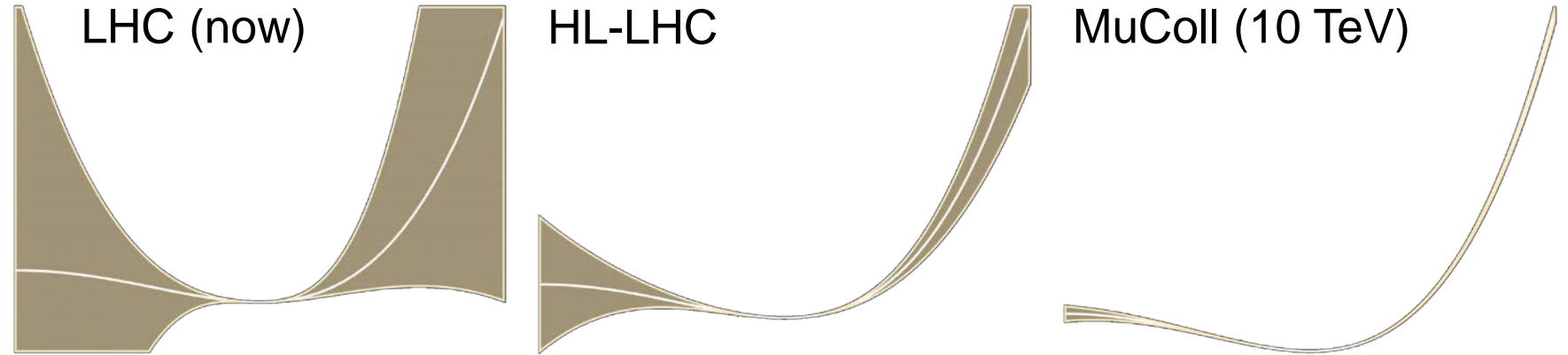


A Bright Future for Collider Physics

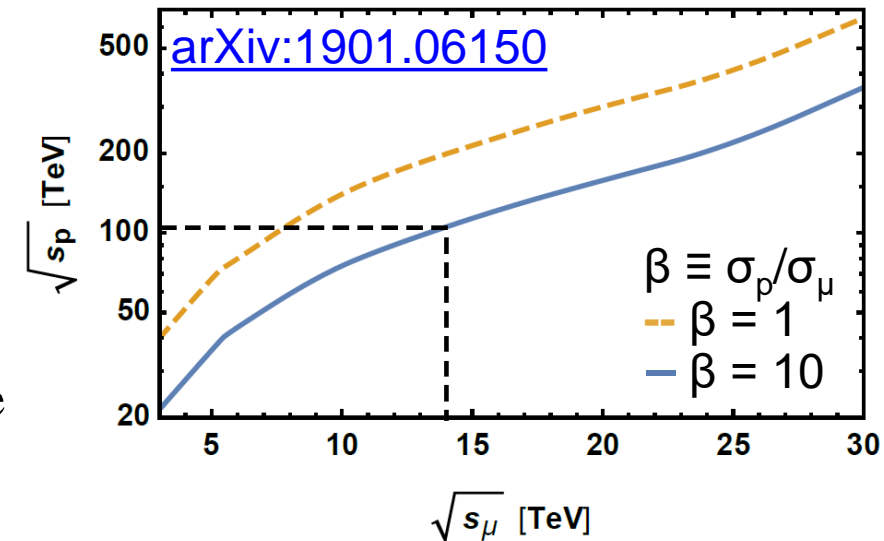


[Nathaniel Craig](#)

