QUARK MATTER 2015
Sep. 27 – Oct. 3, 2015 Kobe, Japan

Contribution ID: **199** Type: **Poster**

Influence of quantum conservation laws on particle production in hadron collisions

Tuesday, 29 September 2015 16:30 (2 hours)

Conservation laws strongly influence particle production. Effects connected to this mechanism were studied in details using correlation techniques in e^+e^- collisions. At the time models were tuned to correctly reproduce measured data [1]. Similar studies for hadron-hadron collisions have never been performed, until recent ALICE measurement [2]. ALICE reported on studies of untriggered two-particle angular correlations of identified particles (π, K, and p) measured in pp collisions at center-of-mass energy of $\sqrt{s} = 7$ TeV. The ALICE results confirm that also in hadron-hadron collisions conservation laws strongly influence the shape of the correlation functions for different particle types and must be taken into account while analysing the data. Moreover, now, when ALICE results are available, it can be observed that the contemporary models (Pythia, Phojet) no longer reproduce the data well. It should be noted, that also in heavy-ion collisions conservation laws (i.e. local charge conservation) provide crucial elements that are needed to describe experimental data [3].

In the talk we would like to present a brief history of experimental measurements of correlations induced by conservation laws, also including the newest Preliminary results from ALICE. We explain interesting structures observed in ALICE LHC data employing a dedicated model, called CALM (ConservAtion Laws Model). CALM is a model developed to study analytically the influence of the conservation laws on the shape of the $\Delta\eta\Delta\phi$ correlation functions. With this model we demonstrate that local conservation of charge, strangeness, and baryon number in hadron production mechanism is essential for description of experimental data.

[1] H. Aihara et al., (TPC/Two Gamma Collab.), Phys.Rev.Lett. 57, p. 3140, 1986.

[2] L. Graczykowski and M. Janik (for ALICE Collab.), Nucl.Phys. A926, pp. 205–212, 2014.

[3] P. Bozek, W. Broniowski, Phys.Rev.Lett. 109, p. 062301, 2012.

On behalf of collaboration:

NONE

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Session Classification: Poster Session

Track Classification: Correlations and Fluctuations