ML/AI @ ALICE

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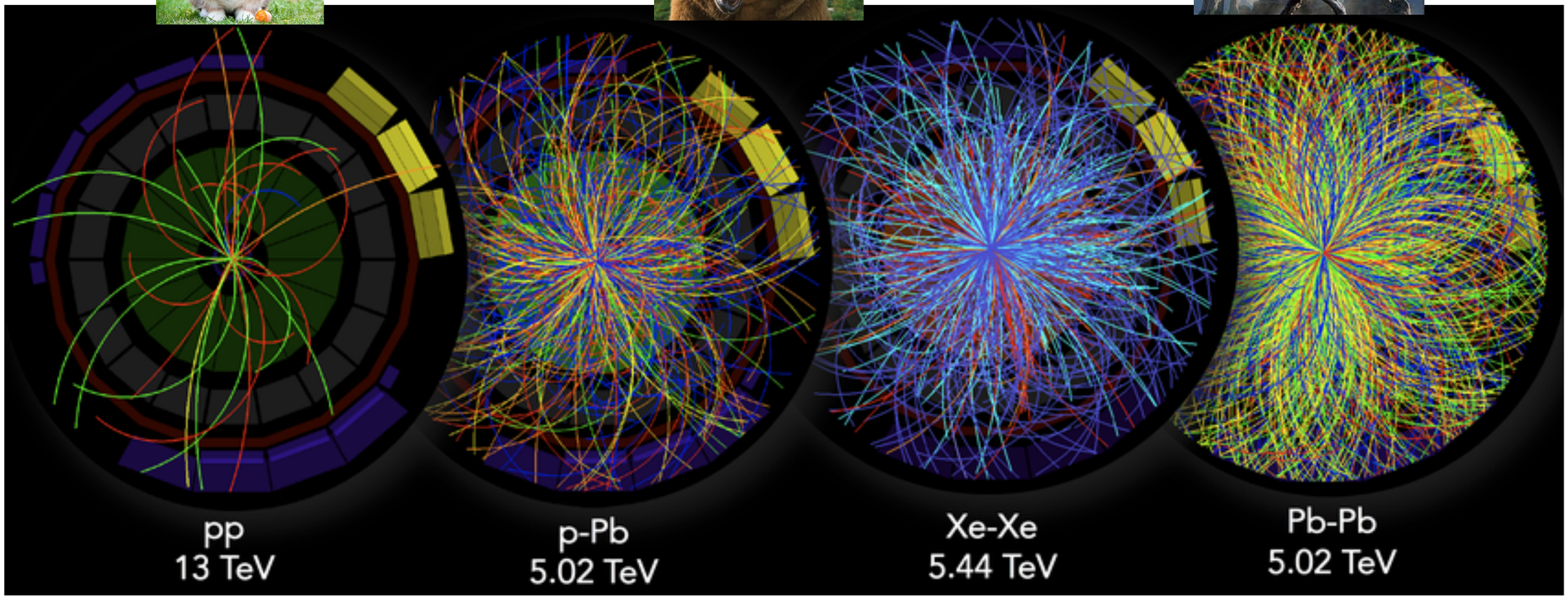
Nikhef

Nikhef AI Event

What is going on in ALICE NL?

