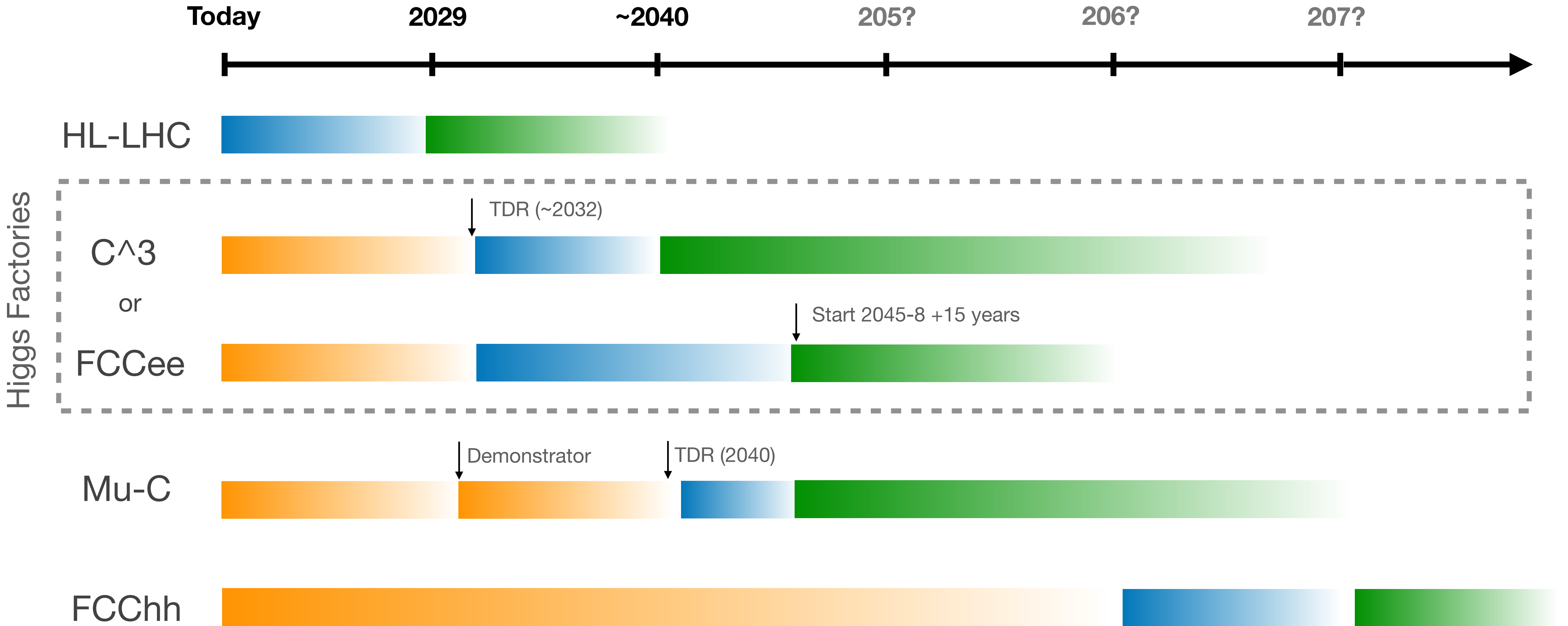


An Inclusive Timeline for Future HEP Collider Projects

Julia Gonski

R&D
Construction
Physics



With CERN facilities...

R&D
Construction
Physics

Today

2029

~2040

205?

206?

207?

