CERN openlab

Explorations in heterogeneous computing

Summer Student Lightning Talks

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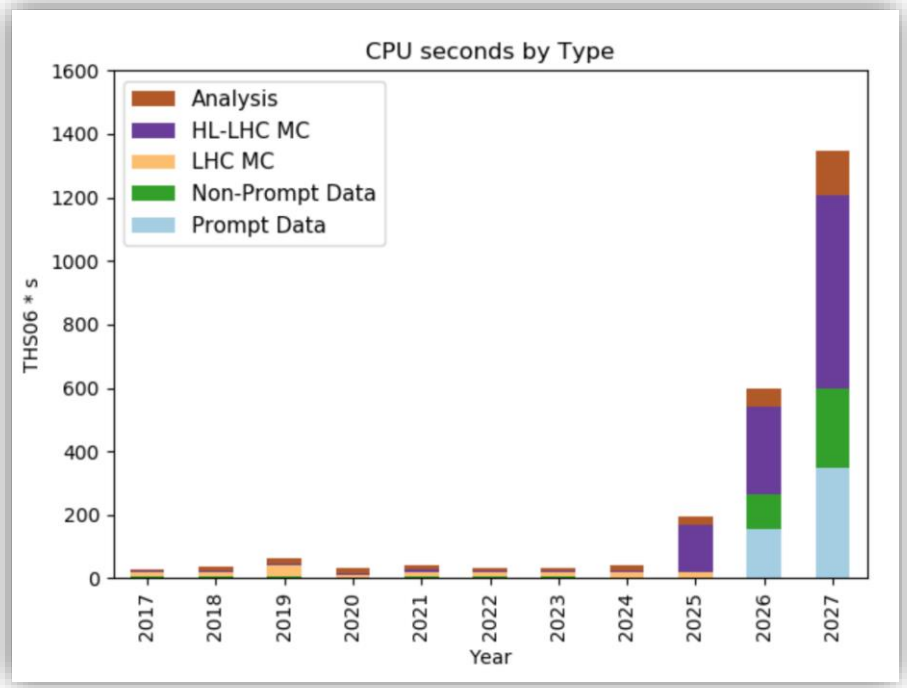
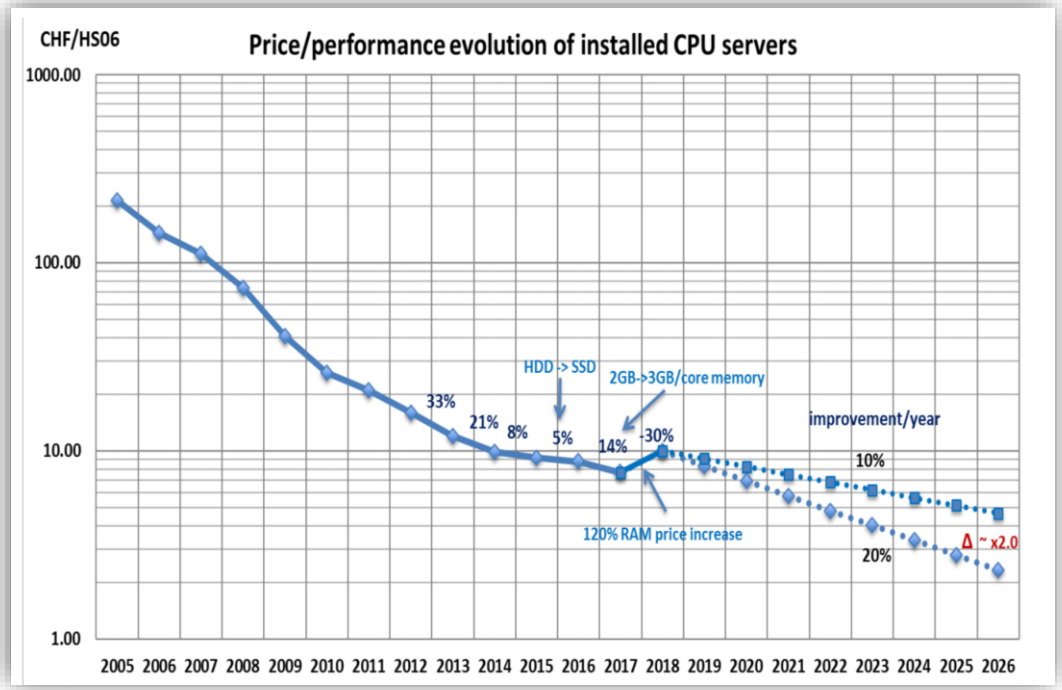
LHC experiments future challenges

