



Contribution ID: 232

Type: Parallel Talk

New opportunities for understanding high-density QCD matter with CMS PhaseII detector at the High Luminosity LHC era

Thursday, 7 July 2022 10:28 (17 minutes)

The intriguing phenomena emerging in the high-density QCD matter are being widely studied in the heavy ion program at the LHC and will be understood more deeply during the high luminosity LHC (HL-LHC) era. The CMS experiment is under the Phase II upgrade towards the HL-LHC era. A new timing detector is proposed with timing resolution for minimum ionization particles (MIP) to be 30ps. The MIP timing detector (MTD) will provide the particle identification (PID) ability with a large acceptance covering up to $\eta < 3$ through time-of-flight (TOF). Combining MTD with the other new sub-detectors, a tracker with acceptance $\eta < 4$, high granularity calorimeters with acceptance covering $\eta < 5$, will enable the deep studies of high-density QCD matters in ultra-relativistic heavy ion collisions. In this presentation, the performances of a broad range of measurements in heavy ion programs will be discussed using TOF-PID. These include the (3+1)D evolution of heavy flavor quarks, QGP medium response to high- p_T parton energy loss at wide jet cone angles, collectivity in small systems, fluctuations and transport of initially conserved charges, and light nuclei physics.

In-person participation

Yes

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