.. a couple of selected examples

An obvious application: analysis

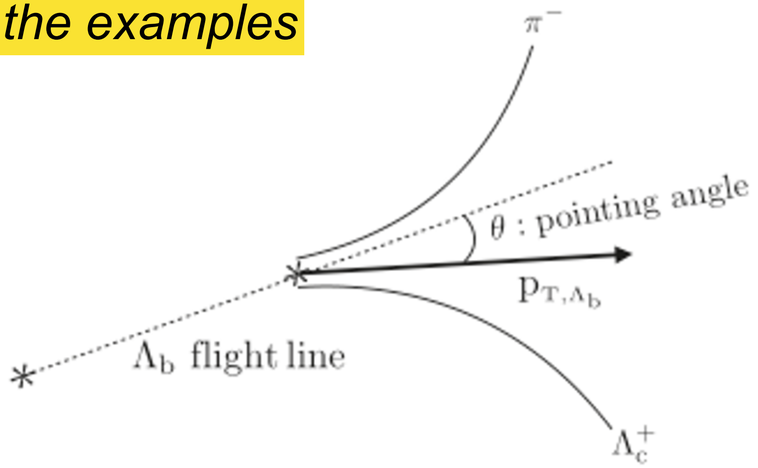


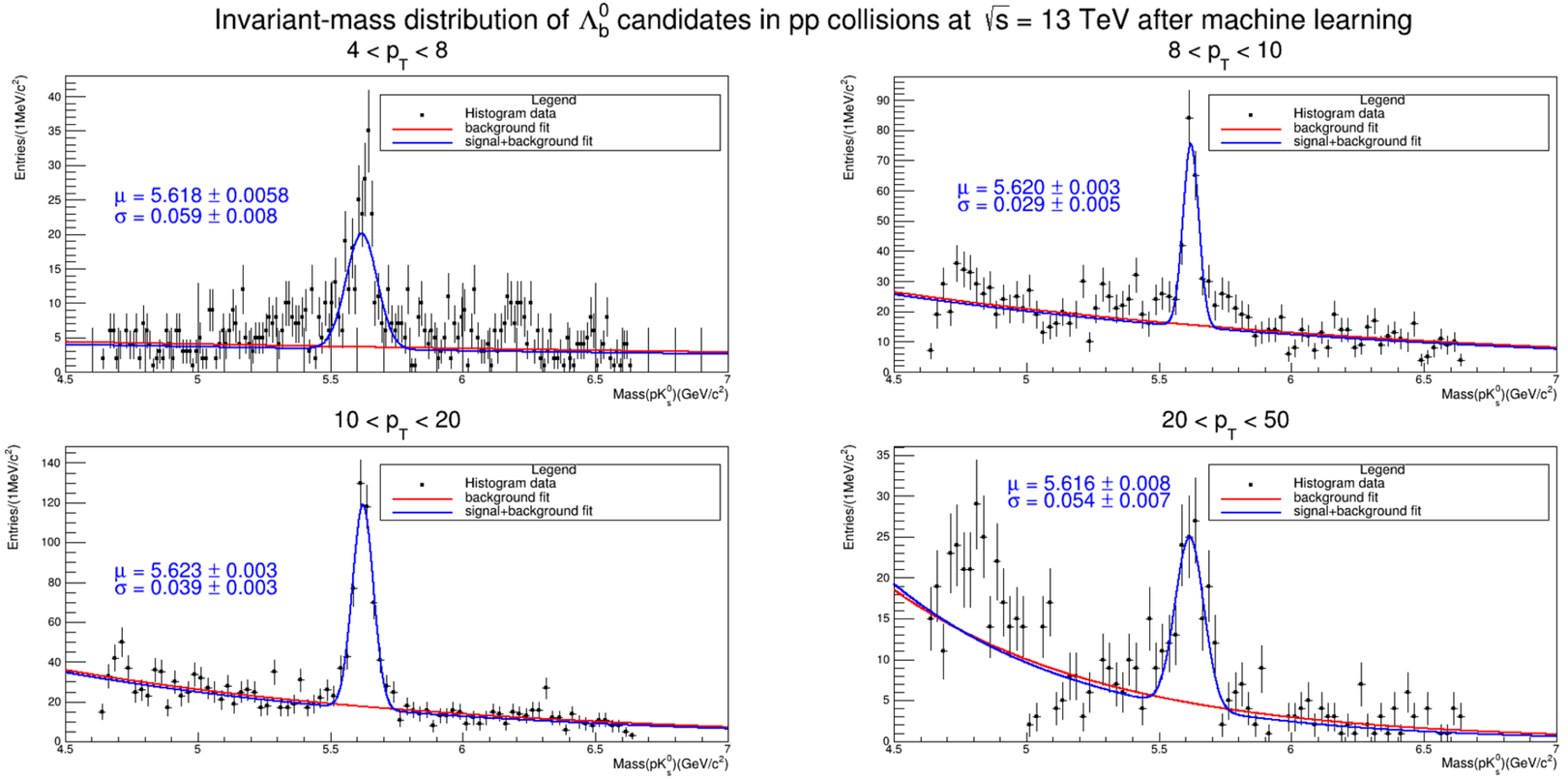
An obvious application: analysis

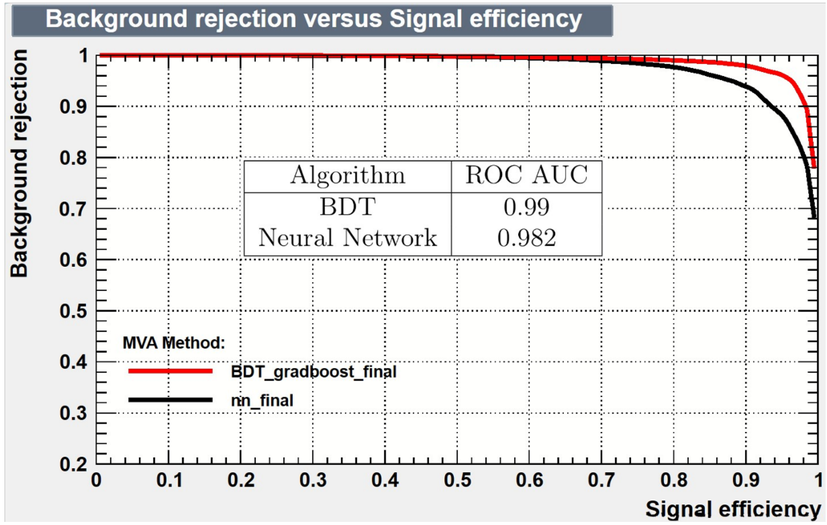
Just one of the examples

☑ Λ_b search requires background rejection on a 18th dimension feature space

☑ Supervised learning (in this case) for particle searches: **CNN vs BDT**