Computing requirements will grow exponentially

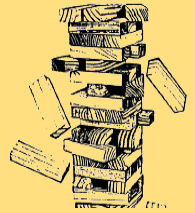




In 2027 4 million of today CPU cores would be needed

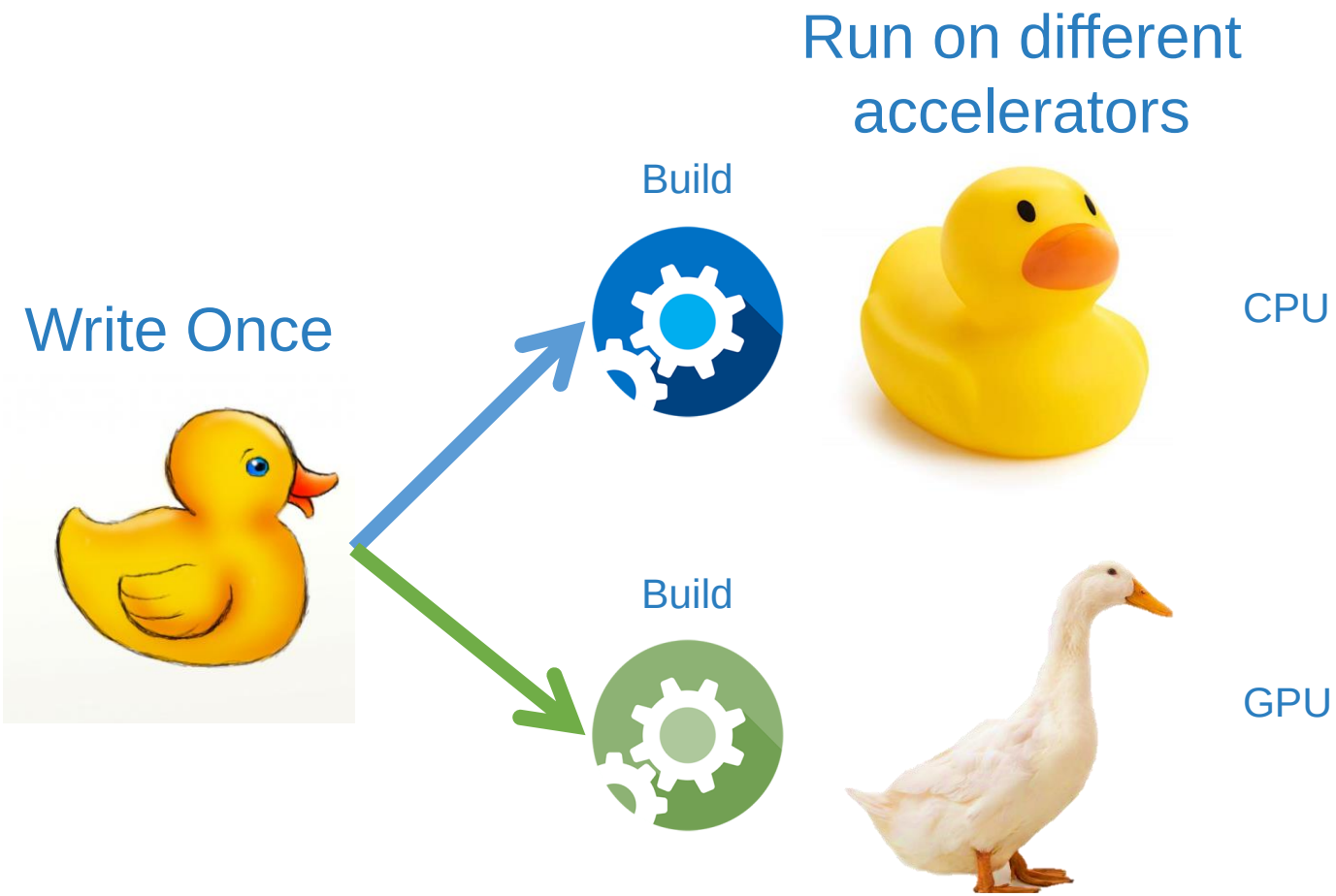
Scale out to GPUs

Patatrack Group for CMS



CUDA to Cupla

Evaluating the use of Alpaka + Cupla to write accelerator-independent code