HL-LHC



Higgs Factories

FCCee

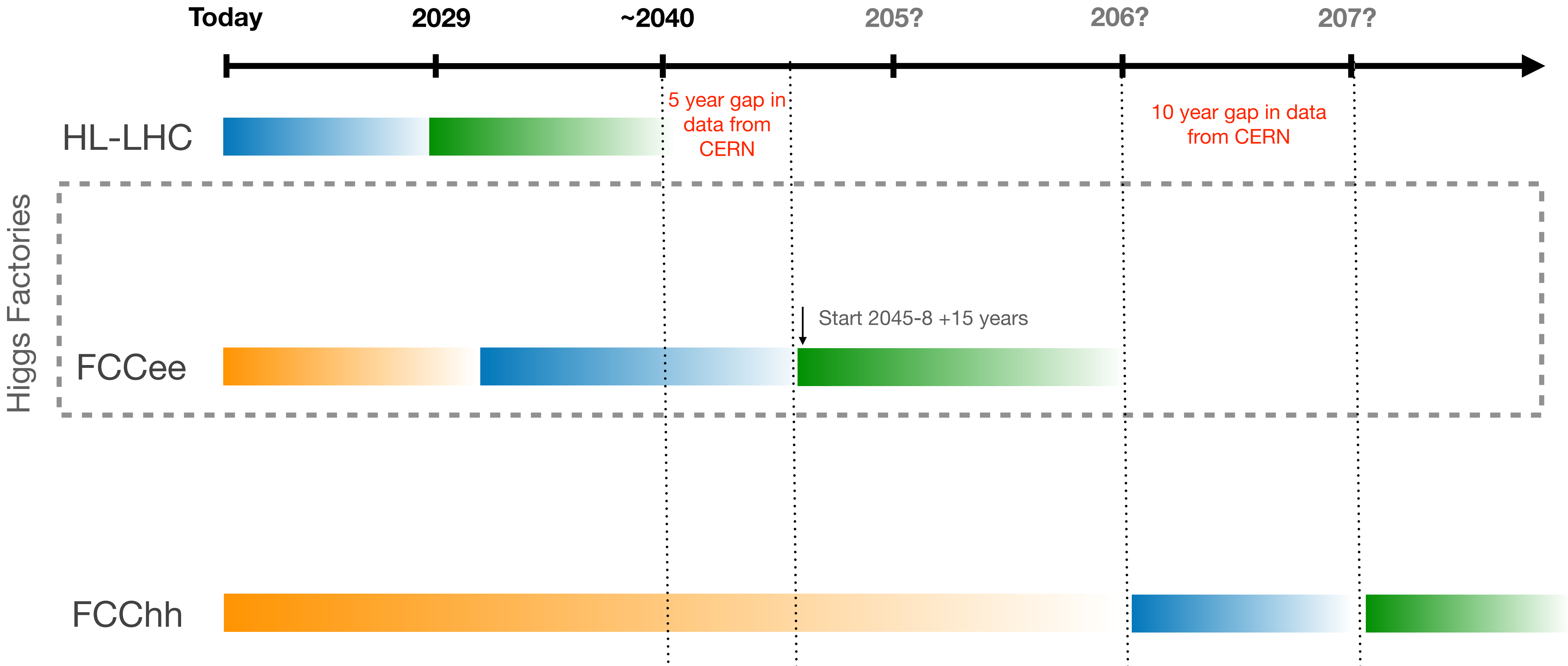


FCChh



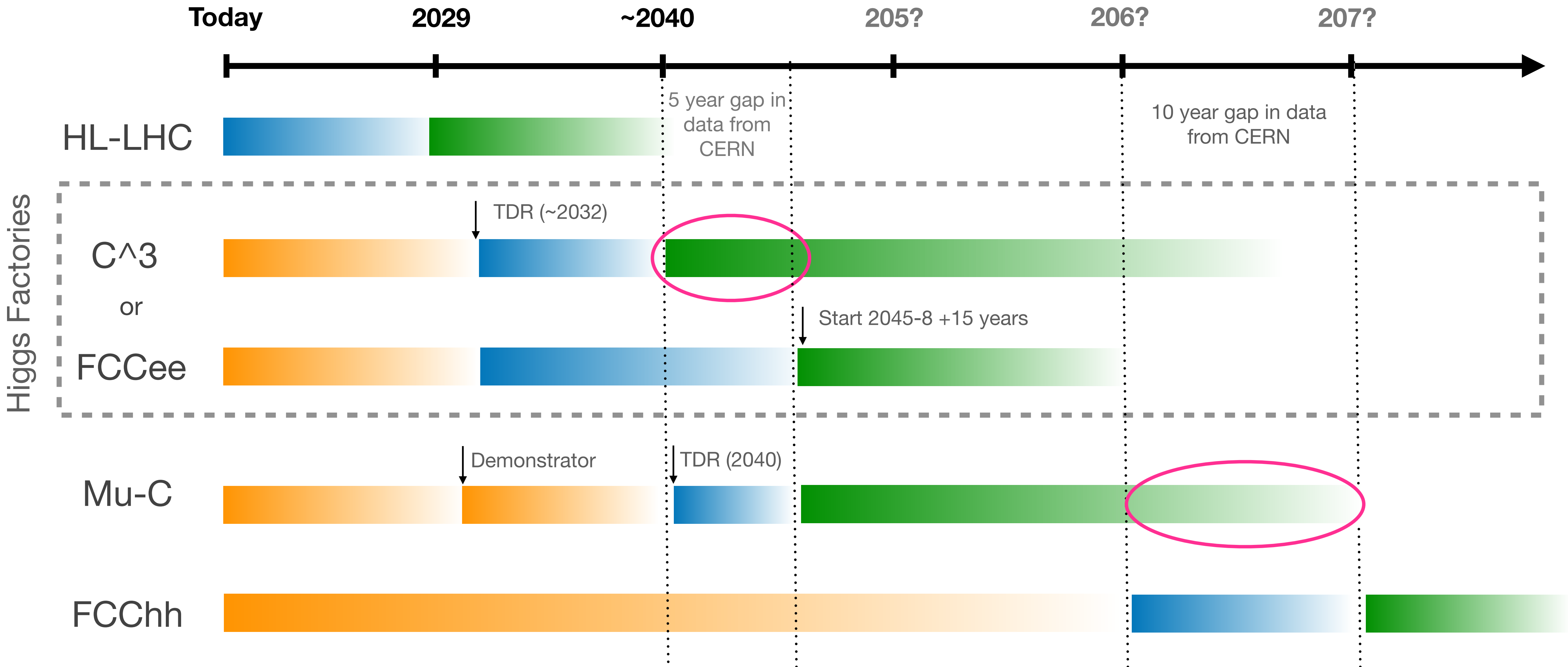
With CERN facilities...

R&D
Construction
Physics



Novel Technologies & Potential US Options

R&D
Construction
Physics



Narrative Points

- Interleaved R&D, construction, and physics activity such that there is *no gap in data across global collider HEP*
 - Good for PhD recruitment/retention and early career pipeline
- Fund accelerator R&D & invest in US option while seizing opportunities on the table → *avoid pitting projects against each other*
 - Compatible with summary vision from Snowmass EF report [[2211.11084](#)]
- **This is not a flat budget**
 - Inclusivity in P5 report leaves flexibility for increased lobbying efforts & positive changes in funding expectations
- Deliberate flexibility on choice of Higgs factory (depending on next ~years)
 - Maybe the construction of a Higgs factory elsewhere in the world shifts FCC-hh priority?
- Maintain close US relationship & leadership in CERN projects, as well as potential for US-based projects over several timescales
- Heavy investment in accelerator R&D → good for very long-term future; synergies with neutrino program

Summary

- ➔ Get in on the ground floor of FCC, pending CERN activity
- ➔ Significant commitment to accelerator R&D for coherent C³/Mu-C projects
- ➔ Keep the door open to different funding scenarios/modified lobbying strategies and be prepared for success!

Sources

- HL-LHC and FCC: F Gianotti, BNL Energy Frontier P5 Town Hall [[13 Apr](#)]
- Mu-C: D Stratakis, SLAC Accelerator Frontier P5 Town Hall [[3 May](#)]; EF report [[2211.11084](#)]
- C³: E Nanni & C Vernieri, SLAC Accelerator Frontier P5 Town Hall [[3 May](#)]

