

ENERGY FRONTIER

Conveners:

Meenakshi Narain (Brown University)

Laura Reina (FSU)

Alessandro Tricoli (BNL)

Useful Links:

- [Wiki](#)
- [Indico](#)
- [Slack channels](#)
- [Calendar](#)



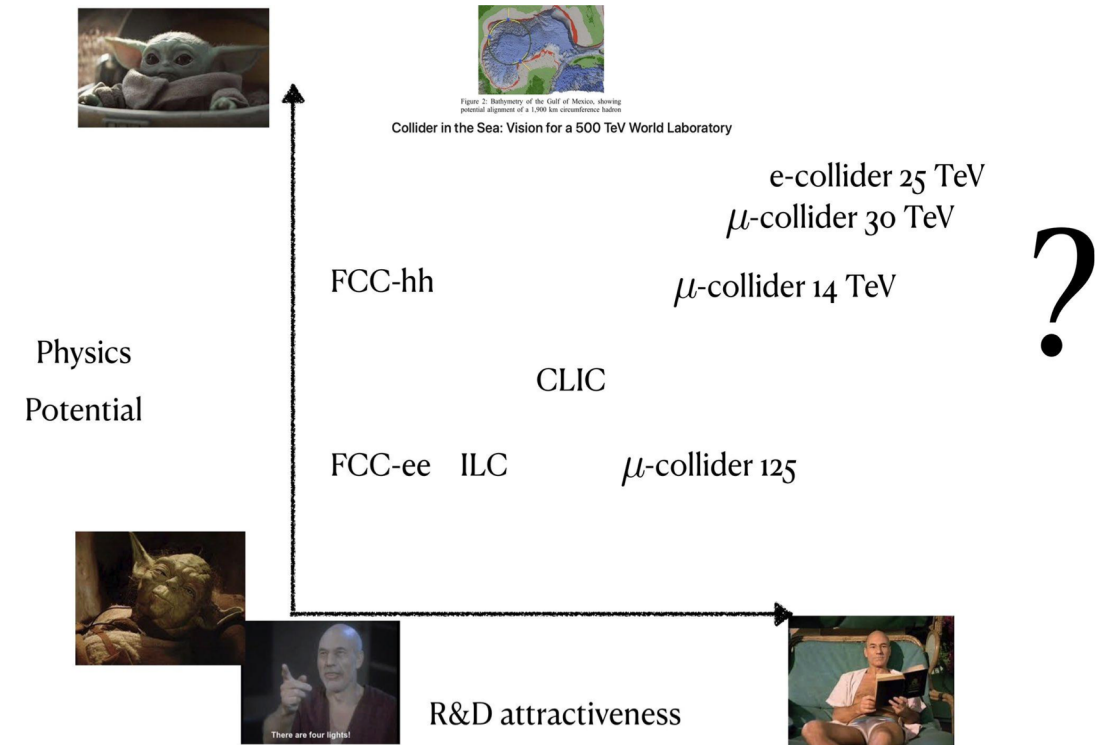
Energy Frontier (EF) Science Goals

- The goal is to explore the TeV energy scale and beyond
- It is an exciting time for Snowmass 2021
 - The LHC program is maturing
 - Run 1 delivered the Higgs boson
 - Run 2 is providing a wealth of new measurements.
 - The HL-LHC will usher in the era of precision Higgs physics.
 - There are exciting results from other frontiers: rare processes, cosmology, ...
 - There is no preferred model for physics beyond the SM!
 - It is time to think beyond the LHC and update the scenarios of proposed future colliders.
- There is a lot of space to propose new ideas, new perspectives, new tools.
- Energy Frontier Organization: Ten Topical Groups (EF01 to EF10) which focus on
 - Electroweak (EW) physics
 - QCD and Strong Interactions
 - Beyond-Standard-Model (BSM) physics



Energy Frontier Machines

- Discoveries at the Energy Frontier are intricately linked to new accelerators and detector instrumentation.
- Proceed along two complementary directions
 - Study known phenomena at high energies
 - **Factory of Higgs bosons** (or other known particles)
 - Electroweak (EW) physics
 - QCD and Strong Interactions
 - Search for direct evidence of BSM physics
 - Next high **energy frontier machine**
- What are the most promising future colliders?