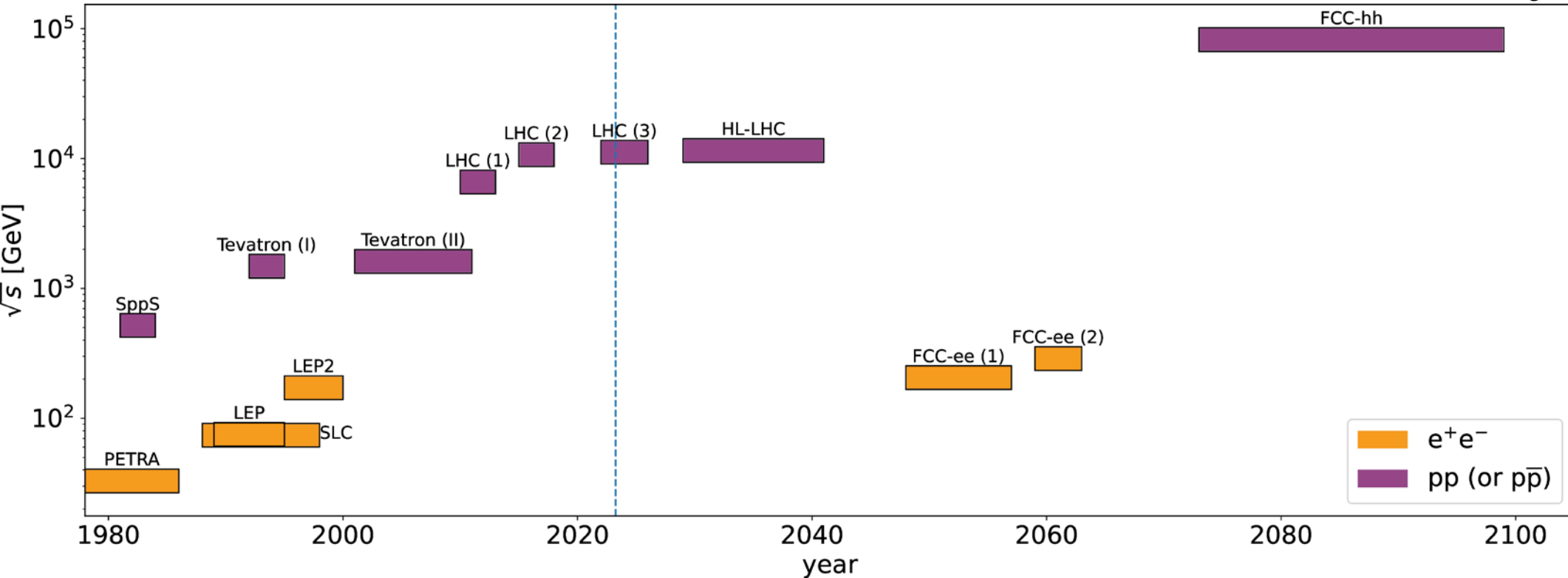


[arXiv:astro-ph/0608407](#)

- Discovering the Higgs boson at the LHC: only the *beginning* of the story
 - Need to observe Higgs *self-interactions* for complete understanding of potential
- Physics *beyond* the Standard Model exists
 - Major example: dark matter
- **Multiple paths** before us to learn about the Higgs and probe new energy scales



