FIAS Frankfurt Institute for Advanced Studies

GPU-accelerated track reconstruction in the ALICE High Level Trigger

David Rohr

Frankfurt Institute for Advanced Studies

CHEP 2016, San Francisco

13.10.2016

SPONSORED BY THE

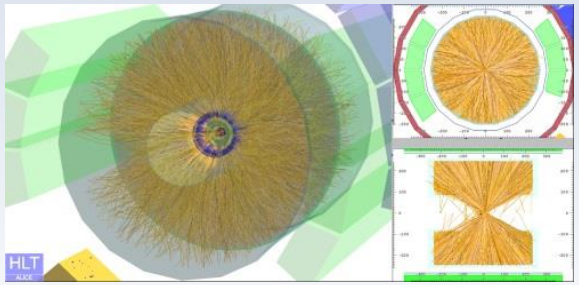
Federal Ministry of Education and Research

Highlights

- **ALICE employs GPUs for track reconstruction.**
- **Working stable in 24/7 operation since 2012.**
- **Significant speedup compared to CPU, can find and fit up to 40.000.000 tracks/second in ALICE HLT.**
- **Free GPU resources to be used to perform additional reconstruction tasks, looking ahead to run 3.**

Summary

- **HLT track reconstruction fast enough to cope with all trigger scenarios in Run 2 and with the maximum TPD DDL link rate.**
- **Tracker has a common source code for CPU / OpenCL / CUDA yielding consistent results.**
- **180 compute nodes with GPUs in the HLT**
  - Since 2012 in 24/7 operation, no problems yet.



- **Cost savings compared to an approach with traditional CPUs:**
  - About 500.000 US dollar during ALICE Run I.
  - Above 1.000.000 US dollar during Run II.
  - Mandatory for future experiments, e.g. CBM (FAIR, GSI) and ALICE upgrade with >1TB/s data rate.
  - Can be used to test new online tracking features for Run III.
- **We are now looking into optimizations for new GPU architectures, but not yet specific to one model.**
  - Plan to bring more components onto the GPU, reduce PCIe transfer, keep component structure.
  - Using GPUs with more memory, we are confident to process timeframes similarly to events today.