

# Broader Impacts of Muon Collider R&D










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# Broader Impacts of Future Colliders

- To build future colliders: need **holistic** arguments about why this research is beneficial to society.
- ITF evaluated **negative** impacts: time, money, power, risk. What about **positive** impacts?

 <p><b>&gt; Inclusion</b></p> <p>Increasing and including the participation of women, persons with disabilities and underrepresented minorities in STEM.</p>	 <p><b>&gt; STEM education</b></p> <p>Improving education and educator development — at any level — in science, technology, engineering and mathematics.</p>	 <p><b>&gt; Public engagement</b></p> <p>Increasing public scientific literacy and public engagement with STEM.</p>
 <p><b>&gt; Societal well-being</b></p> <p>Improving the well-being of individuals in society.</p>	 <p><b>&gt; STEM workforce</b></p> <p>Developing a more diverse, globally competitive STEM workforce.</p>	 <p><b>&gt; Partnerships</b></p> <p>Building partnerships between academia, industry and others.</p>
 <p><b>&gt; National security</b></p> <p>Improving national security.</p>	 <p><b>&gt; Economic competitiveness</b></p> <p>Increasing the economic competitiveness of the U.S.</p>	 <p><b>&gt; Infrastructure</b></p> <p>Enhancing infrastructure for research and education.</p>

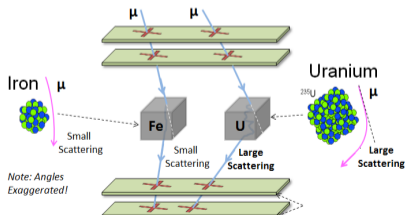
Proposal Name (c.m.e. in TeV)	Collider Design Status	Lowest TRL Category	Technical Validation Requirement	Cost Reduction Scope	Performance Achievability	Overall Risk Tier
FCCee-0.24	II					1
CEPC-0.24	II					1
ILC-0.25	I					1
CCC-0.25	III					2
CLIC-0.38	II					1
CERC-0.24	III					2
ReLiC-0.24	V					2
ERLC-0.24	V					2
XCC-0.125	IV					2
MC-0.13	III					3
ILC-3	IV					2
CCC-3	IV					2
CLIC-3	II					1
ReLiC-3	IV					3
MC-3	III					3
LWFA-LC 1-3	IV					4
PWFA-LC 1-3	IV					4
SWFA-LC 1-3	IV					4
MC 10-14	IV					3
LWFA-LC-15	V					4
PWFA-LC-15	V					4
SWFA-LC-15	V					4
FCChh-100	II					3
SPPC-125	III					3
Coll.Sea-500	V					4

NSF

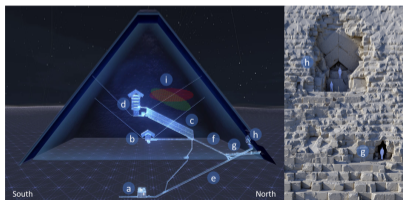
ITF Report (2208.06030)

# Broader Impacts of Muon Colliders

- R&D towards a muon collider will enable development of new technologies:
  - Some **in common** with other colliders: superconducting RF cavities, high-field magnets, work on microelectronics and AI for detector design and readout systems, etc.
  - Enabling **other experiments**: neutrino factories, fixed-target experiments, **CLFV**, etc.
  - **Muon scanning**: **lots of interest**, currently using cosmic ray muons for archaeology, engineering, defense, monitoring nuclear reactors, volcanology, and more!
- Other examples of potential positive impacts that we should consider:
  - Significant **economic benefits** to the host site/country (e.g. CERN in Geneva!)
  - Significant opportunities for **STEM education and outreach**.



B. Locke and M. Hohlmann



Procureur et al (10.1038)

# Workforce Development

- I had opportunities to do detector R&D **in grad school**:
  - Worked on ATLAS HL-LHC tracker upgrade.
  - Learned a lot about (rad-hard, high speed) microelectronics and detector design!
  - Lots of transferrable skills (both inside and outside academia).
  - **Will next generation have similar opportunities?**
- Muon collider: close coupling between **accelerator and detector design** (due to BIB):
  - Offers an opportunity to cross-train collider physicists in accelerator physics!
- **P5 ask**: provide support for future collider R&D:
  - Consider these issues when planning for the future, to help make the case for future facilities!
  - Support muon collider R&D: **physics case is strong**, other significant positive impacts!

