

Introduction, Collaborative tools and Physics samples

LPC meeting on future 100 TeV proton collider

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Goals

This meeting focuses on the summary of physics studies done in the context of the Snowmass 100 TeV proton collider, as well as discussions on challenges and next steps for future hadron machines.

The emphasis will be on the physics studies, preparation of collaborative tools and efforts for global initiatives on a 100 TeV proton collider.

Currently there are two major initiatives (feasibility studies) in progress

1. CERN FCC: <http://indico.cern.ch/conferenceDisplay.py?confId=282344>
2. CFHEP Beijing studies : <http://cfhep.ihep.ac.cn/index.htm>

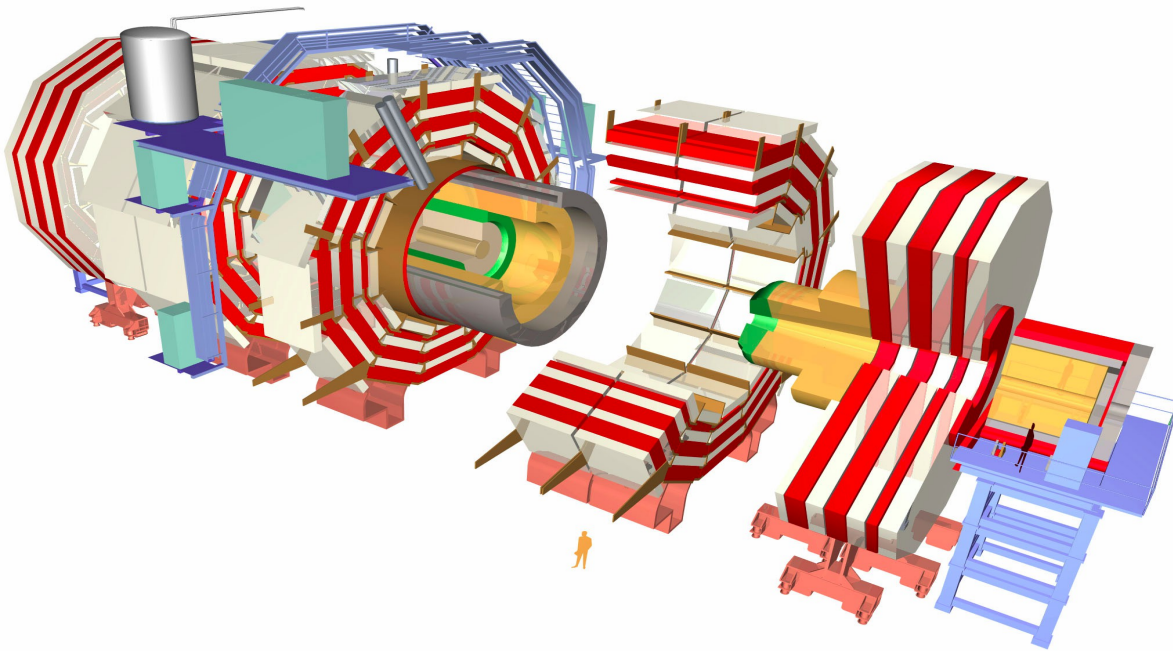
Irrespective of where this will be built, we need physics and detector studies

→ Lifeblood of our field

Collaborative Tools

Do we have a detector and simulation framework (with pile-up) for such studies?

Combined Snowmass detector (arXiv:1309.1057, arXiv:1307.6346)



“Components” from
the ATLAS and CMS
detectors:

- CMS tracker
- ATLAS Calorimeter
- etc

During the Snowmass process, LPC@Fermilab took a leading role in:

- Creating a “Combined Snowmass detector” for the HEP community
- Produced large “statistics” of Physics simulations up to 3000 fb^{-1} of lumi (with PU)
(First time ever, many thanks to the resources from the OSG!)

However, we need to evolve:

- Based on best available knowledge (digital calorimeter, better segmentation, etc)

Physics samples for 100 TeV feasibility studies

Energy Frontier Simulation (with pile-up)

http://www.snowmass2013.org/tiki-index.php?page=Energy_Frontier_FastSimulation

Dataset name	Physics process	Number of recoil jets
B-4p	γ or on-shell W, Z	0
Bj-4p	γ or on-shell W, Z	1-3
Bjj-vbf-4p	γ or off-shell W, Z, H in VBF topology	2-3
BB-4p	Diboson (γ, W, Z) processes	0-2
BBB-4p	Tri-boson (γ, W, Z) processes including BH	0-1
LL-4p	Non-resonant dileptons (including neutrinos) with $m_{ll} > 20$ GeV	0-2
LLB-4p	Non-resonant dileptons with an on-shell boson, $m_{ll} > 20$ GeV	0-1
H-4p	Higgs	0-3
tj-4p	Single top (s- and t-channel)	0-2
tB-4p	Single top associated with a boson	0-2
tt-4p	$t\bar{t}$ pair production	0-2
ttB-4p	$t\bar{t}$ associated with γ, W, Z, H	0-1

arXiv:1308.1636

Many thanks to the collaboration with SLAC members:

- Timothy Cohen, Kiel Howe and Jay G. Wacker

Physics requirements at 100 TeV proton collider

The discovery potential of a future 100 TeV proton collider will depend on

→ Instrumentation Challenges

→ Muon detection at several 10s of TeV range

→ Calorimeters capable of measuring jets close to 50 TeV

and at the same time able to resolve sub-jets efficiently

→ Forward detectors in high radiation environments etc.

We plan for a workshop in July 2014 ([Next Steps in the Energy Frontier](#))

→ Collaborate with instrumentation frontier for best possible technologies

→ Evolve the current simulation tools to accommodate such changes

→ Physics studies/“gains” using the best available knowledge and tools

The results of these studies will be extremely beneficial to the community at large

Welcome to this meeting

These are exciting times, let us get started ...