

Multi-pass ERL Driven FELs and Light Sources

Tuesday, 4 October 2022 08:30 (20 minutes)

Any proposal for an accelerator facility based upon a multipass energy recovery linac (ERL) must possess a self-consistent match in longitudinal phase space, not just transverse phase space. We therefore present a semianalytic method to determine self-consistent longitudinal matches in any multipass ERL. We apply this method in collider scenarios (embodying an energy spread minimizing match) and FEL scenarios (embodying a compressive match), and discuss the consequences of each. As an example of the utility of the method, we prove that the choice of common or separate recirculation transport determines the feasibility of longitudinal matches in cases where disruption, such as synchrotron radiation loss, exists. We show that any high energy multipass ERL collider based upon common recirculation transport will require special care to produce a self-consistent longitudinal match, but that one based upon separate transport is readily available. Furthermore, we show that any high energy multipass ERL FEL driver based upon common recirculation transport requires a larger resultant rf beam load than the one based on separate transport, favoring the separate transport designs.

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Session Classification: Beam Dynamics and Instrumentation

Track Classification: Beam Dynamics and Instrumentation