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Search for intense magnetic field via electron-positron pair asymmetry measurements in Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV with ALICE

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We aim to experimentally detect an intense magnetic field to be created in heavy ion collisions. The intensity of this magnetic field in non-central collisions should reach $\sim 10^{14}$ T at the LHC energies. Interesting expectations in the very intense field, such as chiral magnetic effects, synchrotron radiation, photon decay and so on, have been theoretically discussed in the recent years. The field, however, has not yet been detected.

We have proposed two new approaches for the detection. First, we focus on polarization of direct virtual photons. Virtual photons perpendicular to the field strongly interact with the field and a polarization of the order of 10% may appear according to theoretical calculations [1]. Second, we focus on aligned deflection of electron-positron pairs from the decay of direct virtual photons. Electrons and positrons in the magnetic field deflect into opposite directions. The direction from the electron to the positron is hence aligned to the direction of the field. For this analysis, we first determine the direction of the field. The field appears perpendicularly to the reaction plane, and its direction depends on the orientation of the plane.

In this presentation, the status of the two analyses, polarization and deflection, in Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV at ALICE will be presented.

[1] K. Ishikawa, D. Kimura, K. Shigaki, and A. Tsuji, J. Mod. Phys. A28 (2013) 1350100

Primary author: TANIZAKI, Remi (Hiroshima University (JP))

Presenter: TANIZAKI, Remi (Hiroshima University (JP))

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