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Reinforcement Learning and Fault Diagnosis - How to support accelerator operation

Friday, 8 October 2021 14:50 (25 minutes)

Within LEAPS, the League of European Accelerator based-Photon Sources, the idea of an LEAPS Integrated Platform (LIP) has been developed bringing together the fields of Digital Twinning, Machine Learning and Virtual Diagnostic. This platform should contain digital twins from the accelerator over the photon transport up to the experiments. This does not only allow the experimentalists to get familiar with the facilities and make more efficient experiments, but can also support the operators to increase the performance of the facility with respect to the wishes of the experiments. In addition, it offers the capability to test new algorithms for control and optimization also exploiting machine learning on the digital twin before bringing them to the real facility, and, if the digital twin parts are real-time capable, they can be even used online for control and diagnosis. All in all, the digital twin can support on the way towards an autonomous accelerator. Two research projects, which are followed at DESY along this line are presented, where the usefulness of the model, the digital twin, is underlined. The first is on reinforcement learning for accelerator operation, where the twin is exploited offline for training the controller and the goal is to support the startup and tuning procedure in the future. The second is on fault detection for superconducting radio frequency cavities, where the digital twin is used online to detect anomalies in the behavior.

Session

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Session Classification: Lessons learnt from the pandemic