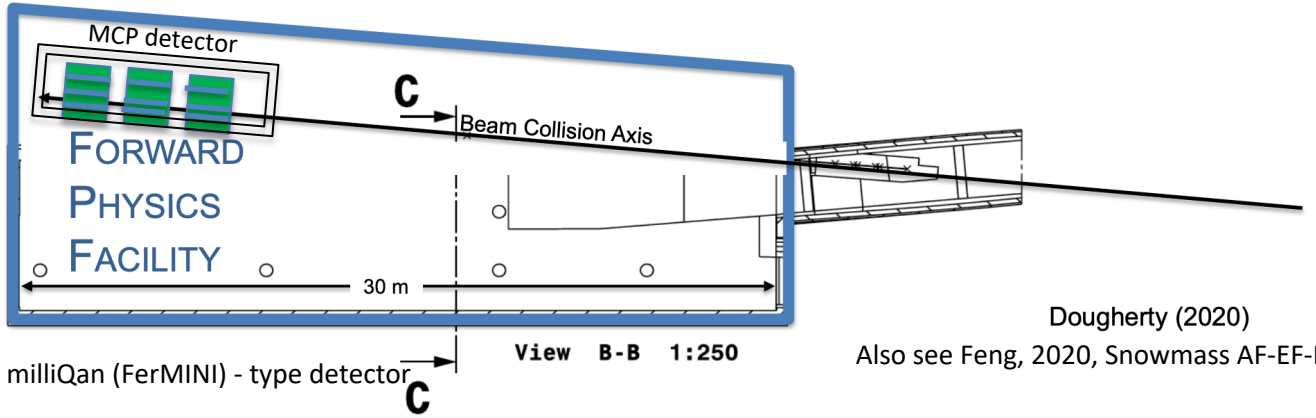
# Looking **Forward** for **Millicharged Particles** at LHC

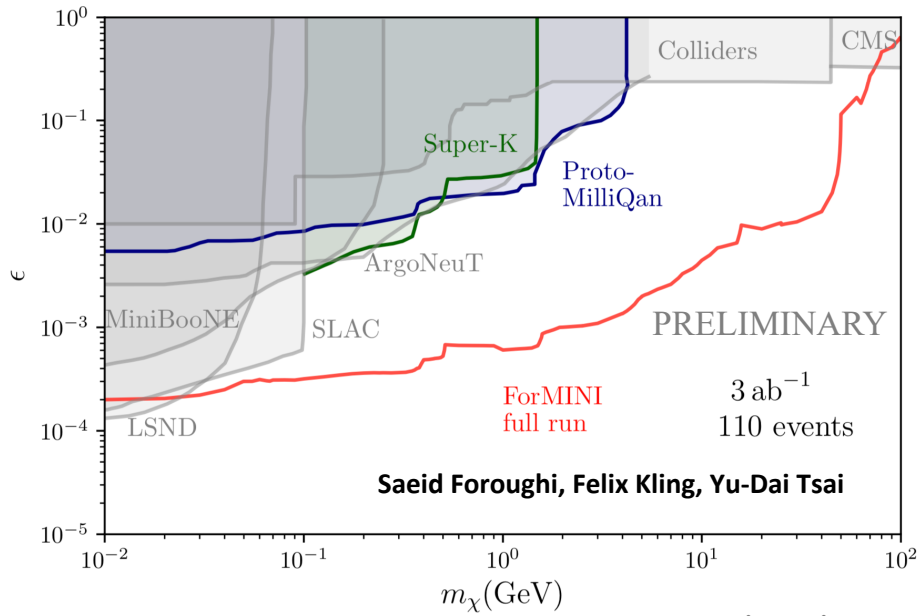



Dougherty (2020)

Also see Feng, 2020, Snowmass AF-EF-RF Meeting

Adding a milliQan (FerMINI) - type detector

See, e.g., **milliQan (arXiv:1410.6816 / 1607.04669 / 2005.06518)**, **FerMINI (arXiv: 1812.03998)**, more detailed refs in **next slide!**




- Projection of Millicharged Particle (MCP) sensitivity with different masses and Qx/e.

- Saeid Foroughi, Felix Kling, Yu-Dai Tsai
- Forward MCP search
- consider missing productions
- various locations (esp. forward region)
- coming out ~ next week
- We will add other projections in the paper

# Accelerator Probes of MCP: Reference

**Works from other people and collaborations:**

- SLAC mQ (hep-ex/9804008)
- Early collider bounds (LEP+) (hep-ph/0001179)
- Invisible decays of positronium (hep-ex/0609059)
- LHC - CMS (1210.2311)
- milliQan (1410.6816 + 1607.04669 + 2005.06518)
- LDMX MCP probe (1807.01730)
- NA64 MCP Probe (1810.06856)
- LArTPC's (1902.03246) / ArgoNeuT (1911.07996)
- MAPP (conf. proceeding, LHCP 2019)
- Electron colliders (1909.06847)
- SUBMET (2007.06329)
- …

