ID de Contribution: **67** Type: **12mOral**

Design and performance of the prototype gaseous beam monitor with GEM and pixel sensors for the CSR external-target experiment

jeudi 21 novembre 2024 08:47 (17 minutes)

A gaseous beam monitor utilizing gas electron multiplier (GEM) and pixel sensors is being developed for the Cooling Storage Ring (CSR) external-target experiment (CEE) at Heavy Ion Research Facility in Lanzhou (HIRFL). The beam monitor is mainly used to track each beam particle, providing an accurate reconstruction of the primary vertex of the collision. Two generations of the pixel sensors (named Topmetal-CEE) were produced, with the second generation having much-improved noise performance over the first one. The readout electronics includes two chip carrier cards, two front-end cards, and a readout and control unit. This talk presents the design and performance of two prototype detectors, featuring two generations of the pixel sensors, respectively.
In particular, the results of the tests with heavy-ion beams and laser beams are presented, showing a spatial resolution of better than 50 μm and a time resolution of better than 15 ns.

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Classification de Session: HEP experiments

Classification de thématique: High energy and nuclear physics experiments