One Path for the Future of Collider Physics

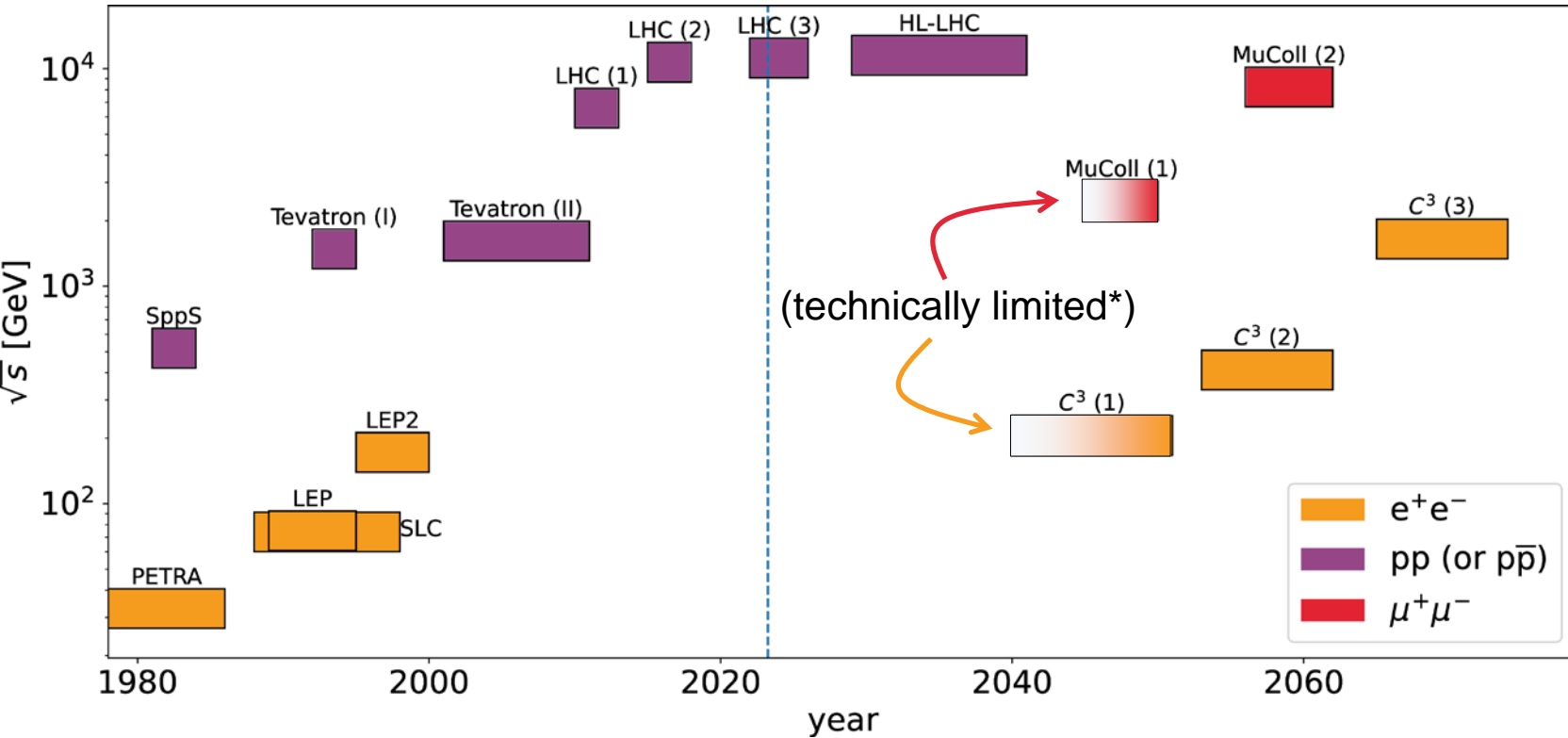


Based on
Snowmass
timelines from
M. Narain
([latest version](#))

Source code:
[kpedro88/collider_timelines](https://github.com/kpedro88/collider_timelines)

- Community exploring feasibility of this plan
 - Future is *uncertain* → keep options open
 - When assessing future paths: consider physics reach, health of the field (worldwide)
- *35-year gap* in high-energy colliders will **impact workforce, morale**
 - Reduced scientific output and training opportunities for entire generation of (collider) physicists
 - Even ≥ 7 -year gap before FCC-ee is concerning

