

Targetry Overview

Kevin Lynch Workshop on a Future Muon Program at Fermilab 2023 March 28

The present – Mu2e

A search for charged lepton flavor violating neutrinoless muon to electron conversion in the field of a nucleus with 4 order of magnitude increase in sensitivity



The Future – Mu2e-II and AMF

- Mu2e-II aims for a factor of 10 better than Mu2e
- AMF is an idea to gain an addition two orders of magnitude across the main muonic CLFV channels with a new facility at Fermilab:
 - mu → e gamma
 - mu → 3e
 - $\quad \text{mu } \mathsf{N} \to \mathsf{e} \; \mathsf{N}$
 - Mu ↔ Mubar



We clearly need lots of muons for these experiments!

- Mu2e
 - Radiatively cooled tungsten target in vacuum and high field
 - 8 GeV, 8 kW proton beam
 - 700 W power deposition
 - 200 ns pulse length
 - ~200 kHz (30% duty factor)
- Mu2e-II
 - Actively cooled something
 - 800 MeV, 100 kW beam
 - 25 kW power deposition in tungsten
 - 100 ns pulse length
 - ~ 200 kHz (95% duty factor)

- AMF
 - No idea! Similar to muon collider parameters
 - 800 MeV 8 GeV, 1MW beam
 - 1 kHz pulse rate (100 % duty factor)
 - ~10 ns pulse length
- Compare to LBNF
 - Long graphite target
 - 120 GeV, 1.2(2.4) MW beam
 - 1 Hz
 - ~10mu s pulse length



Overview of the session

- We have a target for Mu2e that should work
- We have some concepts for Mu2e-II that might work
- We have no idea how to build an AMF target (yet!)
 - Similar in scope and power to current muon collider parameters, with a few intersting issues
- Target materials are difficult in this regime
 - High heat loads
 - High fields
 - High radiation damage
 - High stress wave amplitudes
- How much overlap with muon collider R&D is possible, and what other synergies can we both exploit?

