

Snowmass 2021

EF09 - BSM

More general explorations

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https://snowmass21.org/energy/bsm_general



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Oct 16th 2020



Snowmass CPM

- Big thank you to everybody who participated to the CPM
 - More than 1200 people on Monday plenary session, 400-600 for most other plenaries
 - Parallel sessions well attended, many with 50-100 people each, depending on the session
- Recording are available for most sessions

=== LIST OF SESSIONS PARTICULARLY RELEVANT TO EF09

- #136 (Oct 6, 2020, 12:30 PM EST) [Heavier particle dark matter \$>\sim 10\$ GeV](#)
- #108 (Oct 6, 2020, 12:30 PM EST) [Accelerator Probes of Light Dark Matter \(keV-GeV\)](#)
- #126 (Oct 6, 2020, 2:00 PM EST) [BSM: direct and indirect searches](#)
- #127 (Oct 6, 2020, 3:00 PM EST) [Searches for dark sectors](#)
- #101 (Oct 6, 2020, 4:00 PM EST) [Higgs as a probe of new physics](#)

=== LIST OF GENERAL EF SESSIONS THAT ARE ALSO RELEVANT TO EF09

- #1 (Oct 6, 2020, 12:00 PM EST) [EF Intro](#)
- #130 (Oct 6, 2020, 12:30 PM EST) [Enabling technologies for low mass and ps timing detectors](#)
- #131 (Oct 6, 2020, 1:30 PM EST) [Physics requirements for HEP colliders](#)
- #80 (Oct 6, 2020, 3:30 PM EST) [Computing Requirements & Opportunities for the Energy Frontier](#)
- #123 (Oct 6, 2020, 4:00 PM EST) [Data Handling and AI/ML](#)
- #183 (Oct 6, 2020, 4:00 PM EST) [Intermediate lepton collision energies between 500 GeV and 3 TeV](#)
- #99 (Oct 7, 2020, 2:00 PM EST) [Advances in Event Generation and Detector Simulation](#)
- #119 (Oct 7, 2020, 2:00 PM EST) [HEP Workforce, Careers, and Training](#)
- #26 (Oct 7, 2020, 2:00 PM EST) [Energy Frontier discovery machines](#)
- #132 (Oct 6, 2020, 3:30 PM EST) [Collider Data Analysis Strategies](#)
- #201 (Oct 7, 2020, 4:00 PM EST) [EF Planning](#)

MC Taskforce: how to get started

- MC taskforce twiki page ([link](#)) contains information on:
 - samples from collaborations/study-groups publicly accessible
 - simulation frameworks for various collider options
 - Information on Delphes cards available
- Large set of tutorials run in the past month
 - All linked from the twiki page!
- **Possible common backgrounds** that can be centrally simulated (large-stat)
 - Focus on Delphes-based sample
 - some full sim negotiable if well motivated
 - MC Taskforce will start soon a production phase!
 - **Looking for volunteers** at all experience levels **to join the production team**: contact [John Stupak](#)
 - [Fill request form](#). Also reach out to us with the request, so that we can make sure it is handled

October 2020

 14 Oct [MC/Simulation Framework Tutorial: ILC Analysis Walkthrough](#)

 13 Oct [MC/Simulation Framework Tutorial: LHeC/FCC-eh](#)

September 2020

 30 Sep [MC/Simulation Framework Tutorial: Muon Collider](#)

 29 Sep [MC/Simulation Framework Tutorial: FCC-ee/hh \(day 3\)](#)

 28 Sep [MC/Simulation Framework Tutorial: Whizard for e+e-](#)

 22 Sep - 23 Sep [MC/Simulation Framework Tutorial: FCC-ee/hh \(day 1/2\)](#)

 08 Sep [MC/Simulation Framework Tutorial: CEPC](#)

August 2020

 28 Aug [MC/Simulation Framework Tutorial: ILC](#)

Agenda and next EF09 meetings

11:00 AM	→ 11:20 AM	Introduction	🕒 20m
Speakers: Simone Pagan Griso (Lawrence Berkeley National Laboratory), Tulika Bose (University of Wisconsin-Madison), Zhen Liu (University of Maryland)			
11:20 AM	→ 11:35 AM	new bosons at future lepton colliders	🕒 15m
Speaker: Roberto Franceschini			
11:40 AM	→ 12:00 PM	new bosons at EIC	🕒 20m
Speakers: Ross Corliss (SBU), Yulia Furlitova (JLAB)			
12:05 PM	→ 12:20 PM	CMS HL-LHC heavy boson studies	🕒 15m
Speaker: Conor Henderson			

- For the next meetings, we would like to dedicate each meeting to a topic
 - Today: Heavy Bosons
 - Next: Massive long-lived particles
- Contact us at any time if you have updates you'd like to share
 - Work-in-progress is perfectly fine, no need to wait for the final results!
 - Allows the community to give early feedback
 - Ensures your work is best used in the final report

Snowmass 2021: EF Benchmark Scenarios

Snowmass 2021 Energy Frontier Collider Study Scenarios

Collider	Type	\sqrt{s}	P [%] e^-/e^+	L_{int} ab^{-1}
HL-LHC	pp	14 TeV		6
ILC	ee	250 GeV	$\pm 80 / \pm 30$	2
		350 GeV	$\pm 80 / \pm 30$	0.2
		500 GeV	$\pm 80 / \pm 30$	4
		1 TeV	$\pm 80 / \pm 20$	8
CLIC	ee	380 GeV	$\pm 80 / 0$	1
		1.5 TeV	$\pm 80 / 0$	2.5
		3.0 TeV	$\pm 80 / 0$	5
CEPC	ee	M_Z		16
		$2M_W$		2.6
		240 GeV		5.6
FCC-ee	ee	M_Z		150
		$2M_W$		10
		240 GeV		5
		$2 M_{\text{top}}$		1.5

