

Reinforcement Learning for  
Autonomous Accelerators



# RL4AA'26

## Discussion

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# Discussion – Survey results

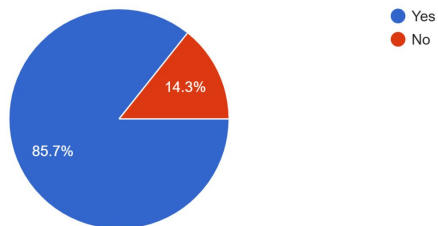


28 responses

Mostly accelerator people...

Do you currently work at a particle accelerator facility or have access to a particle accelerator for testing purposes? if not please specify your scientific facility/application

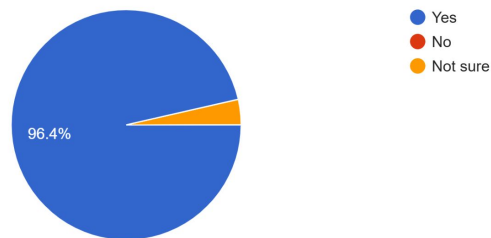
28 responses



... and with positive views of RL opportunities!

Do you see opportunities for applying RL to your work?

28 responses



# What opportunities do you see for RL?

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## Beam dynamics

- Bunch splitting, bunch rotation, energy matching
- Phase space manipulations
- Multi-harmonic RF tuning

## Beam steering & orbit corrections

- Closed orbit and optics control
- Steering and beam stabilisation
- Injection and multi-machine coordination

## Tuning and optimisation

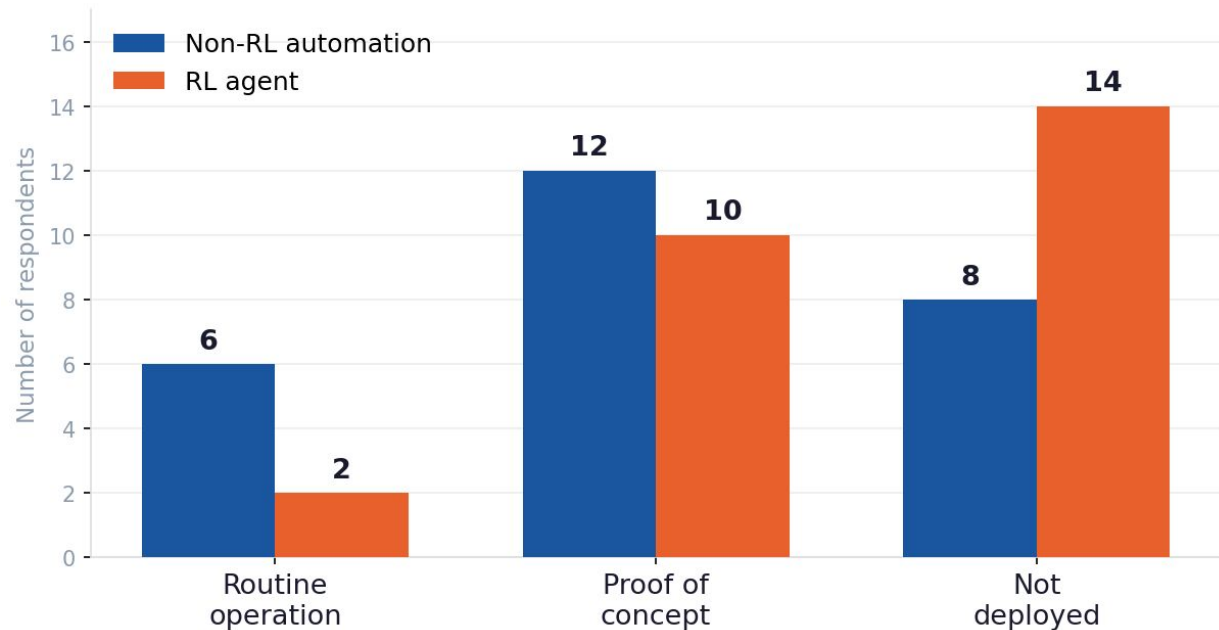
- Machine tuning and commissioning
- Luminosity optimisation
- Transmission efficiency between machines

## New contexts

- Accelerator/experiment design with RL
- Wireless communication

# Are we deploying RL for automations?

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Excited about RL, but not reaching routine operation yet...

