Detector Simulation Input for the European Strategy for Particle Physics Update

Introduction to the November 22nd, 2024
HSF Detector Simulation Activity meeting

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The European Strategy for Particle Physics Update

Defines roadmap and priorities for Particle Physics in Europe

Last update 2017 (start of process) - 2020 (report released)

The third update is in progress

Council appointment of the members of the PPG and decision on the venue for the **Open Symposium**

End September 2024

Deadline for the submission of main input from the community

31 March 2025

Open Symposium

23-27 June 2025

Deadline for the submission of final national input in advance of the **ESG Strategy Drafting Session**

14 November 2025

Submission of the draft strategy document to the Council

End January 2026

December 2024

Council decision on the venue for the **ESG Strategy Drafting Session**

26 May 2025

Deadline for the submission of additional national input in advance of the **Open Symposium**

End September 2025

Submission of the "Briefing Book" to the ESG

1-5 December 2025

ESG Strategy Drafting Session

March and June 2026

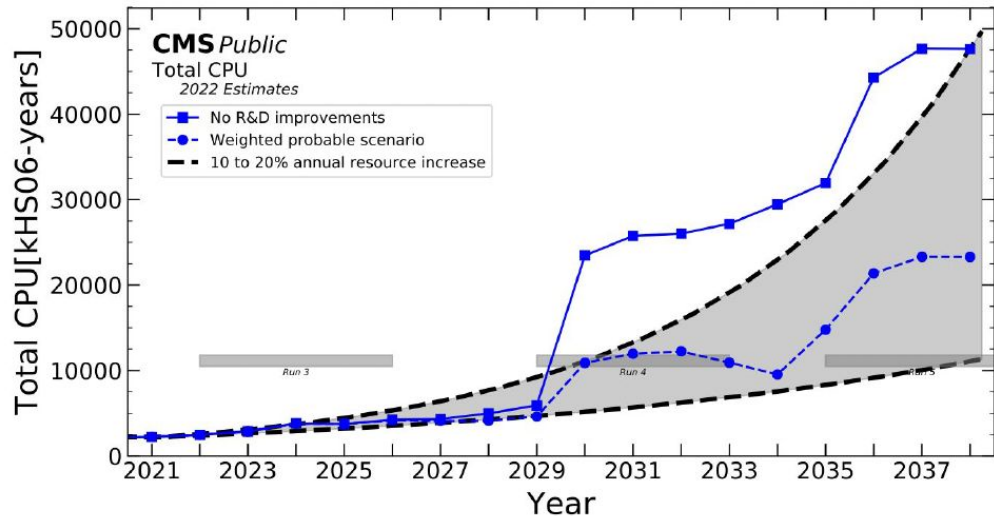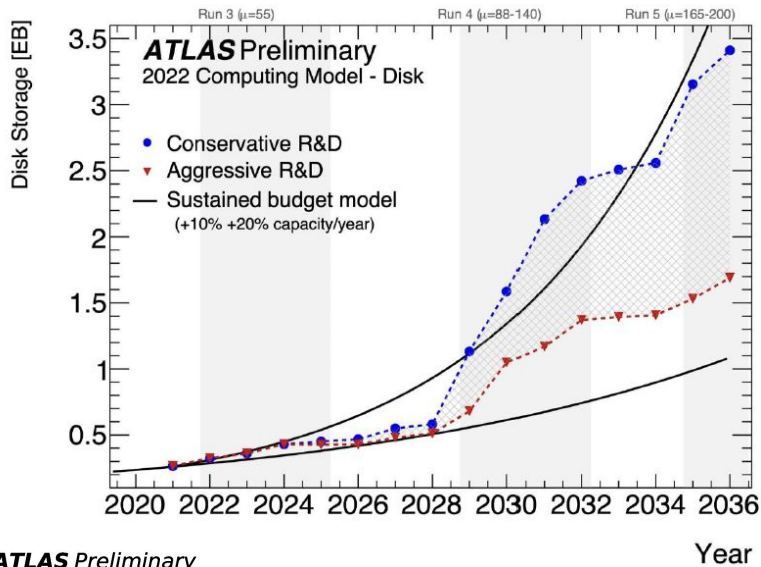Discussion of the draft strategy document by the Council and **updating of the Strategy**

