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Application of reinforcement learning for efficient beam tuning in CiADS room temperature front-end prototype accelerator

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In proton accelerators, nonlinear effects, such as space charge effects and fringe field effects, significantly contribute to the nonlinear characteristics of beam dynamics and control strategies. These nonlinear characteristics increase the degree of coupling between accelerator control elements, complicating the beam commissioning process and extending beam tuning time.
Reinforcement Learning (RL) is adept at swiftly formulating decisions contingent upon the prevailing system state and control demands, thereby offering an efficacious control strategy for accelerator systems. We have conducted a study on beam tuning based on reinforcement learning for application in the beam tuning process of the current CiADS room temperature front-end prototype accelerator. The goal of this research is to enhance the efficiency of the tuning process. To achieve this, we trained RL agents in a simulated environment. Subsequently, the successfully trained agents will be tested in the real accelerator environment to validate their effectiveness.

Footnotes

Funding Agency

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Yes

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