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Time-of-flight PID upgrade at CMS for hard probes in dense QCD matter at the high-luminosity LHC era

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The intriguing phenomena emerging in the high-density quantum chromodynamics (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 2 upgrade towards the HL-LHC era. Among others, a new timing detector is proposed with its timing resolution for minimum ionization particles (MIP) to be 30 ps. The MIP timing detector (MTD) will also provide the particle identification (PID) ability with a large pseudorapidity acceptance covering up to $|\eta| < 3$ through time-of-flight (TOF). Combining MTD with a new wide-acceptance tracker ($|\eta| < 4$) and high-granularity calorimetry ($|\eta| < 5$), CMS will enable deeper studies of high-density QCD matters in ultrarelativistic heavy ion collisions. Taking advantage of upgraded detector capabilities, new opportunities in probing the quark-gluon plasma with hard probes will be presented, such as investigating the (3+1)-dimensional evolution of heavy flavor quark dynamics and particle composition inside jets over a wide angular range. The latest status and progress of the MTD project will also be presented.

Category

Experiment

Collaboration

CMS

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