Advantages:

- Code reuse
- Maintenability
- The code can adapt to different datacenters architectures
- Easier updates

Disadvantages:

- Dependencies on third party libraries

CUDA to Cupla

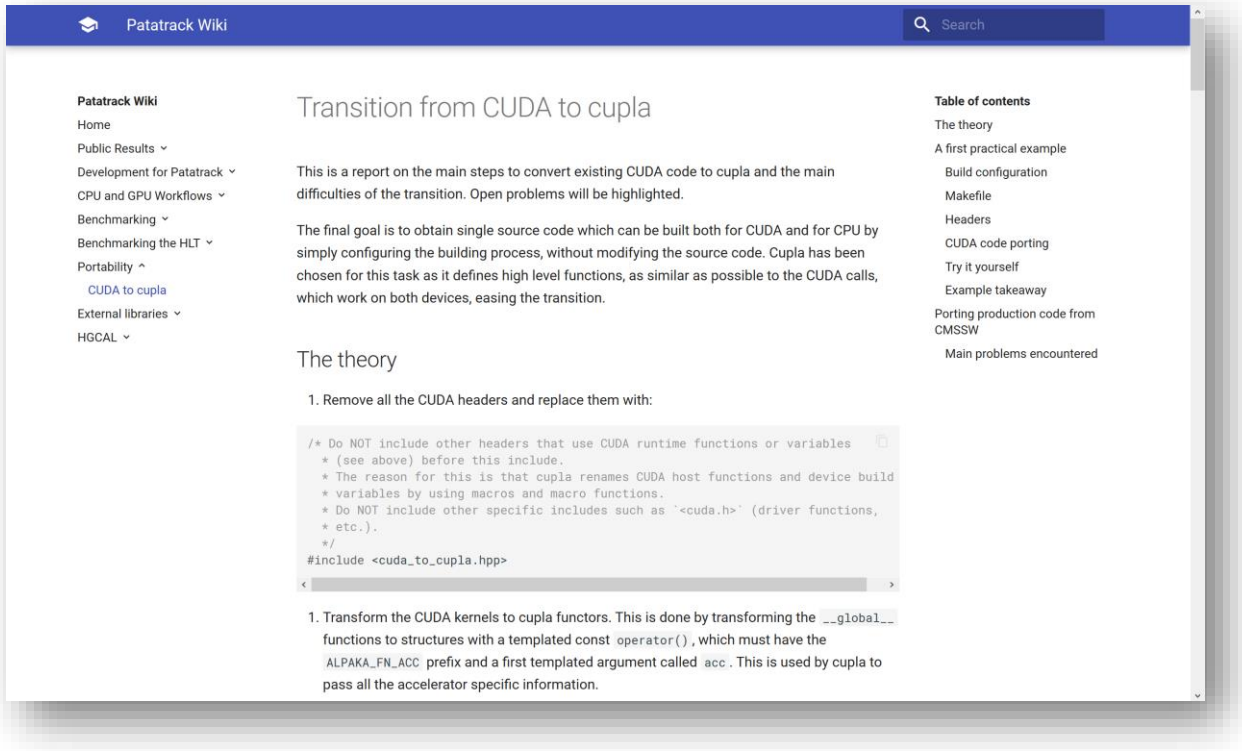
Evaluating the use of Alpaka + Cupla to write accelerator-independent code