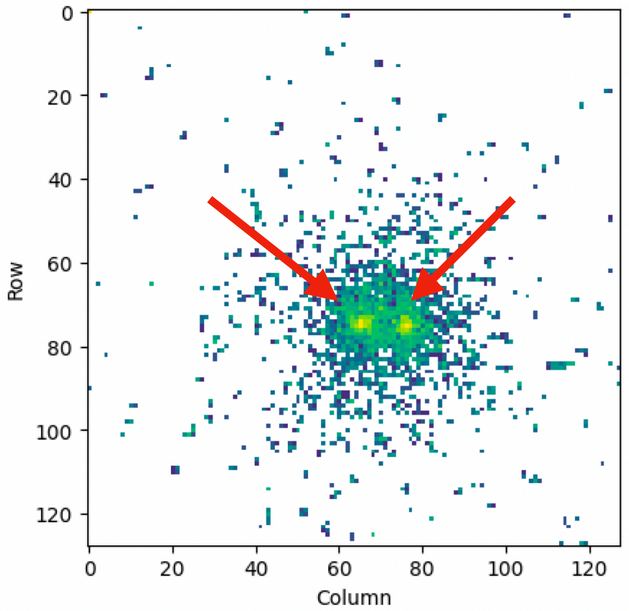




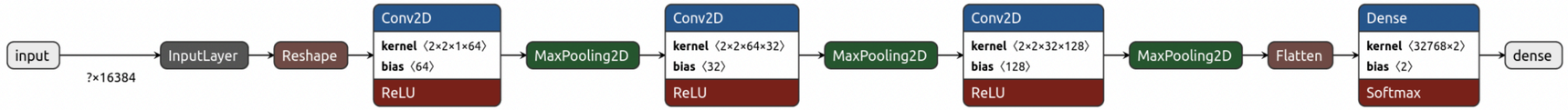


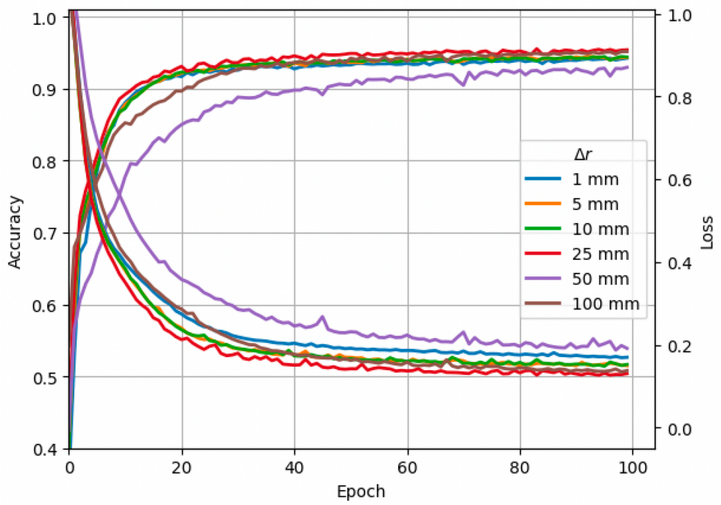
Readout: High risk - high reward

- ☑ Can we put AI on FPGA for fast decisions (trigger but not only ..)
- ☑ Pilot study performed with CNN on *Kria KV260 Vision AI Starter Kit*
- ☑ **Physics question:** can we tag multi jet events where the jets overlaps, being faster than CPU and GPU analogous calculations?