Another Path for the Future of Collider Physics



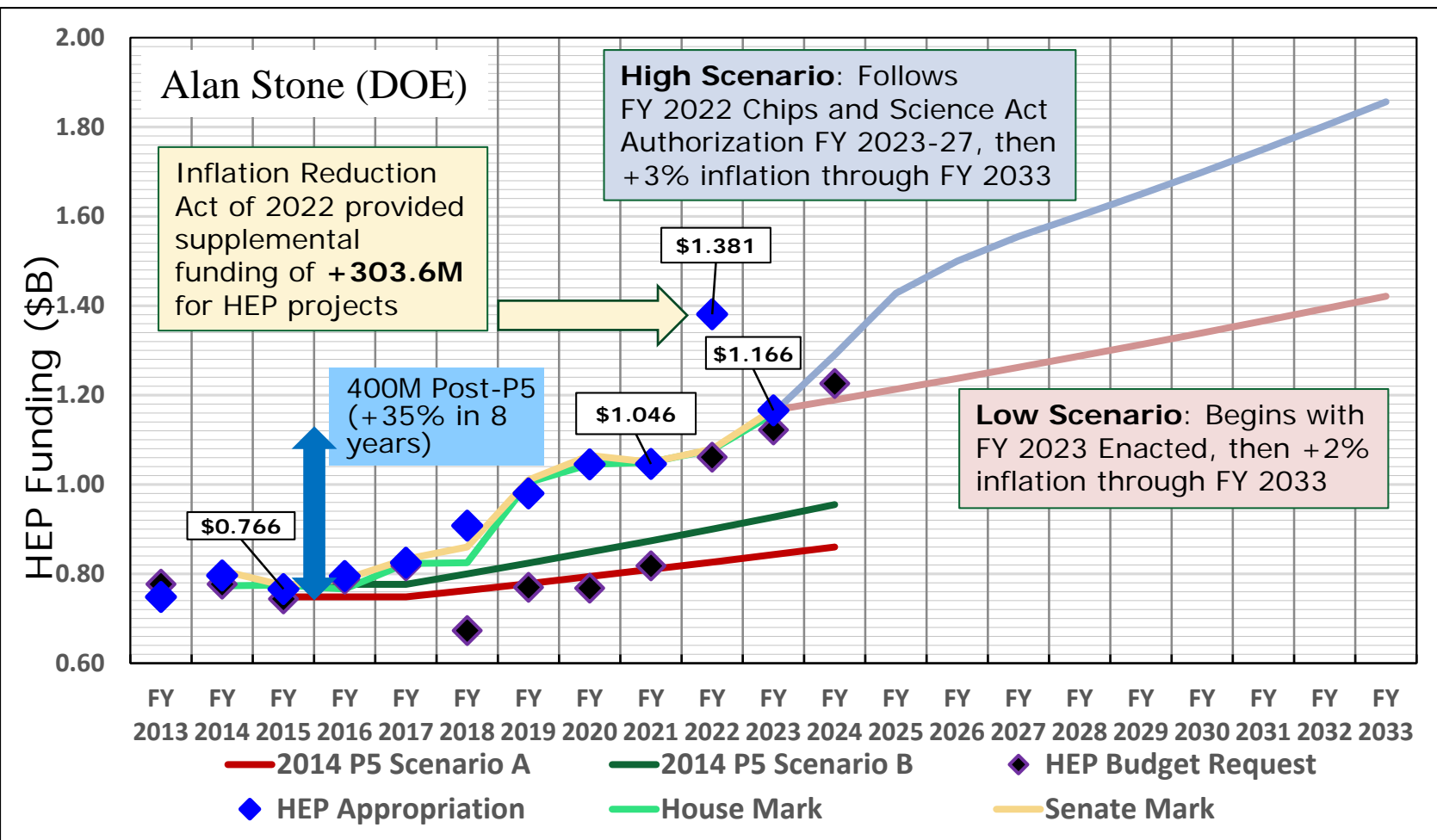
- Utilize *new technologies* for *more compact & efficient* colliders
 - C³ vs. ILC: 8 vs. 20 km
 - MuColl vs. FCC: 16 vs. 100 km
 - *Minimize* civil construction costs and site power, *maximize* return on (federal) science funding
- These new technologies have the potential to *scale up further* than existing technologies
 - Lay groundwork for healthy future *beyond* the next generation

- Ensure continuous science by *minimizing* gap between colliders
- *Multi-site* approach: *stagger* construction & operation (agnostic to specific siting choices)
 - *More stable* funding cycle: avoid another *30% decrease* in core research funding (real \$, since 2014)
 - Continue *collaboration* between US, European, & other international labs

➤ Higher **discovery reach**, in our lifetimes!

* does not account for financial/resource constraints (shading reflects uncertainty in start dates)

First Steps on the Path



- As **Deputy Chair of Government Relations** for Fermilab Users Committee:
 - *My job* is advocating to Congress for science funding
 - Need to *make a case* for growth
 - **P5 support** for robust accelerator R&D funding is *critical*
 - Including targeted R&D and key technology *demonstrators*
 - Emphasize *synergy* w/ detector R&D, other areas of physics: *engage* entire field
 - Avoid prematurely abandoning *promising & exciting* options for future colliders

- Snowmass white papers & reports: [arXiv:2207.00122](https://arxiv.org/abs/2207.00122) , [arXiv:2207.00124](https://arxiv.org/abs/2207.00124), [arXiv:2207.00125](https://arxiv.org/abs/2207.00125), [arXiv:2209.09067](https://arxiv.org/abs/2209.09067), [arXiv:2211.13210](https://arxiv.org/abs/2211.13210)