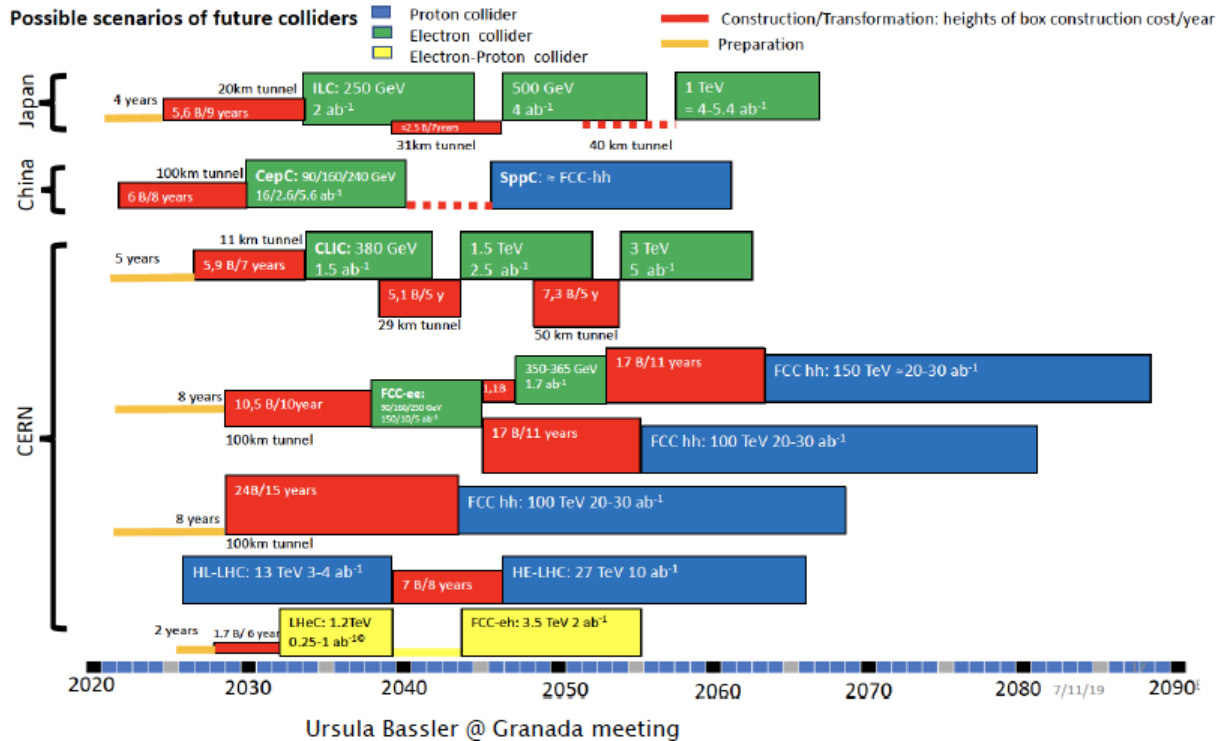


July 27<sup>st</sup>, 2020

# Muon Colliders

*contribution to SnowMass21 process*

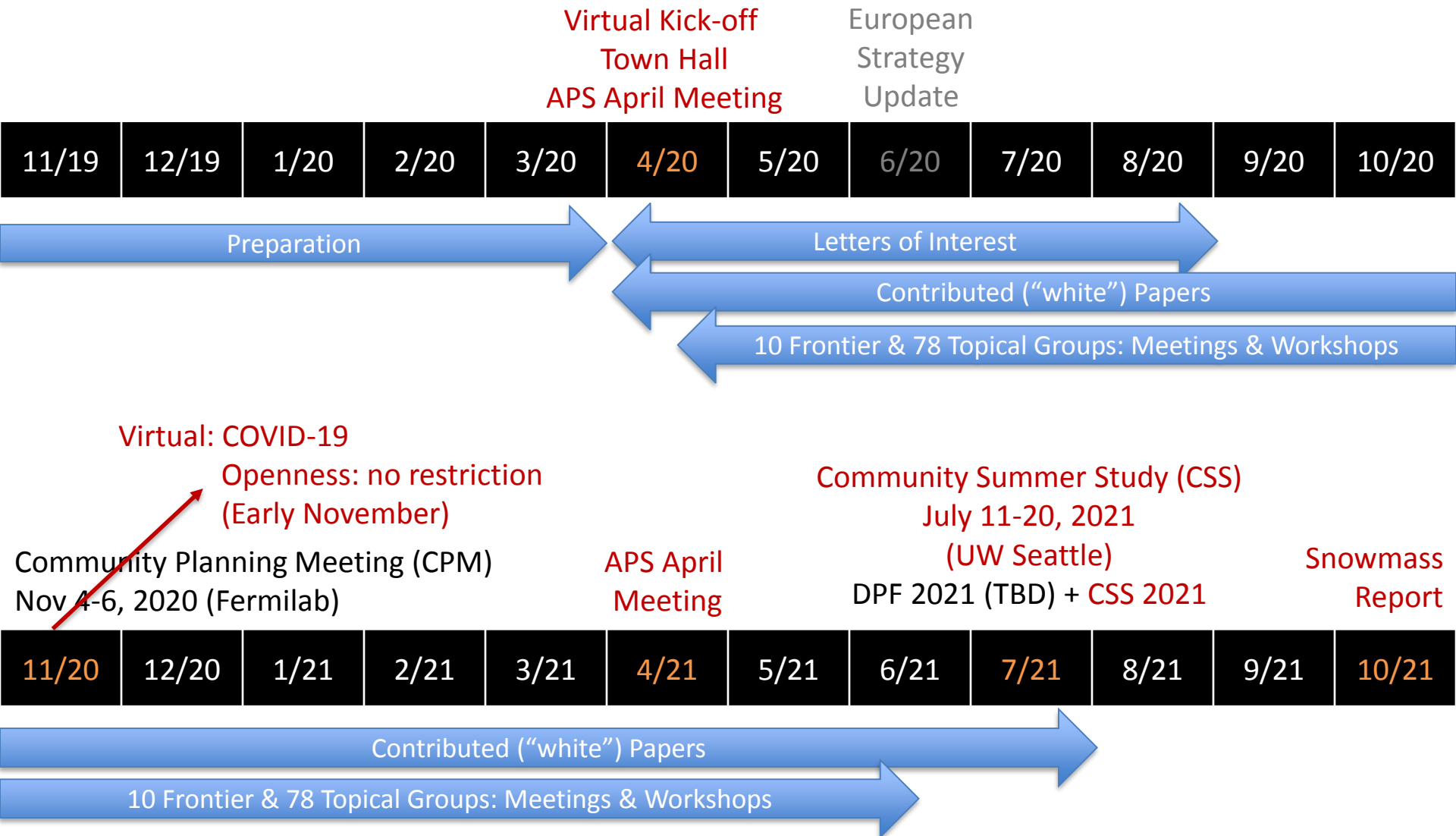
## Future Collider Scenarios & Timelines



- ✓ Will add EIC and Muon Collider to this chart
- ✓ Will consider new proposals that may come up during Snowmass 2021

# Snowmass Timeline

Young-Kee Kim



Virtual: COVID-19

Openness: no restriction  
(Early November)

Community Summer Study (CSS)  
July 11-20, 2021  
(UW Seattle)

DPF 2021 (TBD) + CSS 2021

Snowmass  
Report

# Snowmass Frontiers and Topical

Frontier	Co-Conveners	
<b>Energy Frontier</b> <ul style="list-style-type: none"> <li>• 10 topical groups</li> </ul>	Meenakshi Narain	Brown University
	Laura Reina	Florida State University
	Alessandro Tricoli	Brookhaven National Laboratory
Frontiers in Neutrino Physics <ul style="list-style-type: none"> <li>• 10 topical groups</li> </ul>	Patrick Huber	Virginia Tech
	Kate Scholberg	Duke University
	Elizabeth Worcester	Brookhaven National Laboratory
Frontiers in Rare Processes and Precision Measurements <ul style="list-style-type: none"> <li>• 6 topical groups</li> </ul>	Marina Artuso	Syracuse University
	Bob Bernstein	Fermilab
	Alexey Petrov	Wayne State University
Cosmic Frontier <ul style="list-style-type: none"> <li>• 7 topical groups</li> </ul>	Aaron Chou	Fermilab
	Marcelle Soares Santos	Brandeis University