Computing and High Energy Physics

The LHC experiments (but also others) are producing large amount of raw data, and even larger simulated datasets are required to support their analysis. Luminosity will increase faster than CPU and disk (at fixed budget)
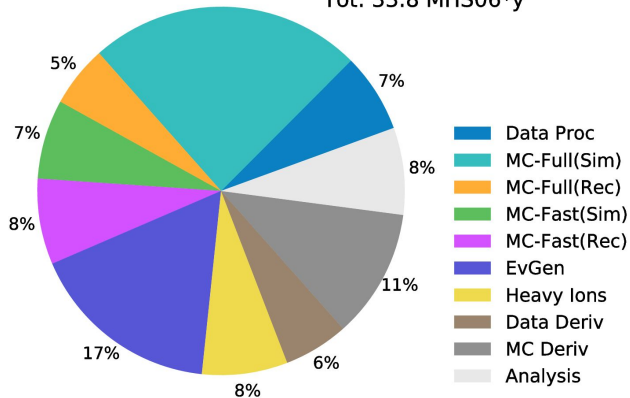
Computing technologies are evolving (multi-core machines with low memory per core, GPUs, ML driven computing)

A robust R&D in software and computing for High Energy Physics should accompany the development of new accelerators and detectors (or detector upgrades) in order to effectively exploit the physics potential of the future facilities

ATLAS Preliminary
2022 Computing Model - CPU: 2031, Conservative R&D

Tot: 33.8 MHS06*y

Data Proc	
MC-Full(Sim)	
MC-Full(Rec)	
MC-Fast(Sim)	
MC-Fast(Rec)	
EvGen	
Heavy Ions	
Data Deriv	
MC Deriv	
Analysis	

MC is projected as being 72% of CPU usage
(17% event generation, 31% simulation 13% reconstruction 11% derivation)

The **H**EP **S**oftware **F**oundation

Promotes the development of common tools and exchange of ideas between experiments for software

In 2017 it prepared a [Community White Paper](#) to define a roadmap for computing and software in the 2020s, providing input to the last update of the Strategy

HSF and the 2024-2026 Strategy Update

We plan to submit a document as part of the community input (i.e. by March 2025) focusing on the areas which are more computing intensive : Event generation, Detector Simulation, Reconstruction and software triggers, Data analysis

Not a full replacement of the White Paper, but updating and highlighting key points. Rely on the CWP and referencing other recent public documents

Space is limited, 10 pages max, so we should aim for 2 pages for the detector simulation

The primary goal is to sustain a continuing support from the funding agencies for computing R&D and common projects, in addition to the support of the computing resources allocated to individual experiments

What was in the Community White Paper in 2017

8 pages on Detector Simulation

Importance of Geant4 as a toolkit which was used by most HEP experiments; desiderability of common software for fast simulation framework, digitization and geometry tools

Physics : developments in EM and hadronic physics to meet the needs of higher energy and higher intensity experiments

Computing : code modernization; multi threading friendly code; SIMD code for GPU usage; fast simulation approaches; more efficient inclusion of pileup

Other relevant documents

https://zenodo.org/records/4009114 HSF input to the LHCC review of HL-LHC computing, written in 2020

https://arxiv.org/pdf/2203.07614 detector simulation document for the US Snowmass 2021 study

What we need from you

Feedback on the high-level priorities that we should highlight in the document for the Strategy.

Since time is limited, we expect a focus on the big picture and key points

You are welcome to send us additional (and possibly more detailed feedback) by e-mail, with references to slides, documents, etc.

We will circulate a draft of the document early next year, asking for feedback. We hope for an endorsement by the experiments of the document that will be submitted

Stay in touch

If you are not a member of the HSF Detector Simulation Google Group/mailing list and would like to join, please go to: https://groups.google.com/g/hsf-simulation

The main HSF mailing list link is: https://groups.google.com/g/hsf-forum

Also see: https://hepsoftwarefoundation.org/future-events.html