From our EF02 colleagues (Meade,Ojalvo):

Energy Frontier Practicalities

- What is the best way for early career physicists (student, postdoc) to contribute to the Snowmass process? → Join a Snowmass Early Career Group!
- Signup and attend EF topical group meeting and get involved in a project of interest
- The EF Snowmass Early Career group is currently organizing
 - [Interest survey](#) for assistance with projects
 - Study matching
 - Monte Carlo workshops
- Bi-weekly chats to discuss EF developments
 - Discussions from an early career perspective
 - Updates from each Topical Group Liaison
 - Every other Tuesday at 19h CERN Time, 12h US Central Time
- Communication and contacts:
 - Slack Channels of Interest (all public) #early-career-energy-frontier-coordination
 - Listserv: SNOWMASS-EARLY-CAREER-EF@FNAL.GOV
 - Link to SEC+EF [Topical Group Liaisons](#)
 - Current SEC Contacts: Grace Cummings, Amber Roepe [rotating positions]



We invite you to the Energy Frontier

Snowmass is a time for the community to innovate and set new directions without prior barriers and constraints

The success of the Energy Frontier depends on your engagement and ambitions!

Let's collectively **DREAM BIG!**



BACKUP



Energy Frontier Topical Groups

- Ten Topical Groups study and compare the physics reach of future colliders.

Topical Group	Co-Conveners		
EF01: EW Physics: Higgs Boson properties and couplings	Sally Dawson (BNL)	Andrey Korytov (U Florida)	Caterina Vernieri (SLAC)
EF02: EW Physics: Higgs Boson as a portal to new physics	Patrick Meade (Stony Brook)	Isobel Ojalvo (Princeton)	
EF03: EW Physics: Heavy flavor and top quark physics	Reinhard Schwienhorst (MSU)	Doreen Wackeroth (Buffalo)	
EF04: EW Physics: EW Precision Physics and constraining new physics	Alberto Belloni (Maryland)	Ayres Freitas (Pittsburgh)	Junping Tian (Tokyo)
EF05: QCD and strong interactions: Precision QCD	Michael Begel (BNL)	Stefan Hoeche (FNAL)	Michael Schmitt (Northwestern)
EF06: QCD and strong interactions: Hadronic structure and forward QCD	Huey-Wen Lin (MSU)	Pavel Nadolsky (SMU)	Christophe Royon (Kansas)
EF07: QCD and strong interactions: Heavy Ions	Yen-Jie Lee (MIT)	Swagato Mukherjee (BNL)	
EF08: BSM: Model specific explorations	Jim Hirschauer (FNAL)	Elliot Lipeles (UPenn)	Nausheen Shah (Wayne State)
EF09: BSM: More general explorations	Tulika Bose (U Wisconsin-Madison)	Zhen Liu (Maryland)	Simone Griso (LBL)
EF10: BSM: Dark Matter at colliders	Caterina Doglioni (Lund)	LianTao Wang (Chicago)	



