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Pseudo-rapidity dependence of inclusive photon multiplicity distribution at forward rapidity in STAR at RHIC Beam Energy Scan energies

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The STAR experiment at Relativistic Heavy Ion Collider (RHIC) has been studying the properties of the QCD matter at extremely high energy density and parton density, created in the heavy ion collisions. Photons are produced at all stages of the colliding system directly as well as through decay of produced particles like neutral pions. The multiplicity and pseudo-rapidity distribution of photons on an event-by-event basis is an important measurement complementing the charged particle measurement in a heavy ion collision. The Photon Multiplicity Detector in the STAR experiment measures inclusive photons in the pseudo-rapidity region $-3.7 < \eta < -2.3$. The photon multiplicity per participating nucleon pair was observed to be independent of collision centrality for Au + Au collision at $\sqrt{s_{NN}}$ = 200 and 62.4 GeV indicating that photon production is dominated by soft processes [1, 2]. Inclusive photon production at forward rapidity also shows an energy-independent longitudinal scaling at these energies [1, 2]. We will present the multiplicity and pseudo-rapidity distributions of photons in Au+Au collisions at $\sqrt{s_{NN}}$ = 39, 27 and 19.6 GeV for different event centralities at rapidity close to the beam rapidity to further test the energy and centrality dependence of the longitudinal scaling.
Photon multiplicity as well as pseudo-rapidity distributions show more photons as compared to that expected from longitudinal scaling; the deviation increasing for peripheral collisions. We assume that these additional photons from excited spectators due to proximity of PMD to beam rapidity. We propose a simple parameterization to calculate the effective number of photon sources, N', to include contribution from participants as well as spectators, at all three energies. The photon multiplicity when scaled with N'exhibits longitudinal scaling even beyond the beam rapidity.

References

[1] STAR Collaboration, Phys.Rev. C73 034906 (2006)

[2] STAR Collaboration, Nucl.Phys. A 832 134-147 (2010)

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