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Hard probes used in heavy ion collisions to study QCD at extreme energy densities

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We present results of the CMS experiment from PbPb collisions at $\sqrt{s_{NN}} = 2.76$ TeV, probing quark and gluon matter at unprecedented values of energy density. The capabilities of the CMS apparatus allows us to investigate various hard probes, using the calorimetry, muon and tracking systems covering a large range in pseudorapidity, complemented by a flexible two-level trigger system. One of the most important early observations was that dijets at high p_T are found to be increasingly unbalanced as a function of collision centrality. The overall p_T -imbalance can be recovered by including tracks found at low p_T and at large angles with respect to the jet axis. Furthermore, the p_T -distribution of charged tracks (jet fragments) has been measured using various jet triggers in pp collisions at 7 TeV, and a reference spectrum is constructed to compare to PbPb collisions at 2.76 TeV/nucleon pair. The inclusive production of isolated prompt photons has also been studied in pp and PbPb collisions. CMS is also well equipped to measure muons and dimuons in the high multiplicity environment of heavy ion collisions. Inclusive and differential measurements of the Z and W boson yields show no sign of modification with respect to NLO pQCD calculations. Dimuon decays of the J/psi particle and the Upsilon family are also investigated and results will be presented.

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