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Using Surrogate Models to make BO safer for particle accelerators

Tuning of the accelerator at the ISIS Neutron and Muon Source has traditionally been done manually, relying on experts to vary parameters in the control system to achieve optimum beam efficiency and intensity. Bayesian Optimisation (BO) is an effective way to automatically tune the Low Energy Beam Transport (LEBT), a section within the linear accelerator. However, due to losses and radiation caused in the accelerator by the initial exploratory nature of BO, the machine can be put into unsafe operating states. To mitigate these losses, we explore how surrogate models can be used for pre-training, exploring their function as low fidelity information sources to achieve high beam intensity without the noisy initial exploration. In addition, such models can be used to test BO algorithms specifically modified to be safe, before running them on the accelerator.

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