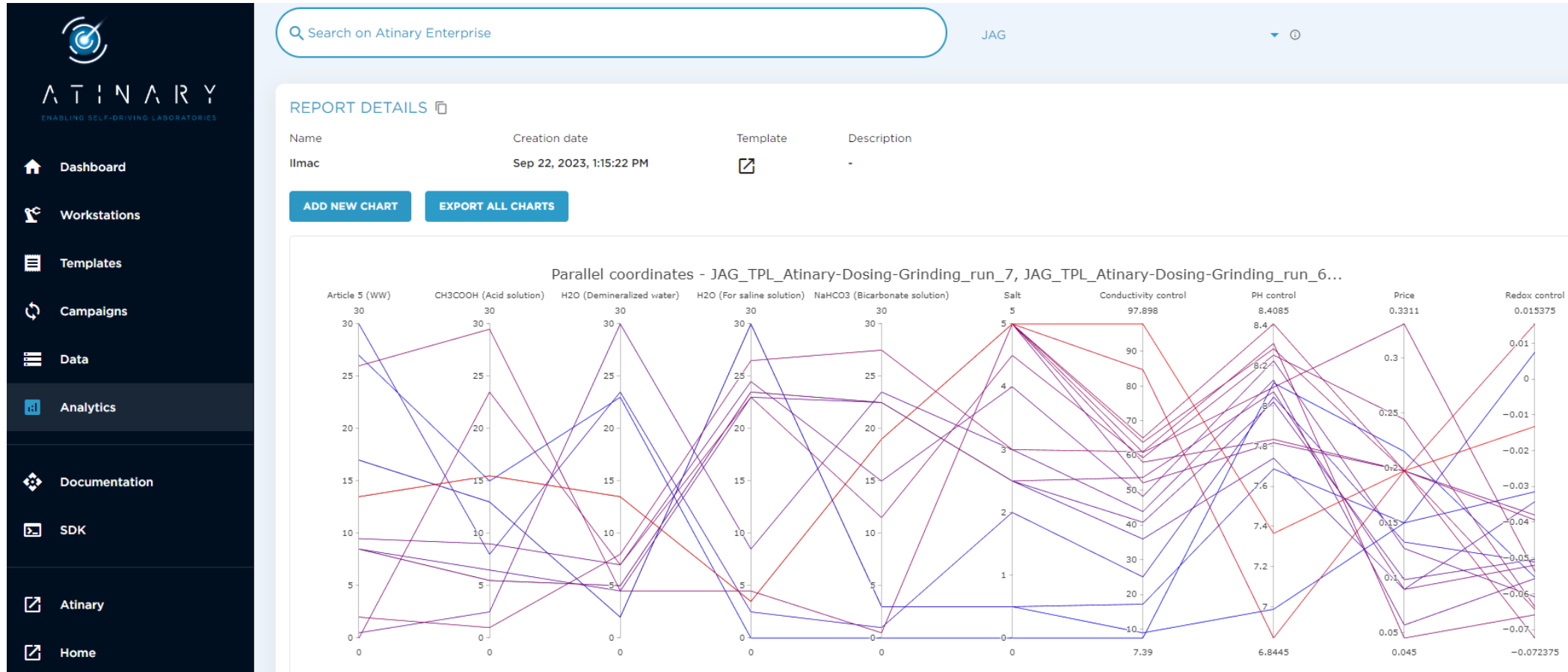
Automated dosing and testing bench

➔ Introduction to Application

- 1) The scientist initiates a basic production recipe with a list of components (raw materials)
- 2) The scientist defines the targets to be reached (ex. reduce the quantity of a certain costly raw material, produce faster, reach a higher pH or conductivity, etc.)
- 3) The dosing bench automatically produces recipes, runs tests and processes results using Artificial Intelligence.
- 4) Running in “closed loop”, the system analyzes tendencies and reformulates recipes until the desired result is reached.
- 5) The scientist becomes a supervisor. He can stop or influence the experiment at any time.

Automated dosing and testing bench

➔ Introduction to Application



Automated dosing and testing bench

→ Attractivity

- ✓ Accurate and repeatable dosing capacities for liquids and powders
- ✓ Full operational traceability (electronic records for dosages, results, batches, events, alarms, ...)
- ✓ 24/7 operation for buffers / samples / submixes preparation and testing
- ✓ Reduction of repetitive / low added value tasks for operators, more comfort
- ✓ Improved throughput (production and testing capacities) for laboratories
- ✓ Reduction of handling / testing errors, improved general Process Quality
- ✓ Simple control by the operators or by any upper system (ERP, LIMS, ...)
- ✓ Connects with AI/ML for cloud-computed formulation (self driving lab)

Automated dosing and testing bench

➔ Cost Effectiveness – Explanation of ROI

- ✓ In case of a laboratory operating 24/7 :
ROI achieved in less than 1 year
- ✓ In case of a laboratory operating 8 hours a day :
ROI achieved in 2 to 3 years
- ✓ When served with a Mobile Manipulator :
one bench can supply different production lines or laboratories : higher use and better ROI
- ✓ Flexibility of design and use :
ensures easy reconfiguration for new tasks : maximization of use over time
- ✓ In case of targeting the discovery of new materials :
use of artificial intelligence / machine learning with "closed loop" method
offers results x5 to x20 times faster than traditional methods (iteration or experimental design)

Automated dosing and testing bench

→ Areas of application

- ✓ **R&D**
 - Formulation discovery (with or without AI/ML)
 - Process optimization (with or without AI/ML)
- ✓ **Quality Control**
 - Automated samples preparation
 - Automated lot control from a production line, intermediate processes, storages, suppliers, ...
- ✓ **Manufacturing**
 - Recipe-driven buffers preparation
 - Automated submixes / small batches formulation

Automated dosing and testing bench

→ Flexibility

Standard implemented PLC and JAG MES ensures the system is highly flexible for :

- ✓ Implementing new operating recipes (ex. dosing, diluting, testing, ...)
- ✓ Implementing new labware formats (ex. bottles, beakers, syringes, ...)
- ✓ Introducing new testing probes or any third-party equipment

Intrinsic flexibility of the 6 axes robotic arm allows additional manipulation :

- ✓ Shaking, filtering, cleaning, packing, heating, cooling, controlling, storing, ...
- ✓ Either by the robotic arm itself or in collaboration with third-party equipment

Stainless steel construction for easy cleaning

Automated dosing and testing bench

→ Easyness to integrate

- ✓ JAG MES connects with third party softwares implemented in laboratories (ERP, LIMS, ...)
- ✓ JAG MES connects with APIs for driving laboratories' equipments
- ✓ Operators can create their own new articles and recipes with no programming experience
- ✓ The system can be “Plug and Play” applied into a laboratory for samples / buffers preparation or submixes reworking
- ✓ Any technical customization can be studied and performed by JAG if the case of a change of use / process in the laboratory

Automated dosing and testing bench

➔ Final message

- ✓ An obvious and simple answer to common difficulties in laboratories
- ✓ A cost-effective and scalable solution for companies
- ✓ A tool designed to help and serve operators
- ✓ A powerful hub offered by an experimented robotic integrator

