

Aggiornamenti sulla scelta per EF tracking

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Pisa

Last steps

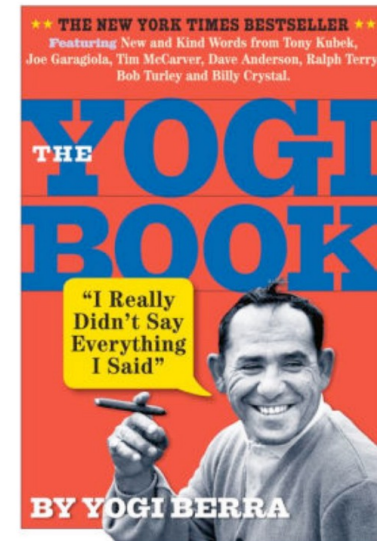
- TDAQ open meeting on Web 9th
 - <https://indico.cern.ch/event/1043185/>
- eTDSG workshop to choose a technology tomorrow

Performance

- Software-only approach clearly yields best performance, meets all requirements
- Hardware-based options may get to similar efficiencies
 - But fake/duplicate rates are high, and reduction comes at a cost in efficiency
 - Impact of worse resolution downstream non-trivial
 - Eg for vertexing, b-tagging, ...
 - d_0 resolution certainly worse for custom HW - crucial for b-tagging (large fraction of regional tracking trigger menu)
 - Refitting of tracks needed for b-tagging can be considered. Not a significant CPU cost.
 - Commodity TF argues resolutions will be correct
 - hits are fed to software tracking
 - They do budget for fast tracking Kalman filter
 - In the current reports, hardware-based options do not meet all requirements
- EF is not Level-1: not correct, efficiency and resolution, in all areas
 - Not explicitly about what is not met and to what extent. Custom solution (largely) meets the requirements.
- Direct impact on all physics objects!

Committee Assessment

- On all fronts but power and cooling the software option is the strongest
 - And there is ample power and cooling margin for a software system that meets the specs
 - If we had to make a final choice today, there is little doubt we'd (have to) go with the software option: lowest risk, best physics performance
 - EF is not L1, need the best possible efficiency and resolution: a 10% efficiency loss in EF is like running at 900 kHz L0 accept instead of 1 MHz, or waste of 10% LHC running time
- But, as Yogi Berra put it, "It's tough to make predictions, especially about the future"
 - The downside of the software option is power consumption
 - A big reason FPGA-on-PCIe cards are commercialized is reducing data center power usage
 - Heterogeneous commodity approach offers significant reduction in power
 - More time is needed to study more complex algorithms
 - R&D should be continued, in the TDAQ high-throughput context (different from offline)
 - Firmware expertise development and maintenance crucial to ATLAS
- We do not see any real advantage to the custom solution
 - But significant risk and a large investment would need to be made soon



Conclusion

- The committee recommends that ATLAS commit to a commercial solution for EF tracking at HL-LHC
 - The context evolution since the TDR, including the reduced pixel readout rate, software tracking resource need reduction, and the commercial availability of “FPGA-on-PCIe” cards, means the custom approach has no advantage anymore (that we can see)
 - SW-only is proven, feasible, gives excellent physics performance at affordable cost and well within power budget
- TDAQ should continue investigating using hardware accelerators to optimize the EF farm
 - Heterogeneous commodity TF has largely demonstrated proof-of-concept
 - A heterogeneous solution (incl. FPGAs and/or GPUs) could lead to substantial power and cost savings
 - But a lot more work is needed to
 - Develop algorithms and optimize their performance (to a point comparable to the software performance) in the TDAQ high-throughput context
 - Implement all the missing low-level components for a complete system
 - System architecture studies and technology tracking
 - That work can then be used to perform a detailed optimization of the EF system, including cost and power considerations