Positron Positron

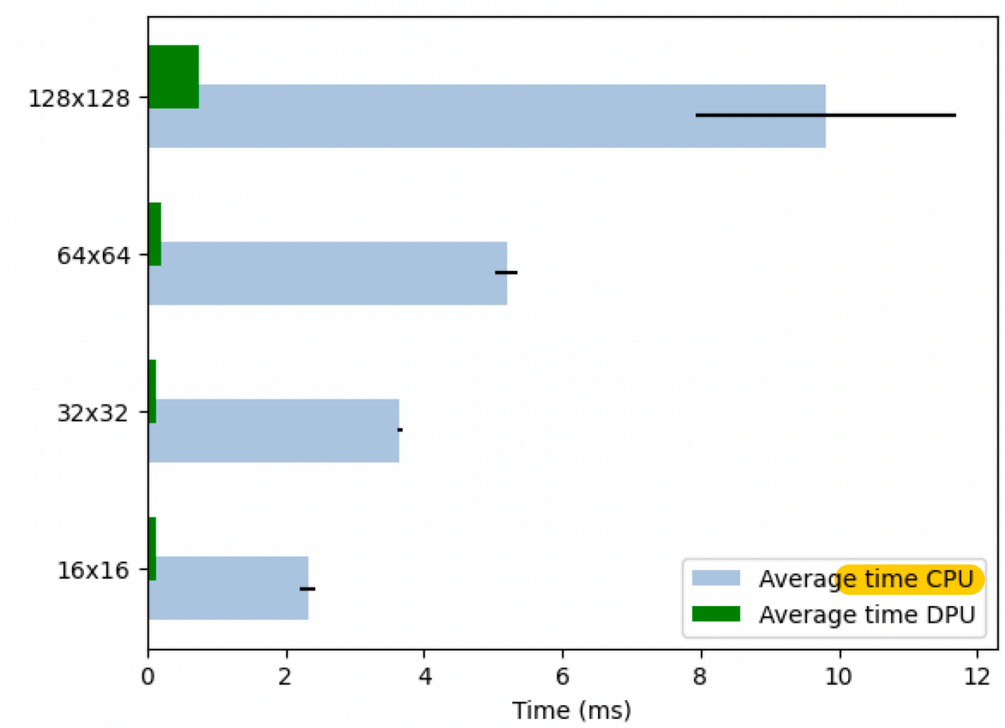




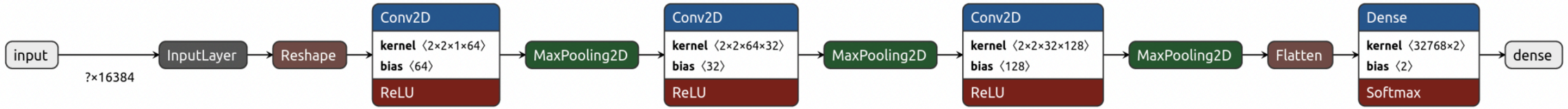
Get started

Readout: High risk - high reward

☑ How fast is the algorithm vs different platforms?



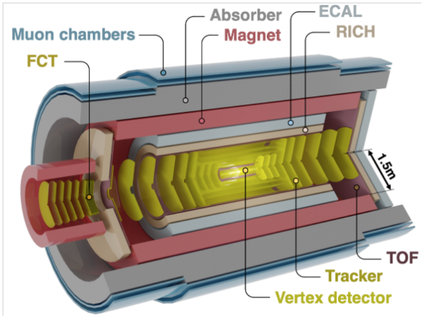
☑ Note: this is just a pilot study, no optimisation yet and arguably there are better (more appropiate) physics questions to ask the FPGA but we proved the machinery is in place and works