Successfully ported a first example with Eigen as a dependency

Verified the limits of the approach when porting large codebases (CMSSW)

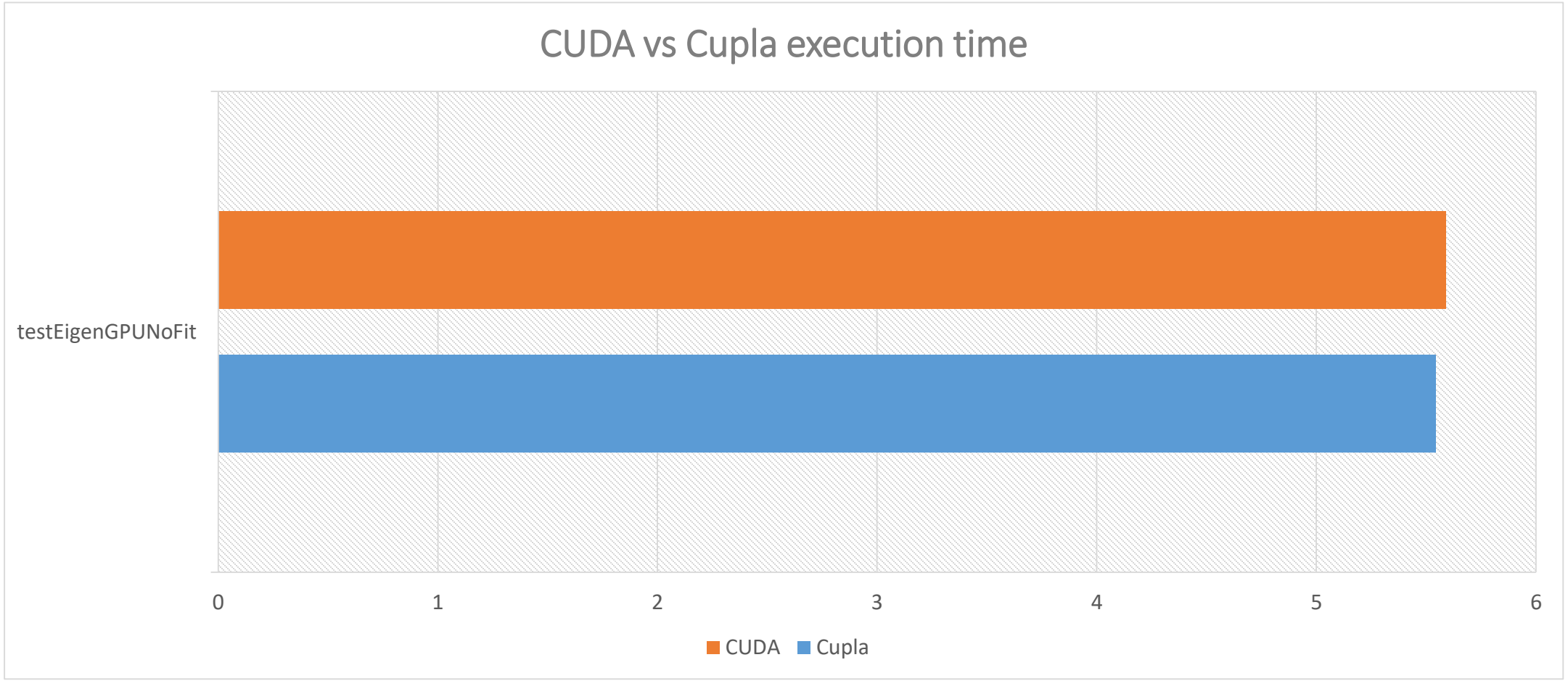
Website with guide and problems to be solved

