

# Non-Toxic Liquid Targets

arXiv 2303.04330

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# High-Power Targets

- At very high beam powers, only liquid targets survive.
- Liquid targets tend to be made out of toxic materials (mercury or lead).
- In some jurisdictions, liquid mercury is not even legal!

The MERIT High-Power Target Experiment at CERN PS  
H. G. Kirk et al. WEPP169, EPAC08 (2008)

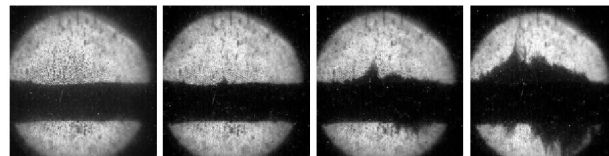
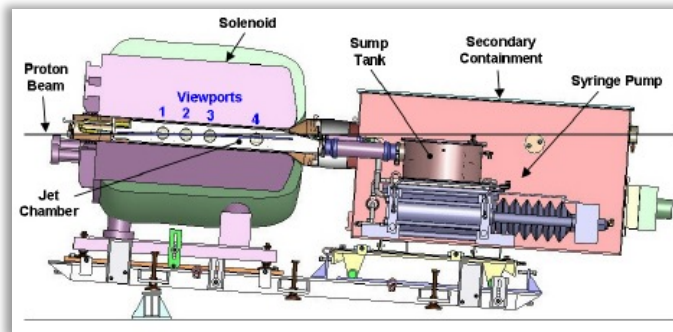


Figure 4: A 1-cm-diameter, 15-m/s Hg jet at 0, 75, 175, and 375  $\mu\text{s}$  after interaction with  $10 \times 10^{12}$  24-GeV protons in a 10-T solenoid field.

Is there a safe alternative to liquid metal targets?

# Why Liquid Xenon?

We are exploring the possibility of a liquid Xenon (LXe) target

- <https://arxiv.org/abs/2303.04330>

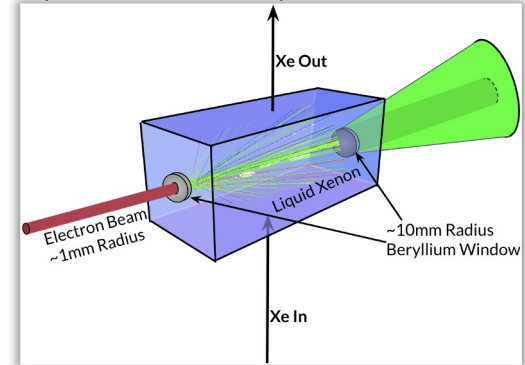
Advantages includes:

- Non-Toxic ✓
- Dense ✓
- Large atomic number (for non-metal) ✓
- Large heat of vaporization (high PEDD) ✓
- Experience with LXe in HEP community ✓

Disadvantages:

- Containment system (windows) ✗
- Longer radiation length (7x) ✗

A Liquid Xenon Positron Target Concept  
M. Varverakis et al. arXiv 2303.04330  
(Submitted to NIM A)



The LUX-ZEPELIN Experiment  
D. Akerib et al. NIM A (2020)

# Liquid Xenon Targets for Muon Collider?

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We have studied LXe targets in the context of a Linear Collider positron source at 100 kW input electron beam power.

- Primary challenge identified is high-power on the beryllium exit window.

Can this concept be extended to a Muon Collider with MW-class proton beams?

- Will extend GEANT studies to examine this case.
- Is it possible to operate system without windows? (e.g. differential pumping)