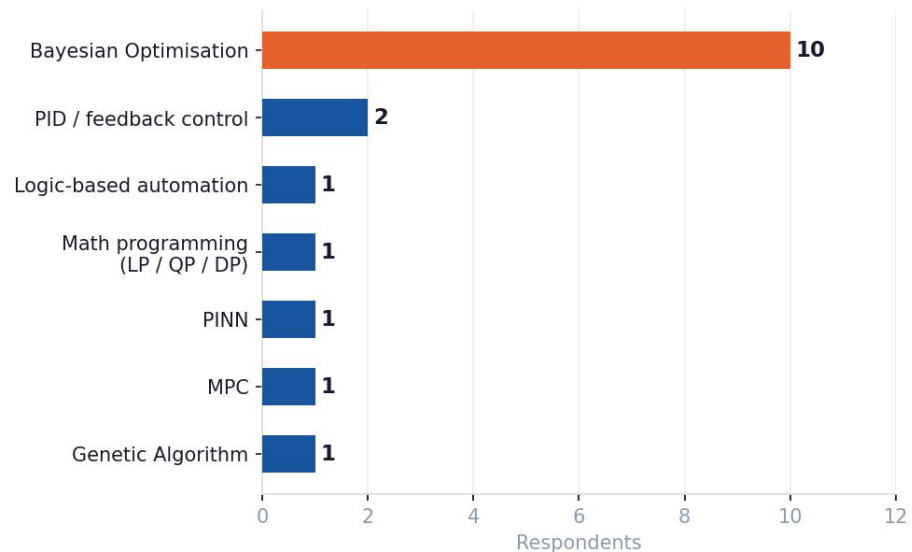
**What algorithms are  
mainly used?**

n=26

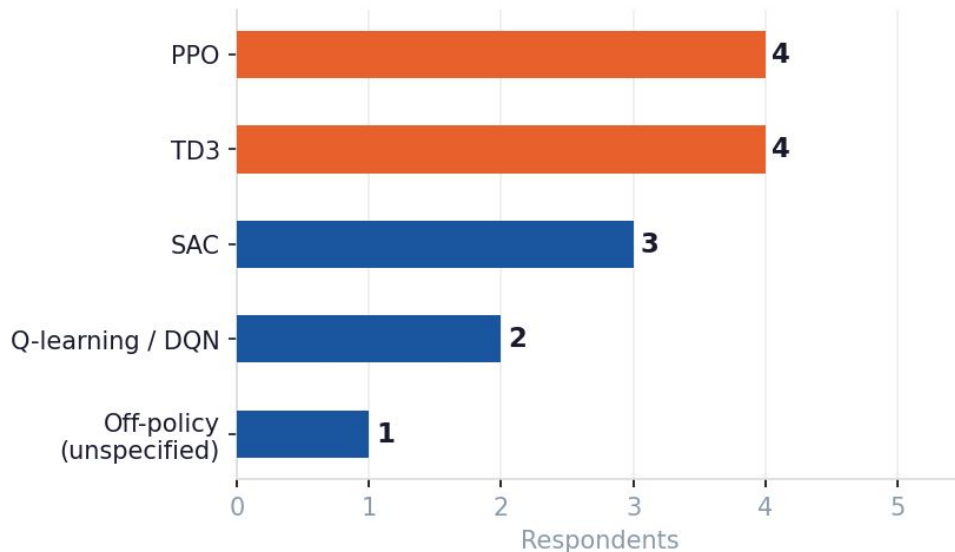
# What algorithms are most popular for automations?