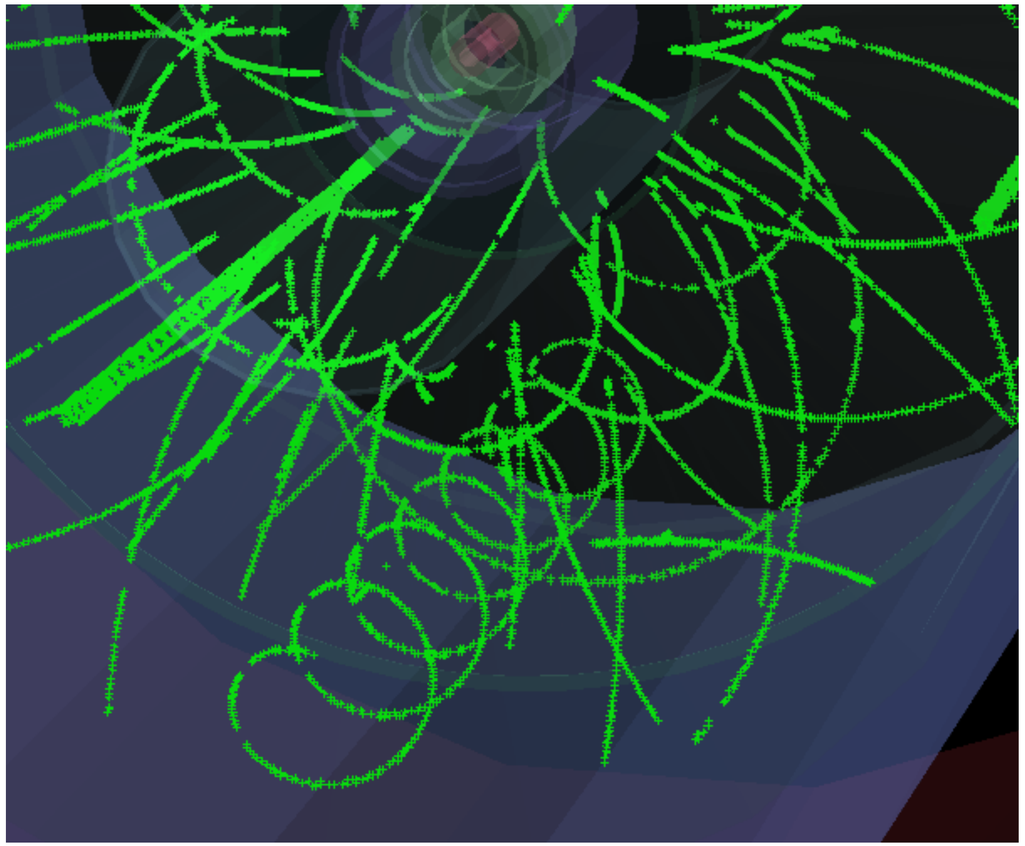


Additional interesting avenues for the future (?)

.. probably a non exhaustive selection

Further applications: tracking



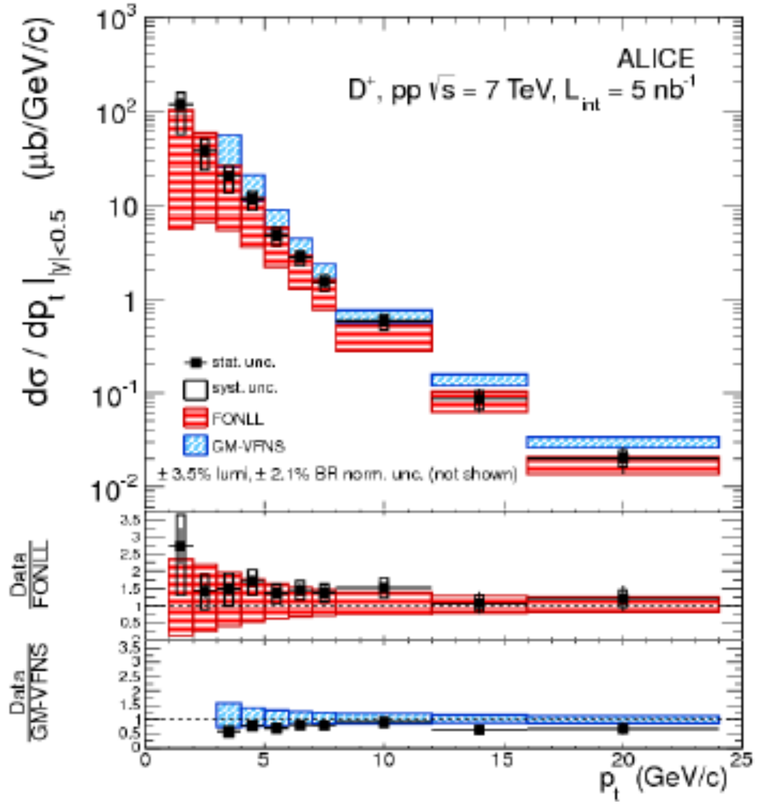


- Interest at nikhef is growing from different groups on the possible usage of AI for tracking

- ALICE case is similar but a bit special: additional goal is to track particles in the 10th-100th MeV range (spirals). Standard algorithms (like KF) fail. Can AI help?

