Simulation:
ECHEP in 6 Months

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This is meant to provoke discussion

- In 6 months, we cannot solve all of our problems

- But maybe we can develop and quantify a generalized strategy

- And maybe we can all work together to make sure it comes about

Full Simulation

- Will always need full simulation to some level

  - E.g. Fast Sim models require training on some sort of dataset.

  - Cannot have data-driven calibration on everything

- How do we balance the simulation needs of all involved parties?

Geant4

- Used by all

- Gains in performance demonstrated, but is more still possible?

- What level of focus do we want to put here?

  - Quantification of FTE impact is needed

  - Are there further GPU strategies to be explored?

  - Which are also not locked to vendor? Does that matter?

- Pushing coupling of FastSim for specific parts of Geant4 physics?

- Conversations from the workshop: Do we want to pursue a "fast Geant4" option building on Geant4 physics with a different code base for specialized architectures?

Fast Simulation

- Fast simulation techniques are/will become necessary for LHC experiments

- Biggest question: What is the speed to detail ratio we want?

- Mix and match of fast and full simulation allows us to gain where we want to, without sacrificing performance where we can't → benchmark

- Are there "best practices" that we can push?

- "Selective" fast simulation within an event?

Interplays

- Can we learn from each other to make simulation better for all?

  - Thread-safety enforced throughout simulation components

  - Can we take an LHCb Allen like strategy and ask what is possible when everything is written for GPU from scratch?

  - Moving to industry supported solutions has a longer lifetime

    - Containerization

  - Is there a use case for SYCL within full simulation?

Deliverables in 6 months

Full Simulation

- Can we define benchmark numbers to compare against and test physics models to give a scale?

- First look into SYCL feasibility

- ...

Geant4

- Estimate influence of HEP FTE on product

- Further explore in depth possible fast simulation connections directly with imported geometry

- ...

Fast Simulation

- Cross-collaboration experiment independent calorimeter simulation?

- Identify cross-experiment comparison case

- Define key measure, show tests on this experiment case

- ...

backup

Possible Deliverables for Generators

<u>Generators</u>

- Run profilers on all generators + patches
  $\rightarrow$ feed back to authors

- Explore cross-collaboration use of generated samples

- ...