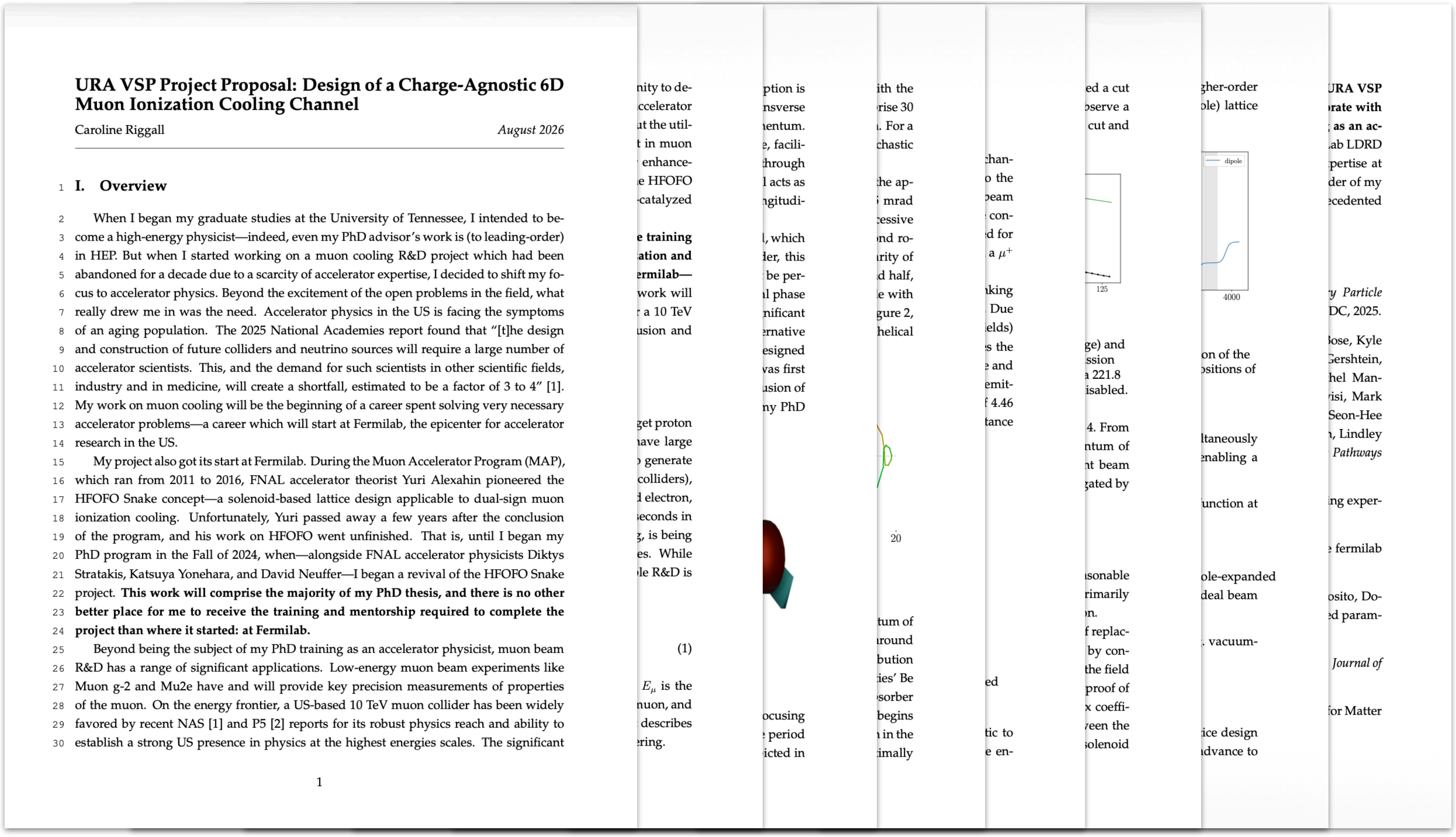
HFOFO Project Updates

August 14, 2026

https://github.com/criggall/muon-cooling/tree/main

URA VSP proposal draft v.1 is finished



URA VSP Project Proposal: Design of a Charge-Agnostic 6D Muon Ionization Cooling Channel

Caroline Riggall *August 2026*

I. Overview

When I began my graduate studies at the University of Tennessee, I intended to become a high-energy physicist—indeed, even my PhD advisor's work is (to leading-order) in HEP. But when I started working on a muon cooling R&D project which had been abandoned for a decade due to a scarcity of accelerator expertise, I decided to shift my focus to accelerator physics. Beyond the excitement of the open problems in the field, what really drew me in was the need. Accelerator physics in the US is facing the symptoms of an aging population. The 2025 National Academies report found that "[t]he design and construction of future colliders and neutrino sources will require a large number of accelerator scientists. This, and the demand for such scientists in other scientific fields, industry and in medicine, will create a shortfall, estimated to be a factor of 3 to 4" [1]. My work on muon cooling will be the beginning of a career spent solving very necessary accelerator problems—a career which will start at Fermilab, the epicenter for accelerator research in the US.

