System size dependence of particle production in p/d+Au, Ru+Ru, Zr+Zr Au+Au collisions at $\sqrt{s_{\rm NN}}$ = 200 GeV with the STAR experiment

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While it has been confirmed that the hot and dense QCD medium called the Quark-Gluon Plasma (QGP) can be produced in large system heavy-ion collisions (e.g. Au+Au and Pb+Pb), recent studies on hard scatterings do not show significant quenching in small systems (e.g. p+Au). Therefore, medium size systems, such as Ru+Ru and Zr+Zr collisions, become crucial to study the system size dependence of QGP formation and its properties. Such collisions provide a wide dynamic range in the number of participants ($N_{\rm part}$) from about 10 to 165, sitting in between p+Au and central Au+Au collisions. Also, the $N_{\rm part}$ of Ru+Ru and Zr+Zr collisions partially overlap with that of Au+Au collisions, allowing us to study how collision geometry influences QGP formation and its evolution. A useful tool is the transverse momentum ($p_{\rm T}$) distribution of charged hadrons. On the one hand, high $p_{\rm T}$ hadrons serve as a proxy to hard scattering processes and can be used to probe parton energy loss in the medium. On the other hand, the distribution on the low-$p_{\rm T}$ end, especially those of species-identified particles, can reveal the transverse expansion and freeze-out properties of the medium.

In this talk, we present charged hadron yields using the large isobar ($^{96}_{44}Ru$+$^{96}_{44}Ru$ and $^{96}_{40}Zr$+$^{96}_{40}Zr$) dataset collected with the STAR detector in 2018. We perform multi-differential yield measurements of low $p_{\rm T}$ identified particles, and centrality-differential measurement on high $p_{\rm T}$ particles. Combined with existing Au+Au and small system (p+Au/d+Au) measurements, we picture an overall system size dependence of QGP production and properties as well as effects of collision geometry on them.