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New Physics emergence in Ultra-high energy cosmic rays events

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During Physics Runs 1-2 of Horizon-xT experiment, a sizable number of which exhibit the unusual spatial and temporal structure of pulses with several maxima (or modes). The separation of the maxima can be from few tens of ns to several hundred ns. The dataset suggests that separation between maxima increases with distance from EAS core, which can not be obtained from simulations, and seem to occur only in events with energy above ˜10ˆ17 eV. To further investigate this phenomenon, the HT-KZ, an ultra-high energy cosmic rays detector system, is currently under construction at Nazarbayev University (NU), Kazakhstan. It is designed to study the spatial and temporal structure of Extensive Air Showers with the energy of the primary above ˜1017 eV, and with high time resolution of the shower disk profile and timing synchronization between the detection points (both ˜1 ns). Detector system construction at NU is conducted in collaboration with the Tien Shan high-altitude Science Station (TSHSS). Based on computer simulations, several prototype designs were created, constructed and tested. The overview of Horizon-xT detector system and the details of the unusual events data will be presented as well as design features and testing data from prototype modules currently in operation at NU.

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