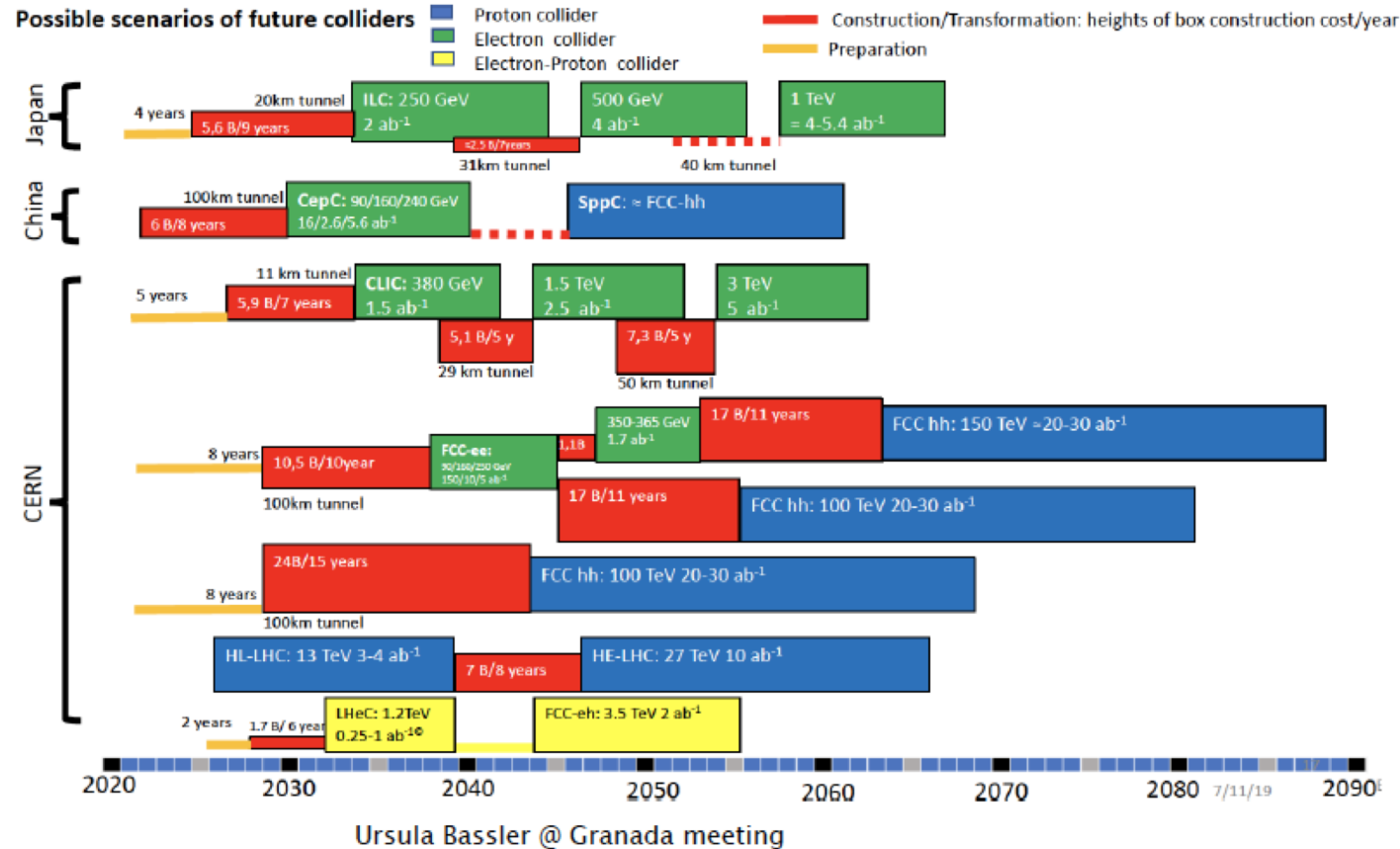
Some selected “Focus questions”

- What is the scale of new physics that can be probed with **precision measurements**?
- How can future colliders address the **naturalness** problem to an extent that either new physics appears or a new paradigm of thinking about naturalness can emerge?
- How can measurements in the **Higgs sector** be combined with measurements in other sectors to improve our understanding of high scale physics?
- How can the **top quark** help elucidate the Higgs sector and inform about possible physics beyond the SM?
- What is the future of **PDF determinations**?
- What is the ultimate precision for α_s and how do we achieve it? How does the knowledge of hadron structure affect measurements of α_s in various processes?
- What is the fundamental composition of **Dark Matter**? What are the best ways to probe the composition of DM and whether it interacts weakly?
- And more...



Future Collider Scenarios & Timelines from ESPP

Update needed to this chart during Snowmass 2021



- Will add **EIC** and **Muon Collider** to this chart.
- Will consider **new proposals** that may come up during Snowmass 2021.
 - e.g. initiatives for gamma-gamma and plasma colliders etc.



Energy Frontier/Snowmass 2021 Timeline

