Measurement of dielectron production in $\sqrt{s_{NN}} = 5.02$ TeV p-Pb collisions at LHC-ALICE

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In high-energy heavy-ion collisions, heavy quarks are primary produced during the initial hard scattering and experience the entire evolution of system. Therefore, they are sensitive to the transport properties of the hot and dense matter created in the collisons. In paticular, the correlation of heavy quark pairs provides key insight into the mechanisms of the energy loss and thermalization[1)]. This can be studied through the measurement of dielectron production because correlated electron-positron pairs from semi-leptonic decays of heavy quarks are the dominant source of dielectrons above 1 GeV/c^2. The dielectron measurement around the intermediate-mass region in p-Pb collisions reveals cold-nuclear-matter effects such as gluon shadowing and gluon saturation on the heavy-quark production.

In the ALICE experiment, the Transition Radiation Detector (TRD) has a capability of the online electron identification and provides an electron trigger to enrich the data samples for the study of heavy-flavor electron production. In 2013, ALICE successfully collected data in p-Pb collisions with the TRD trigger ($L_{\rm int} = 1.4$ nb^{-1}) and the minimum bias trigger ($L_{\rm int} = 0.067$ nb^{-1}).

In the central barrel of the ALICE detector, charged tracks are reconstructed with the Inner Tracking System (ITS) and the Time Projection Chamber (TPC)[2)]. Electrons are identified using dE/dx obtained in the TPC and time-of-flight measurement with the TOF detector (120ps resolution). TOF is essential to remove

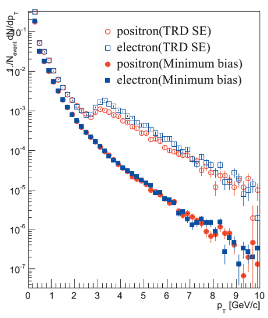

Fig. 1. Single-electron p_T distributions for the minimum-bias trigger and the TRD single-electron trigger.

contaminants such as of kaons, protons and deuterons up to 2 GeV/c. The hadron contaminations can be reduced less than 1% up to 6 GeV/c by the TOF information. Figure 1 shows the single-electron spectrum. A clear enhancement of electron samples by more than 20 times can be observed above 3 GeV/c for the TRD triggered data.

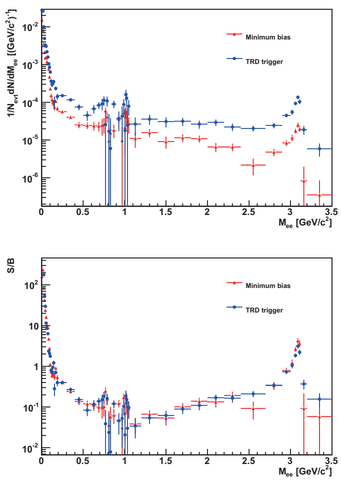

Fig. 2. Upper panel: The dielectron spectrum after background subtraction. Lower panel: the signal to background ratio.

For the estimation of the dielectron background, like-sign pairs in the same-events technique are used. Since the acceptance depends on the sign of charge, acceptance difference between unlike-sign and like-sign pairs is evaluated using mixed unlike-sign and mixed like-sign pairs. Equation 1 is calculated, and the R-factor is corrected to like-sign pairs to estimate the background.

$$R = \frac{N_{+-}|_{mix} + N_{-+}|_{mix}}{N_{++}|_{mix} + N_{--}|_{mix}} \qquad (1)$$

where $N_{++}|_{mix}$, $N_{--}|_{mix}$ and $N_{+-}|_{mix}$, $N_{-+}|_{mix}$ are like-sign pairs and unlike-sign pairs in mixed events, respectively. The estimated background is defined as $N_{CB} = 2R\sqrt{N_{++}N_{--}}$, where N_{++}, N_{--} are like-sign pairs in the same event.

Figure 2 shows the inclusive dielectron spectrum after background subtraction, and the signal-to-background ratio. The vector mesons and J/ψ peaks can be seen clearly. The signal-to-background ratio agrees with the result of the pp collisions[3)]. in different p_T bins.

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References

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