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DBSCAN for anomaly detection of Turn-by-turn Beam Position Monitors

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Collider rings need to have several sensors all around the ring to operate. One of these sensors is the Beam Position Monitor (BPM), which allows operators to measure if the beam travelling in the ring is well centered between the different magnets. One specific category of BPMs, which stands out because of its high acquisition rate, is called the Turn-by-turn BPMs (TbTBPMs). Several methods exist to reconstruct the magnetic lattice and the associated optical functions, which needs reliable data from the TbTBPMs. The FCC will deploy several thousand sensors along a 91-km ring, operating in a challenging environment primarily due to radiation effects on the electronics. To maximize the duty cycle of this large-scale accelerator, operations may continue even if some sensors are not functioning. It is thus important to quickly detect faulty TbTBPMs that hamper the optics functions reconstruction. This poster presents a proposition of an unsupervised machine learning method aiming to detect faulty TbTBPMs in SuperKEKB—the world's largest operating e+/e− collider [1] ; still retaining a high degree of explainability (i.e limit the blackbox effect, current in unsupervised learning techniques). It present the processing pipeline built, the main pivots over which the method revolves (feature extraction and selection) and the first tunings of the algorithm for detection purity on tracking simulation. The paramount objective is to have an algorithm efficient enough to be useful for quick surveys in SuperKEKB and/or scalable to the FCC.

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