My project also got its start at Fermilab. During the Muon Accelerator Program (MAP), which ran from 2011 to 2016, FNAL accelerator theorist Yuri Alexahin pioneered the HFOFO Snake concept—a solenoid-based lattice design applicable to dual-sign muon ionization cooling. Unfortunately, Yuri passed away a few years after the conclusion of the program, and his work on HFOFO went unfinished. That is, until I began my PhD program in the Fall of 2024, when—alongside FNAL accelerator physicists Diktys Stratakis, Katsuya Yonehara, and David Neuffer—I began a revival of the HFOFO Snake project. **This work will comprise the majority of my PhD thesis, and there is no other better place for me to receive the training and mentorship required to complete the project than where it started: at Fermilab.**

Beyond being the subject of my PhD training as an accelerator physicist, muon beam R&D has a range of significant applications. Low-energy muon beam experiments like Muon g-2 and Mu2e have and will provide key precision measurements of properties of the muon. On the energy frontier, a US-based 10 TeV muon collider has been widely favored by recent NAS [1] and P5 [2] reports for its robust physics reach and ability to establish a strong US presence in physics at the highest energies scales. The significant

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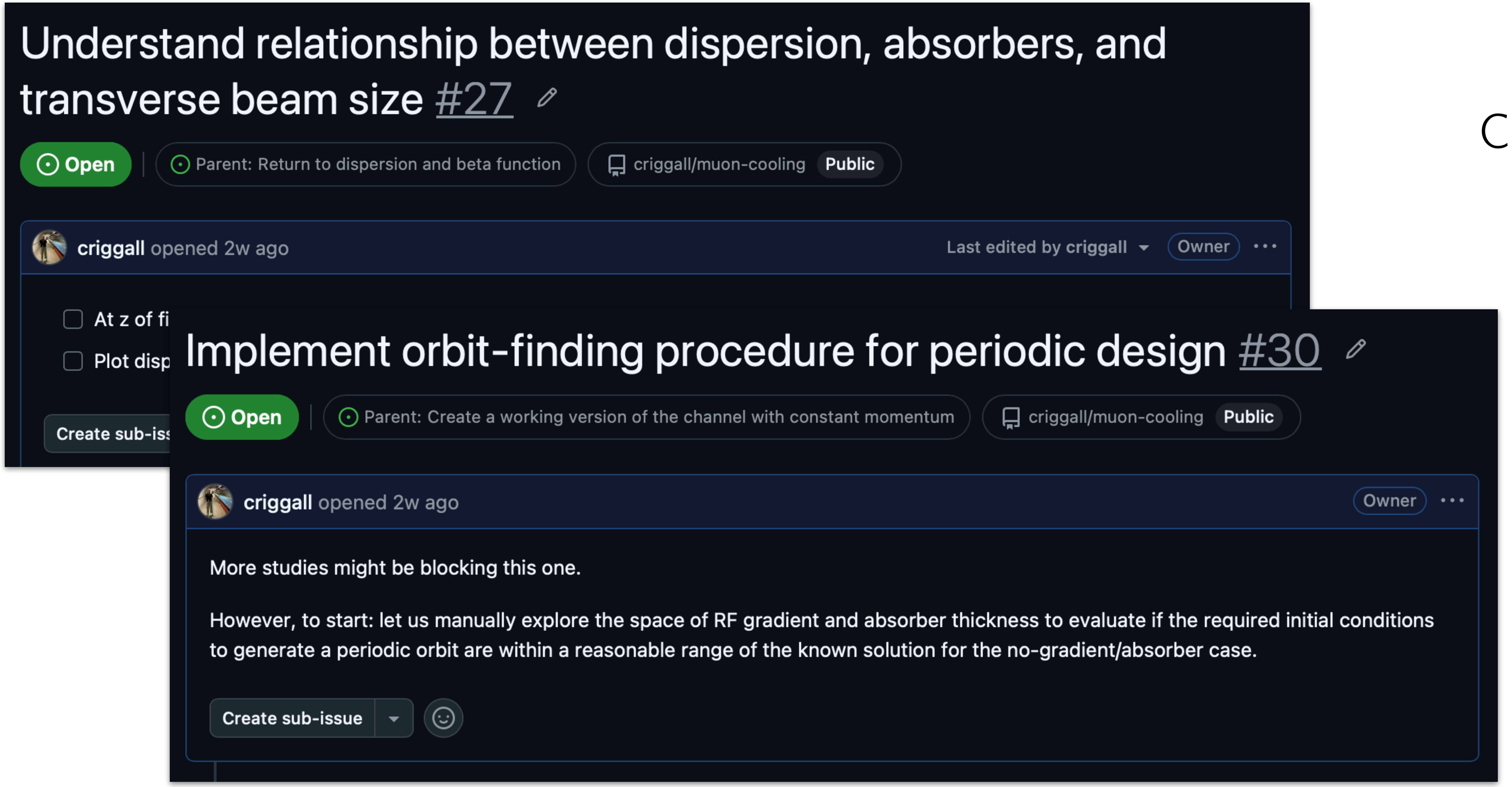
Feedback is welcome!

(Deadline Aug. 31)

To-study list for next week



Continuing w/ last week's studies!