Snowmass 2021 Energy Frontier Collider Study Scenarios

Collider	Type	\sqrt{s}	P [%] e^-/e^+	L_{int} ab^{-1}
FCC-hh	pp	100 TeV		30
LHeC	ep	1.3 TeV		1
FCC-eh	ep	3.5 TeV		2
muon-collider (higgs)	$\mu\mu$	125 GeV		0.02
High energy muon-collider	$\mu\mu$	3 TeV		1
		10 TeV		10
		14 TeV		20
		30 TeV		90

EIC benchmarks to be confirmed/defined

Note for muon-collider: It is important to note that the plan is not to run subsequently at the various c.o.m etc. These are reference points to explore and assess the physics potential and technology. The luminosity can be varied to determine how best to exploit the physics potential.

Other options to explore:

- Muon collider at a very high energy (>30 TeV?)[Need to consolidate growing list of c.o.m. energies]
- FCC pp >200 TeV? and ~ 75 TeV documenting sensitivity loss
- Very high energy e+e- collider
- gamma-gamma collider [need to understand energy/luminosity]

Heavy Bosons: considerations

- Simplified modes:

- Dilepton
- Dijets
- Diboson (VV , Vh , etc)
- Heavy Neutrino

We hope to layout the basic reach of future collider programs

comprehensively in these simplified modes.

Resonance search and EFT searches are both needed.

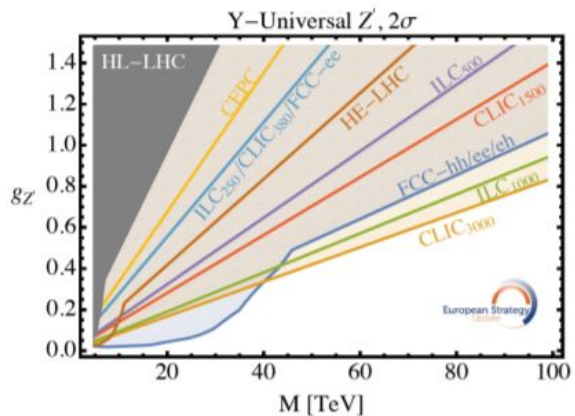
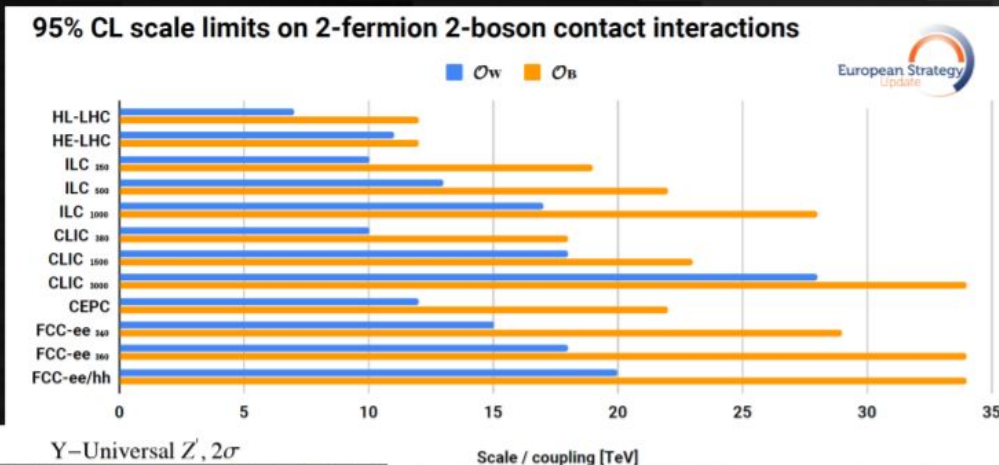
- Beyond simplified modes:

- Triboson
- Flavor violation
- Heavy Fermions
- Dark Matter
- Long-Lived Particles
- ...

These new modes show unique physics potentials from contributed papers (LOIs/EOIs so far)

ee \rightarrow ff: EPPSU

“Y-universal Z” model is considered



For universal-type Z' :

- 250 GeV e^+e^- can exceed HL-LHC reach
- \sim TeV e^+e^- is comparable to 100 TeV hh


Backup

EF09 BSM-General: Heavy bosons

 Friday May 29, 2020, 12:00 PM → 1:31 PM US/Eastern

12:10 PM → 12:25 PM **Heavy bosons at high-energy lepton colliders** ¶

Speakers: Taikan Suehara (Kyushu University), Taikan Suehara (Kyushu University)

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12:30 PM → 12:55 PM **Heavy bosons at hadron colliders**

Speakers: Clement Helsens (CERN), Clement Helsens (CERN)

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1:00 PM → 1:05 PM **New Resonances short presentation**

Speaker: Kaustubh Agashe (University of Maryland)

 multi_boson_Snow...


1:08 PM → 1:13 PM **New Resonances short presentation**

Speaker: Sergei Chekanov (ANL)

 MultiBody_Searche...

1:16 PM → 1:21 PM **New Resonances short presentation**

Speaker: Daniel Hayden (Michigan State University)

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