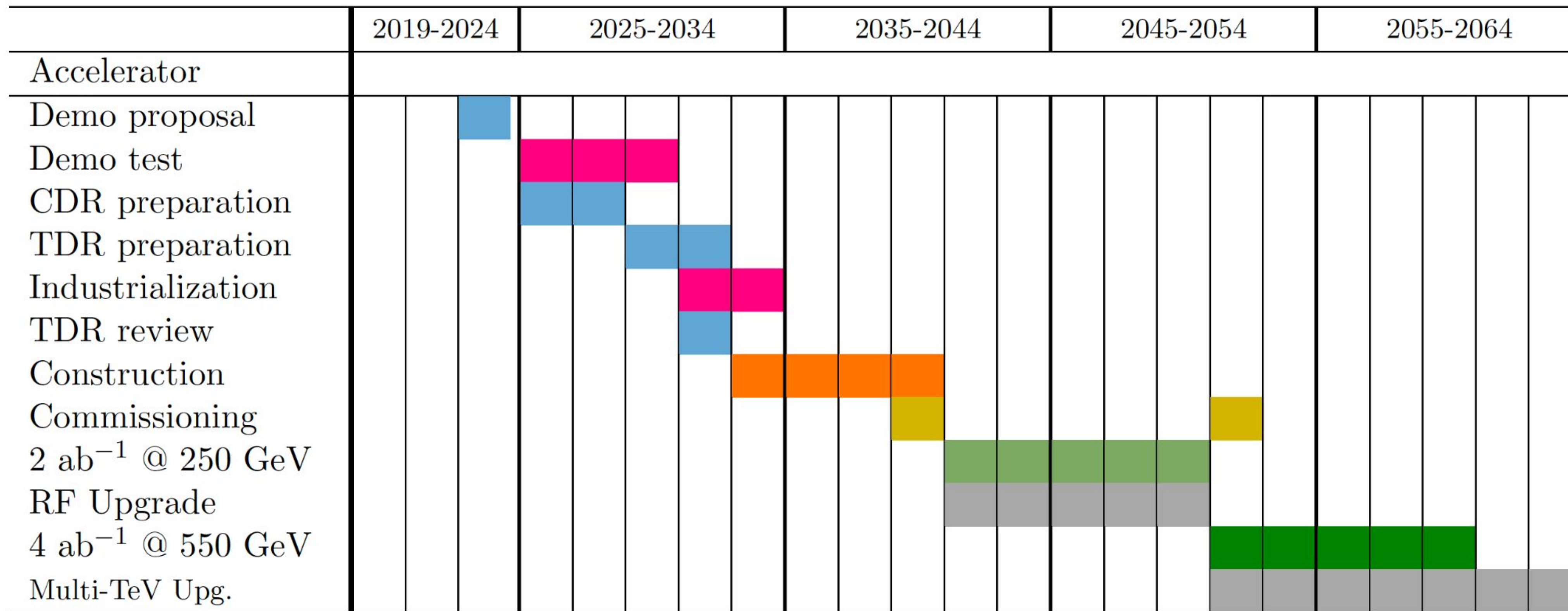
Backup



Technical Timeline for 250/550 GeV CoM

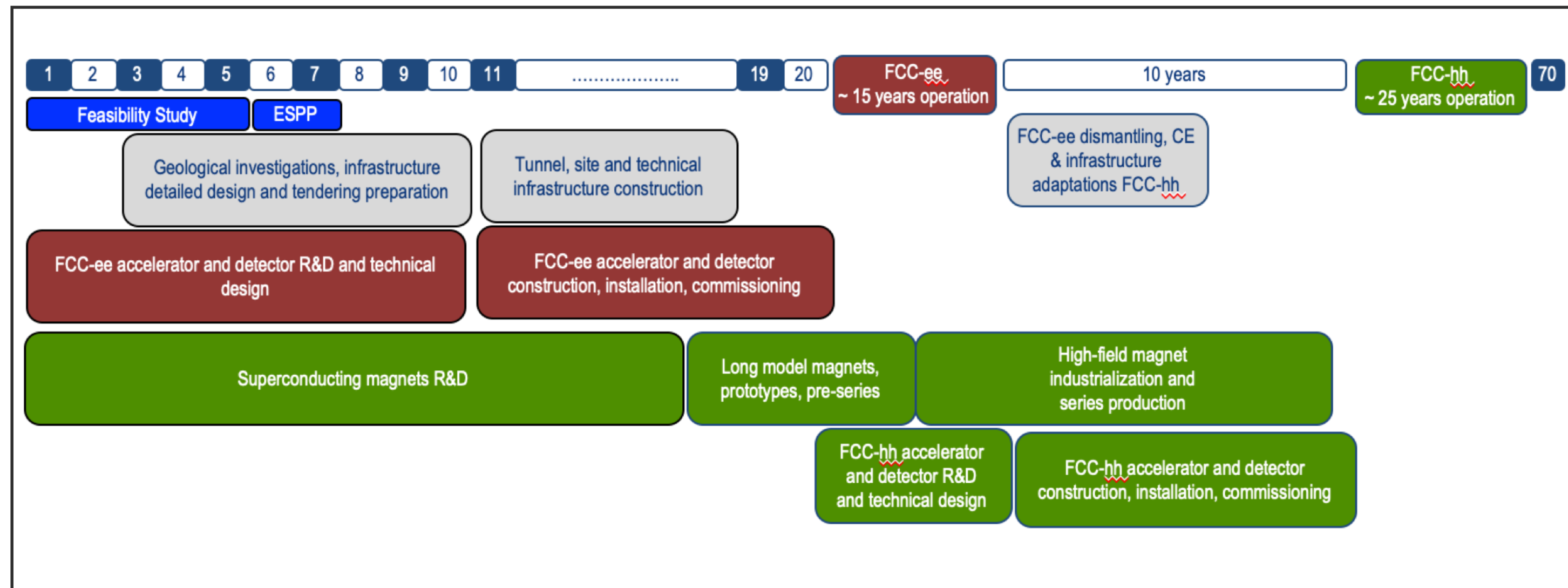
Technically limited timeline developed through the Snowmass process

