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Self-Consistent Modeling of Muon Cooling and Acceleration with Wakefields in WarpX/ImpactX

The modeling of collective effects in the muon beam during ionization cooling and acceleration pose important challenges for a Muon Collider design. Toward the end of the ionization cooling channel, the intense, short muon bunches are subject to significant space charge, and induce wakefields in the foil and the surrounding RF cooling cell that may result in the distortion of the RF waveform. We propose to use the code WarpX with ICOOL to evaluate such effects self-consistently using electromagnetic PIC. Likewise, in the downstream transport, it is important to evaluate the dynamical effects of long-range and short-range wakefields in the accelerating cavities. We propose to use the code ImpactX for efficient multibunch modeling of the muon acceleration transport. WarpX and ImpactX are parallel, GPU-capable codes that form part of the Beam, Plasma, and Accelerator Modeling (BLAST) toolkit.

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