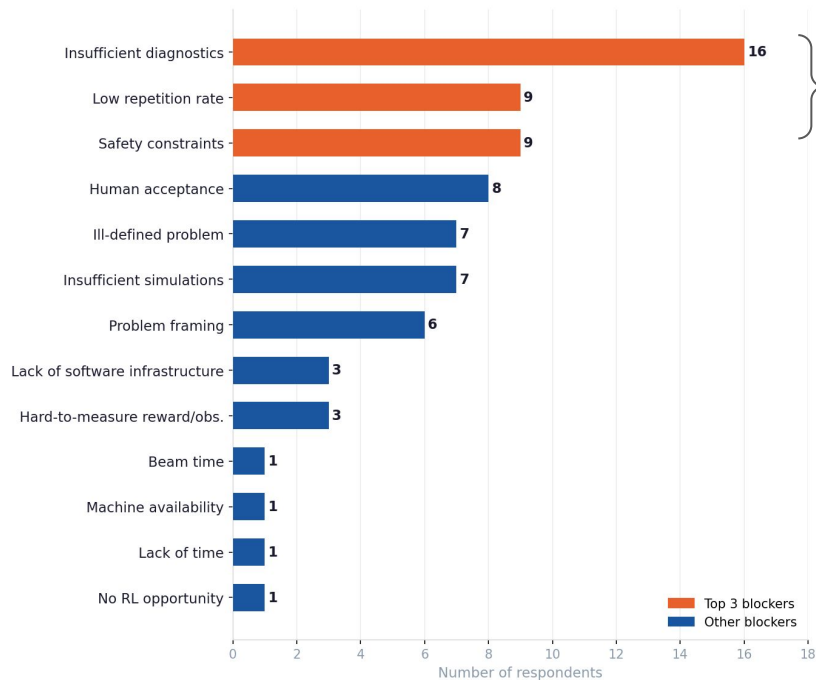
## Non-RL: BO dominates



## RL: SB3-staples of deep RL dominate



# Our major blockers for deploying more RL?

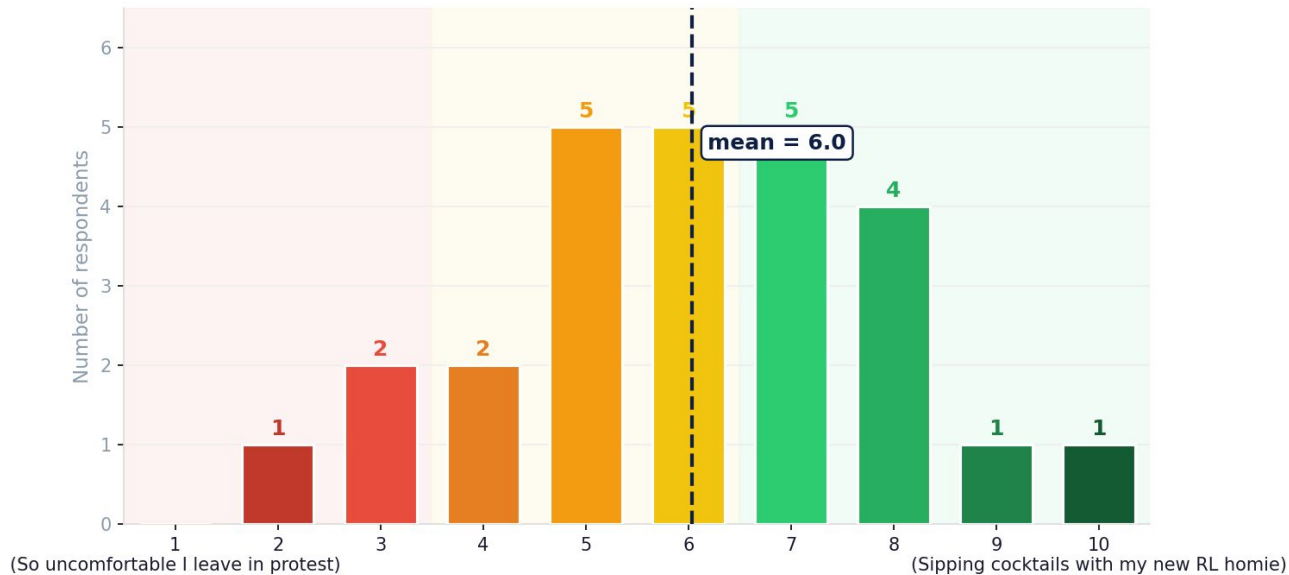


Infrastructure and safety top concerns

But many others options with high scores...

What can we do to overcome these issues?

# How comfortable would you be if you heard that a colleague deployed a trained RL agent to control a safety critical manipulation?



Varied range but slightly positive!