Energy upgrade in parallel to operation with installation of additional RF power sources

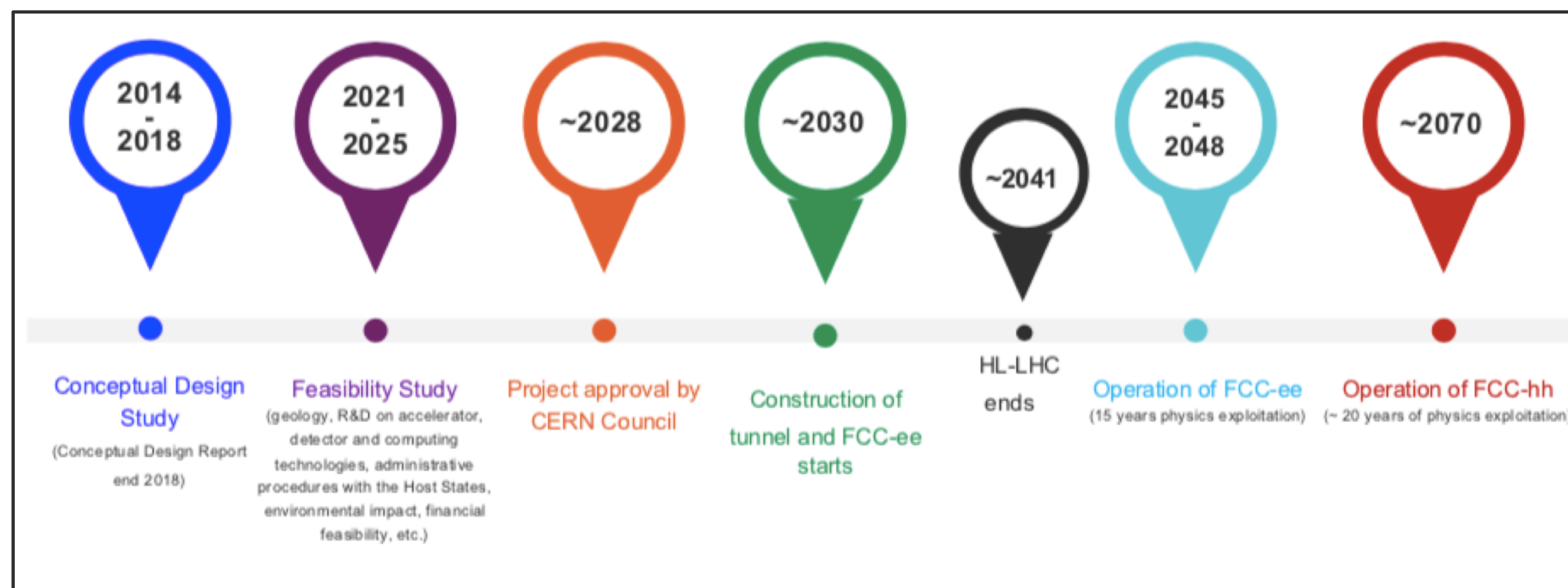


HL-LHC

- C^3: Emilio Nanni, SLAC Accelerator Frontier P5 Town Hall [3 May]