Additionally:

- ☑ Data vs MC matching with ML for reduction of systematics ?



- ☑ Already now many measurements are limited by systematics
- ☑ Many sources of systematic are crucially dependent on the capacity of Monte Carlo to reproduce data (for D mesons, as example, it is crucial to reproduce the shape of the selection cuts)
- ☑ ML could help tuning the simulations

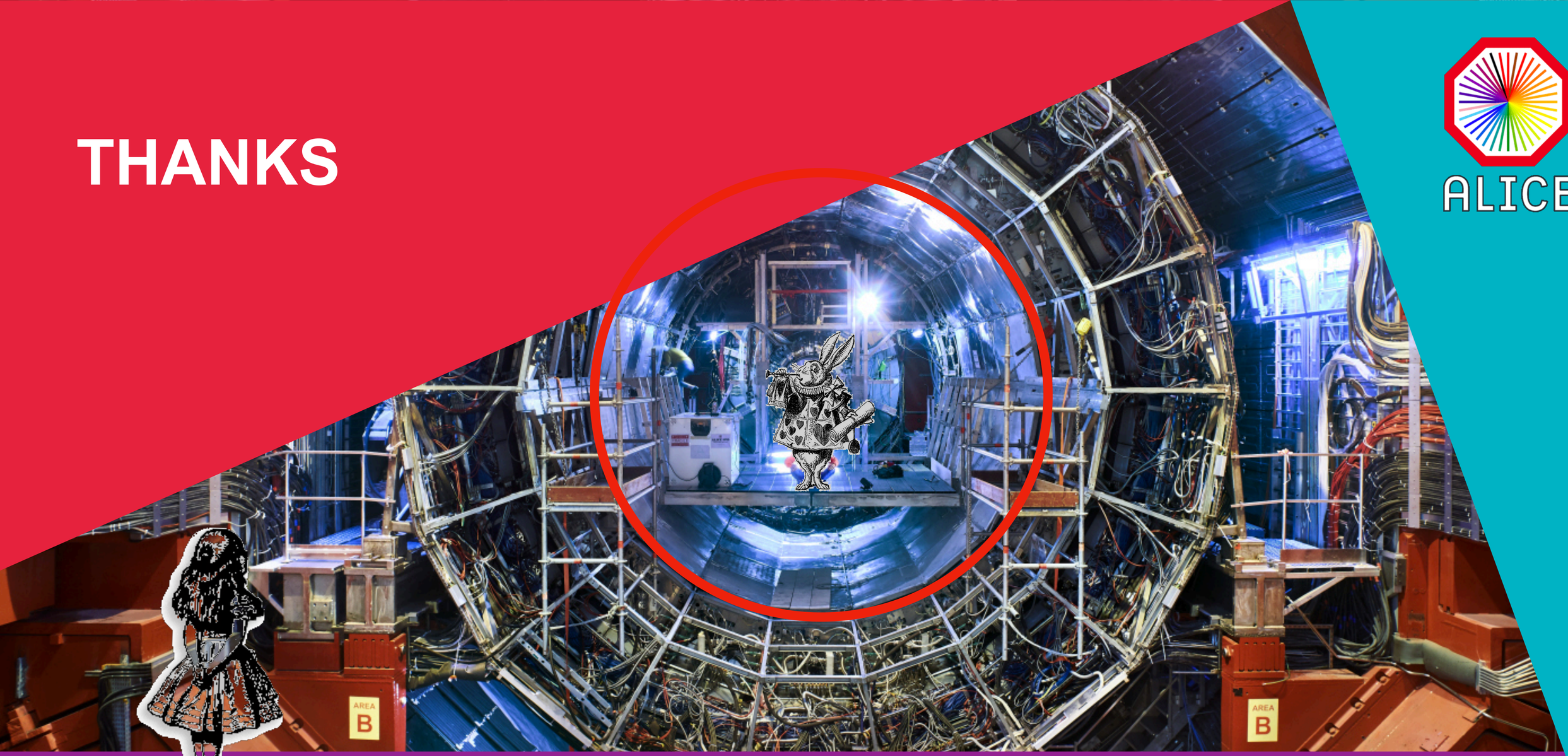
In summary:

- ☑ ML already used in several sector of data analysis: heavy flavour, jet physics, correlation analyses …. Interest can only grow with growing complexity of the searches

- ☑ ML can be used for fast decisions in platforms different from CPUs or GPUs (?). While there is still a question mark, framework is in place and principle works

- ☑ Interest on the investigation of ML for tracking and data-MC matching

THANKS



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