Status of the charm and bottom measurement with PHENIX-VTX

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Heavy quarks (bottom and charm) are one of the clean probes for studying properties of hot dense medium created in the high energy heavy ion collisions. Due to their large mass, heavy quarks are mainly produced though the initial hard scattering. Once produced, the heavy quarks traverse and interact with the medium. Therefore, the modification of their production yield and emission angle reflects the medium properties.

The PHENIX experiment[1)] installed a silicon vertex tracker (VTX)[2)] and collected a large amount of $p+p$, Au+Au and Cu+Au collision events at $\sqrt{s_{NN}} =$ 200 GeV successfully in the past three years. The VTX provides a clear separation of charm and bottom quarks via measurement of distance of the closest approach of electrons relative to the collision vertex (DCA).

The preliminary results of the fraction of $(b \to e)/(b \to e + c \to e)$ and the azimuthal anisotropy of charms were already reported[3,4)]. In order to improve the DCA measurement, we recently updated the following items in the analysis:

(1) Hot and dead channel status on the sensor:
The bad channels that have extremely higher and lower hit rate were masked. In addition, the unstable channels that changed the hit rate by time were also newly masked. Figure 1 shows the map of the hot and dead channels for a readout chip. The colored channels indicate the bad channels caused by the faulty bump bonding between the sensor and the readout chip.

(2) Parameter tuning of the track association between the VTX hits and the track measured in the central arm:
The angular resolution of tracks measured in the central arm was an input for the χ^2 calculation of the track fitting between VTX hits and the track. This resolution was updated to be realistic (1m rad.). The blue histogram and black curve in Fig. 2 show the χ^2 distribution for the reconstructed proton in simulation and the ideal χ^2 function. The histogram suitably reproduces the ideal curve.

(3) DCA decomposition method:
The charm and bottom yields were obtained by fitting the measured DCA distribution with the DCA templates of charms and bottoms[3)]. The DCA templates are correlated with the shape of their transverse momentum (p_T) distribution since the DCA is determined by convolution of two effects: the decay length of the parent particle and p_T kick relative to the parent momentum. In order to include this effect, we fit both the DCA and p_T distribution of electrons simultaneously. We are testing the several methods to decompose charm and bottom components.

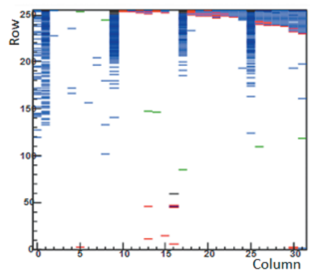

Fig. 1. Hot and dead channels for a readout chip. The colors indicate the bad statuses mostly due to faulty bump bonding.

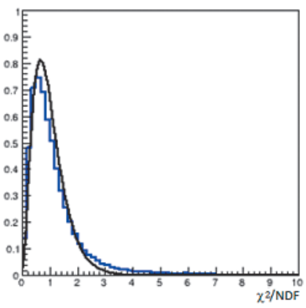

Fig. 2. The χ^2 distribution of proton in simulation. The histogram suitably reproduces the ideal curve.

We are working to complete the Au+Au and $p+p$ analysis for publication. The Cu+Au analysis is also in progress and we aim to show the first Cu+Au result in 2014.

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