http://patatrack.web.cern.ch/patatrack/wiki/cuda2cupla/



Performance

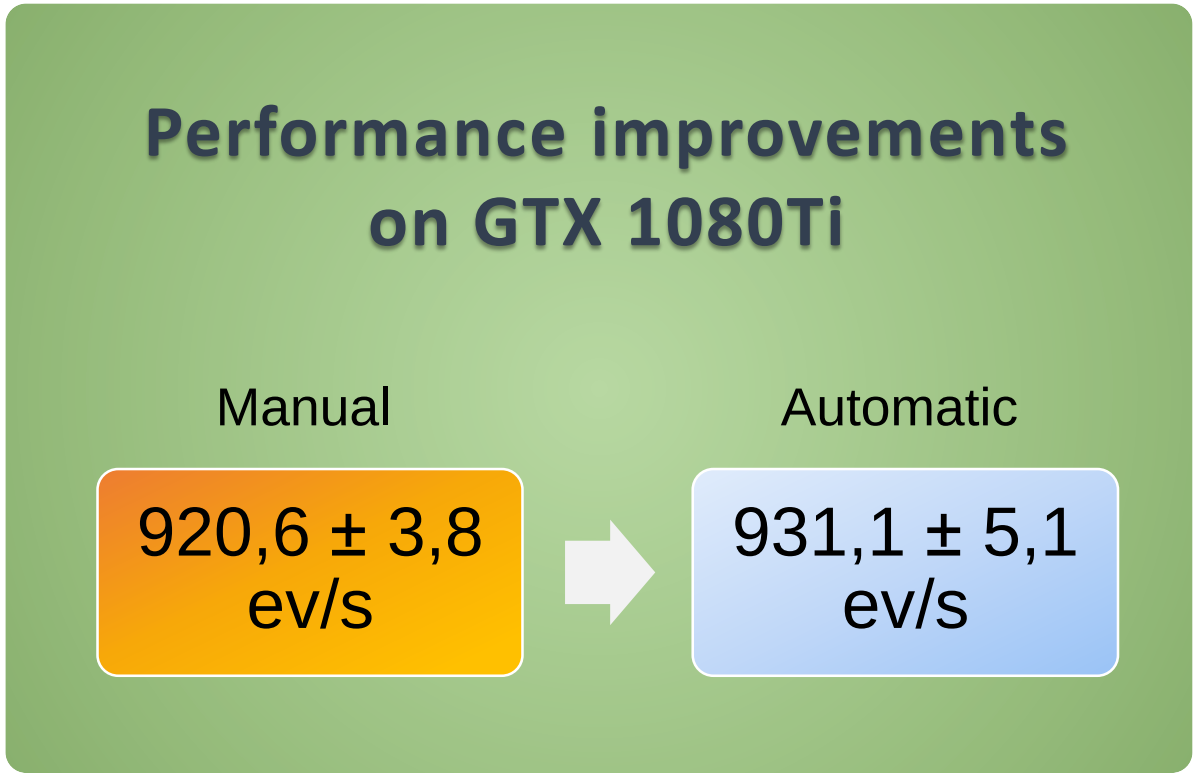
Performance are not affected by Cupla abstraction



Scaling on different GPUs

Automatic optimization of CUDA kernels launch parameters at runtime

- More and more datacenters offer accelerators
- The code needs to scale as much as possible on different (even future) GPU architectures
- Using `cudaOccupancyMaxPotentialBlockSize` to automatically choose at runtime the best parameters to launch each CUDA kernel



Winner of the 4th Patatrack Table Football Tournament

Davide Marcato
Adrian Alan Pol

6th Patatrack Hackathon
Geneva, 05/07/2019

Dr. Felice Pantaleo

QUESTIONS?

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