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The new readout concept of the PANDA experiment

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One of the physics highlights of the future PANDA experiment at the Facility for Antiproton and Ion Research (FAIR, currently under construction) is to search for exotic states that have been predicted by Quantum Chromodynamics, and whose properties are governed by the presence of valence gluons. Such exotic states can be formed directly and copiously in proton/antiproton annihilations, which will be colliding at centre-of-mass energies between 2.5 and 5.47 GeV in PANDA. The challenge lies in reducing the enormous background yield, while preserving a high efficiency for the detection of exotic hadrons. As the detector response for background events is very similar to that for the decay of the exotic states, the use of a conventional triggered readout scheme, where a limited number of subdetectors generates a trigger signal that engages the readout of the complete detector, is ruled out. Therefore, a new type of intelligent readout is being developed, where kinematic constraints are imposed in realtime on online reconstructed events. As this no longer relies on the use of a trigger, this concept is called a triggerless readout system. Another challenge lies in handling the 20 MHz interaction rate, which can cause detector response signals to overlap. These so-called pileup signals will require special treatment by the readout system. To illustrate how the implementation is envisioned, the concept of the triggerless readout system, along with its current status and simulation will be discussed for one of the subdetectors, the Electromagnetic Calorimeter.

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