	Tim Tait	University of California, Irvine
<b>Theory Frontier</b> <ul style="list-style-type: none"> <li>• 10 topical groups</li> </ul>	Nathaniel Craig	University of California, Santa Barbara
	Csaba Csaki	Cornell University
	Aida El-Khadra	University of Illinois, Urbana-Champaign
<b>Accelerator Frontier</b> <ul style="list-style-type: none"> <li>• 7 topical groups</li> </ul>	Steve Gourlay	Lawrence Berkeley National Laboratory
	Tor Raubenheimer	SLAC National Accelerator Laboratory
	Vladimir Shiltsev	Fermilab
<b>Instrumentation Frontier</b> <ul style="list-style-type: none"> <li>• 9 topical groups</li> </ul>	Phil Barbeau	Duke University
	Petra Merkel	Fermilab
	Jinlong Zhang	Argonne National Laboratory
<b>Computational Frontier</b> <ul style="list-style-type: none"> <li>• 7 topical groups</li> </ul>	Steve Gottlieb	Indiana University
	Oliver Gutsche	Fermilab
	Ben Nachman	Lawrence Berkeley National Laboratory
Underground Facilities and Infrastructure <ul style="list-style-type: none"> <li>• 6 topical groups</li> </ul>	Laura Baudis	University of Zurich
	Jeter Hall	SNOLAB
	Kevin Lesko	Lawrence Berkeley National Laboratory
<b>Community Engagement Frontier</b> <ul style="list-style-type: none"> <li>• 6 topical groups</li> </ul>	John Orrell	Pacific Northwest National Laboratory
	Ketevi Assamagan	Brookhaven National Laboratory
	Breese Quinn	University of Mississippi