**Our works:**

- MCPs in neutrino experiments (LSND, MiniBooNE, DUNE) (1806.03310)
- FerMINI (1812.03998), Fermilab today
- Cosmic-Ray production and detection in Super-K (2002.11732)
- Forward MCP Search (coming ~ next week)
- My review talk: https://indico.cern.ch/event/910753/contributions/3831616/

# When Energy meets Intensity

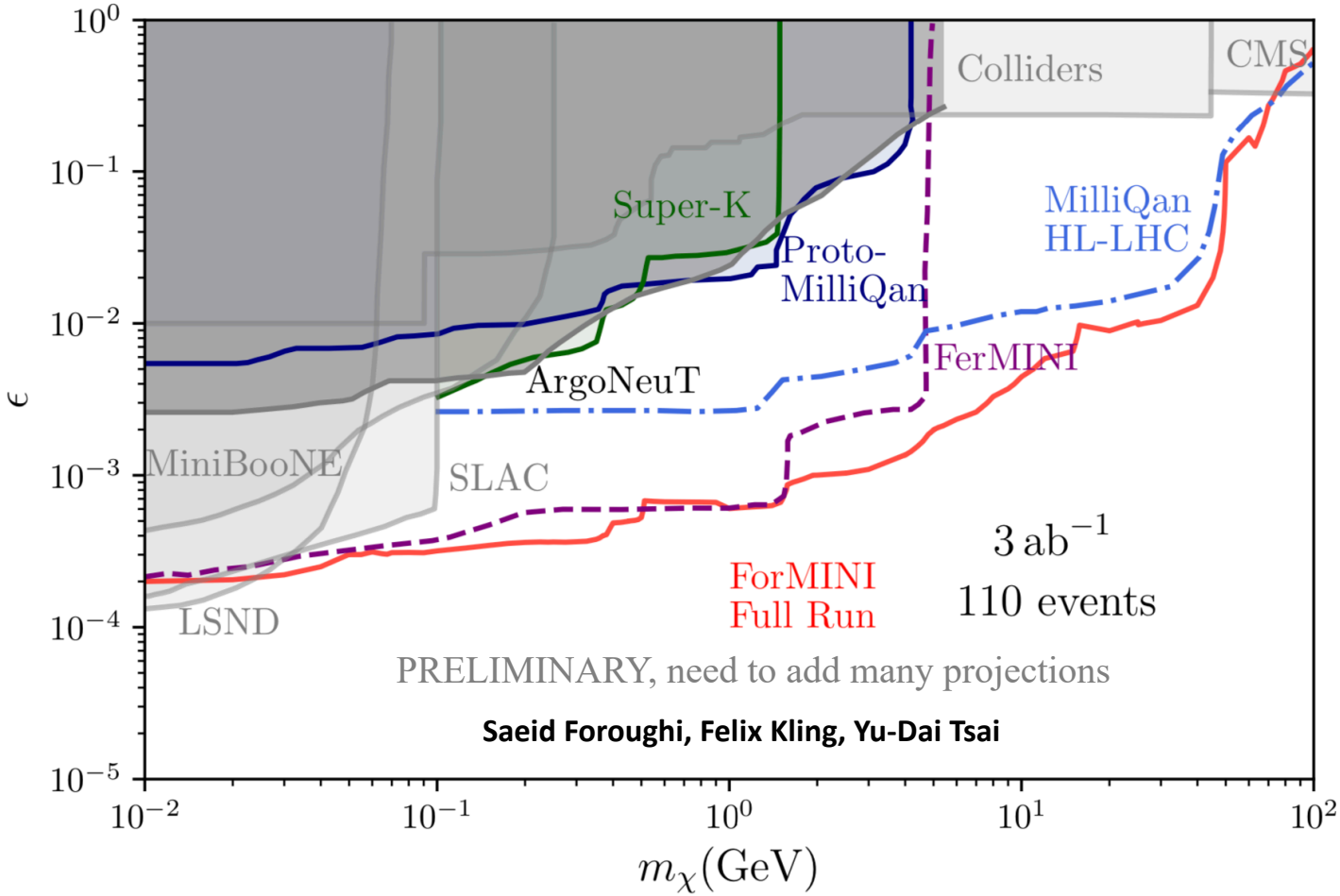
- **High-Intensity Energy Frontier**
- E.g. the LHC forward facility
- General LLP:
  **FASER**
- Specified (MCP):
  **milliQan / ForMINI**
- Only incomplete examples here

**High-Energy Intensity Frontier**

- E.g. Fermilab facilities
- General LLP:
  **DarkQuest/LongQuest**
- Specified (MCP)
  **FerMINI**
- Only incomplete examples here

**Filling low-mass / high-mass gap!**

# A Preliminary Comparison Plot




- Need to add LDMX MCP probe (1807.01730), NA64 MCP Probe (1810.06856) DUNE (1806.03310 / 1902.03246), MAPP (conf. proceeding, LHCP 2019), electron colliders (1909.06847), SUBMET (2007.06329) …