Technical schedule:
FCC-ee could start operation in **2040 or earlier**



Realistic schedule takes into account:

- ❑ past experience in building colliders at CERN
- ❑ CERN Council approval timeline
- ❑ that HL-LHC will run until ~ 2041
- ➔ **ANY future collider at CERN cannot start physics operation before 2045-2048** (but construction will proceed in parallel to HL-LHC operation)

A possible MuC US R&D roadmap for accelerator

2024-2030



- Complete design & simulation of the whole MuC complex, including a neutrino flux mitigation system (include designs for a Fermilab MuC option)
 - Take into account engineering aspects of the design, establish operating parameters and develop technology concepts with potential to meet these parameters
- Proceed with (limited) prototyping & technology R&D
 - Rapid cycling dipoles: magnet prototype, including its power deliver system
 - Proton bunch compression tests at existing facilities
 - Target material study & pion yield measurement at existing facilities
 - Design and testing of high gradient SRF cavities (325, 650, 1300 MHz)
 - Engineering design and begin fabrication of a 1.5-cell cooling cell prototype
- Define what we like to **further test**, how and where after 2030
- **By 2030, achieve enough technical maturity for the construction of the demo facility in 2030s and potential construction of the collider facility in the 2040s.**

Synergistic with other programs

It is crucial for the US to engage **NOW** if we want an MC as a future option!

Summary

- MC offers a unique opportunity for energy frontier collider with high luminosity
- Physics & technology landscape has significantly changed recently
- We have established a highly motivated group to address challenges for a Muon Collider
- As also presented at BNL, we are asking P5 to:
 - Recommend establishing a Muon Collider R&D program with the aim for delivering a **RDR report** for the final facility & **TDR report** for the demo facility by 2030 AND with an overall goal of having a **TDR for the final facility** by 2040
 - Recommend that DOE and NSF recognize Muon Collider work within the AF base program proposals
 - Support the formation of a US Muon Collider effort to coordinate US impact while engaging in the international effort
 - Enable US to compete for hosting a Muon Collider

Mu-C: D Stratakis, SLAC Accelerator Frontier P5 Town Hall [3 May]

- Proton collider
- Electron collider
- Muon collider
- Construction/Transformation
- Preparation / R&D

Proposals emerging from Snowmass 2021 for a US based collider

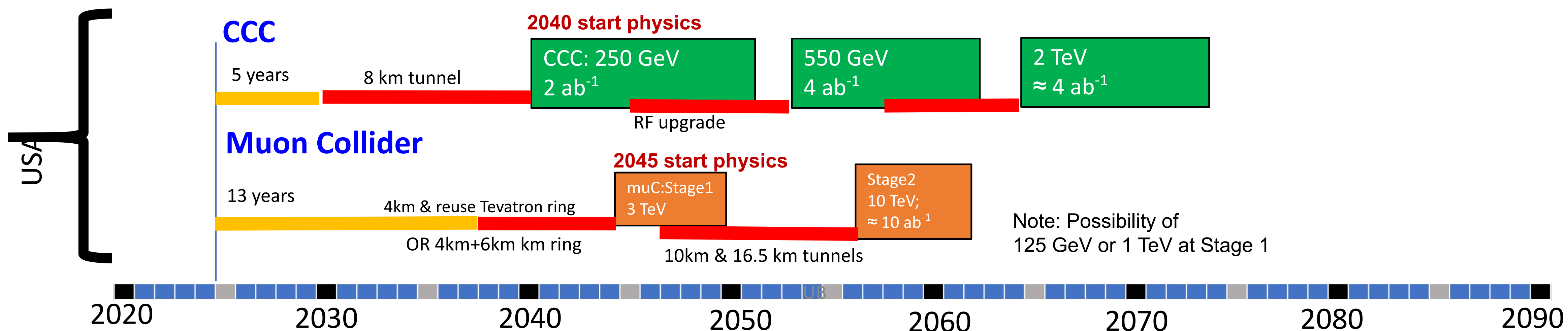


Figure A-2. *Approximate timelines for proposals for ILC/CCC and Muon Collider emerging from Snowmass 2021 for a US based collider option.*

Snowmass EF report, Fig. A-2 [[2211.11084](https://arxiv.org/abs/2211.11084)]