30 Frontier Conveners and >200 Topical Group Conveners

# Snowmass Liaisons

Cross-cutting areas between Frontier Groups and Topical Groups

	Neutrino Physics (NF)	Rare & Precision (RF)	Cosmic Frontier (CF)	Theory Frontier (TF)	Accelerator Frontier (AF)	Instrumentation Frontier (IF)	Computational Frontier (CompF)	Undergrnd Facilities & Infrs (UF)	Community Engagement Frontier (CommF)
Energy Frontier (EF)	Andre de Gouvea	Angelo di Canto	Caterina Doglioni	Laura Reina	Dmitri Denisov, Meenakshi Narain	Maksym Titov, Caterina Vernieri	Daniel Elvira		TBD
Neutrino Physics (NF)		Bob Bernstein	Tali Figueroa-Feliciano, Yvonne Wong	TBD	Laura Fields	Mayly Sanchez	Alex Himmel	Albert de Roeck	Sowjanya Gollapinni
Rare & Precision (RF)			TBD	Alexey Petrov	Bob Bernstein	Marina Artuso	Stefan Meinel	TBD	Bob Bernstein
Cosmic Frontier (CF)				Flip Tanedo		Kent Irwin	Deborah Bard, Brian Yaney	Hugh Lippincott, Jody Cooley	Sijbrand de Yong
Theory Frontier (TF)					Lian Tao		Steven Gottlieb		Devin Walker
Accelerator Frontier (AF)						Andy White	Jean-Luc Vay		TBD
Instrumentation Frontier (IF)							Darin Acosta	Maurice Garcia-Sciveres, Eric Dahl	Farah Rahim
Computational Frontier (CompF)									David Bruhwiler
Undergrnd Facilities & Infrs (UF)									TBD

# Letters of Interest - LOI

*deadline: August 31, 2020*

*Snowmass conveners see the proposals and encourage the community to begin studying them.*

*Help conveners to prepare the **Snowmass Planning Meeting**;*

**Virtual Snowmass Community Planning Meeting October 5 (Oct. 5-9), 2020**

*Letters should give **brief descriptions of the proposal and cite the relevant papers to study***

*Instructions for submitting letters are available at <https://snowmass21.org/loi>*

*Authors of the letters are also encouraged to submit later a full write-up for their work as a contributed paper*

- Very brief (two pages)
- Uploaded by Authors through Snowmass 2021 Wiki
- Index of submitted LOI available on the Snowmass 2021 Wiki
- Could represent existing work (cite) or new ideas
- Help conveners plan work of the Frontier (liaisons with other Frontiers: avoid duplication/build synergy)
- **If further developed in the Snowmass 2021 exercise could lead to a Contributed Paper**

<https://snowmass21.org/submissions/>

**deadline: July 31, 2021**

**July 27<sup>st</sup>, 2020**

**Nadia Pastrone**



# Machine - MDI

- **LoI requested by AF4 (multi-TeV Collider) – Accelerator Frontier**  
to MAP, LEMMA and the new International Muon Collider Collaborations  
*focusing on potential machine routes, R&D requirements, and possible timelines to deliver colliders that could operate in the 1-100 TeV center-of-mass energy range*  
**link to AF1 and AF7 for enabling machine technologies**
- Different dedicated meeting across Energy and Accelerator Frontier to discuss machine parameters and possible physics reaches → see at links:  
<https://indico.fnal.gov/category/1113/>

# Energy Frontier

- **We have to discuss which Lol we can prepare mainly related to:**
  - **EF01-04:** Higgs, Top, EW
  - **EF08-10:** BSM – new resonances - LLP
- Energy Frontier meetings → see at links:  
<https://indico.fnal.gov/category/1145/>

# Instrumentation & computation Frontier

Understand the impact of detector designs on physics

- **We have to prepare requirement we would like to reach at an experiment at Muon Collider, mainly on:**
  - **Trackers – sensors with timing and electronics**
  - **Calorimeter – high granularity and timing required**
  - **Software tools**
  - **AI/ML applications**

Instrumentation → see at links: <https://indico.fnal.gov/event/43730/>

Computational → to come soon at links: <https://indico.fnal.gov/event/43829/>



# Immediate goal of this meeting

SnowMass21 Lols submissions is a first deadline to face – very close  
Perfect timing to concentrate on physics benchmarks and detector performances at a Muon Collider

We would like to list all possible different contributions we may want to submit on physics, instrumentation and software beyond machine's ones

- agree on this list
- identify who is willing to prepare the 2 pages of text
- everybody is free to submit a Lol → better to coordinate!

Let's proceed with our discussions and try to define the list of  
Muon Collider Lols even in synergies with other efforts