Proposal: FastMC

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Motivation

Enable fast (> 10x faster than standard) MC for Phase-2 for early, approximate physics studies, signal parameter scans, evaluation of physics driven systematic uncertainties and potentially more.

Lower processing **and** storage needs focusing on derived data formats (Mini/NanoAOD or DAOD_PHYS/PHYSLITE)

Requirement

Adequate physics performance

CMS FastSim

Fast simulation (FastSim) is an integral part of CMS physics studies and the CMS software framework

Speeds up CMS event simulation **~100 times** and CMS event simulation+reconstruction **~20 times**

FastSim is mainly used for Run 2 BSM signal production, top systematic studies and private production for MSc/PhD theses. O(10B) events per production year

Regularly validated within the official CMS software release validation framework

Mainly validated against Geant-based full simulation (FullSim). Reproduces FullSim mainly by about 10% (depends on signature)

CMS FastSim

by Sezen Sekmen
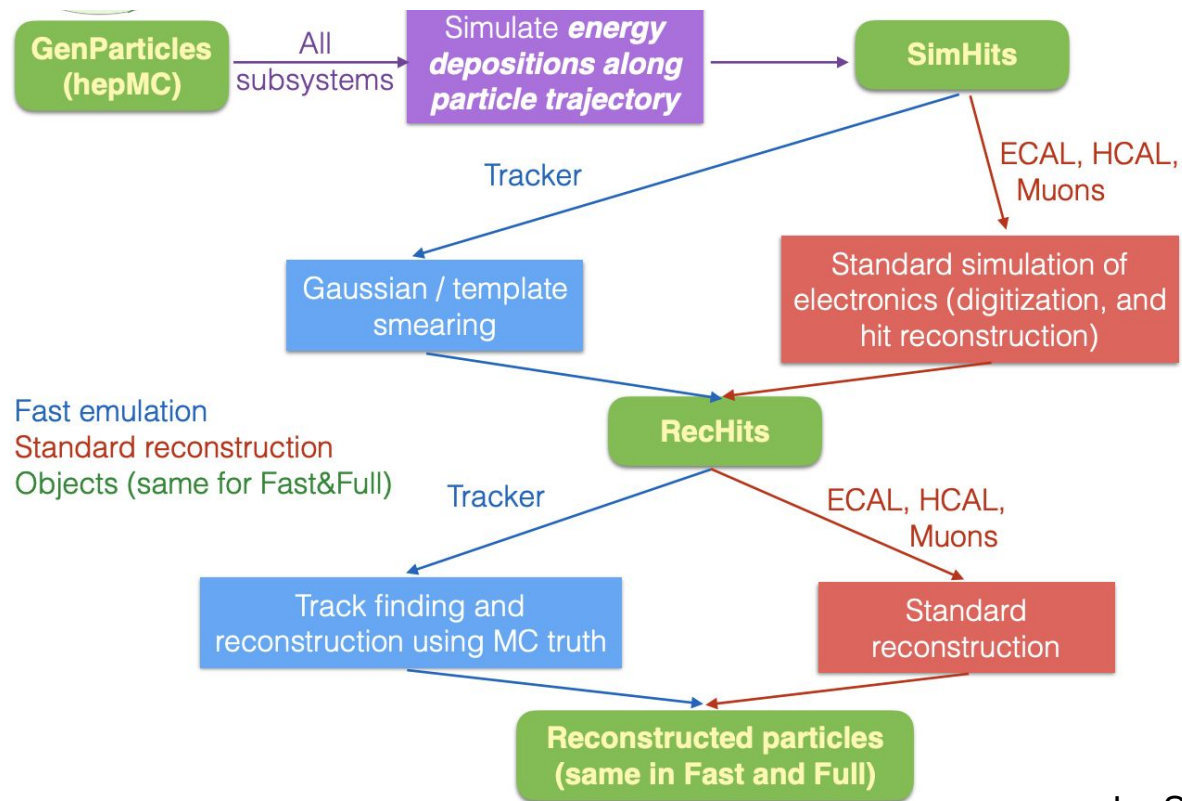
Program of work in 2 Phases

CMS focused and starting from FastSim

- 1) Implementation of Phase-2 detector simulation and reconstruction, specifically for HGCAL
- 2) Validation of physics performance
- 3) Expanding usage for physics in Run 3
- Milestones for end of 2020
    - first Phase-2 release
    - demonstration of Run 2 analysis

IRIS-HEP oriented, i.e. not necessary limited to CMS

- 1) FastMC tuning with ML
- 2) Fast reconstruction using ML - see Phil's talk
- 3) Calorimeter showering with ML
- Milestones for Summer 2021
    - first ML based tuning for Run 3
    - test and give feedback on 2)
    - evaluate performance of 3)

People and Collaboration

Personnel

- MIT undergraduates
- Justin Yang - grad student, MIT fellowship
- Andrea Marini - postdoc, DOE (will move to a new position soon)
- NN - postdoc, DOE (potentially 25% IRIS-HEP in 2021)
- Markus Klute (PI)

Collaboration

- CMS FastSim team
- Phil on FastReco
- Kyle and Mike (Constantin) on ML topics