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Impact of baryon anti-baryon annihilation on strangeness enhancement (baryon sector) at SPS energy

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A deconfined medium of quarks and gluons called Quark-Gluon Plasma (QGP) is produced when heavy-nuclei are collided at relativistic energies. The formation of QGP is often characterized by a phenomenon called strangeness enhancement where the production of strange-to-non-strange particles are enhanced relative to peripheral or proton-proton interactions. Besides the enhancement in K/π ratios, a non-monotonic energy dependence was also reported for Λ to $\bar{p}$ ratios at CERN SPS, attributed to a signature for the strangeness enhancement . As anti-particles are produced directly from the reaction, the Λ/ $\bar{p}$ ratios are considered as a cleaner probe for the strangeness enhancement. However, at this energy range hadronic interactions are dominant and, particularly for Λ and $\bar{p}$, processes like baryon-anti-baryon ($B\bar{B}$) annihilation can significantly modify final yields and spectral shape which may lead to an apparent enhancement in the $\Lambda/\bar{p}$ ratios. In this work, we use UrQMD hadronic transport model, to investigate the role of baryon-anti-baryon ($B\bar{B}$) annihilation on Λ, $\bar{\Lambda}$ hyperon production and its effect on $\bar{\Lambda}/\bar{p}$ ratios. The UrQMD calculations with $B\bar{B}$ annihilation can produce the trend of average transverse mass spectra for Λ and $\bar{\Lambda}$, as well as, the characteristic enhancement in $\bar{\Lambda}/\bar{p}$ ratios in data as a function of centrality and collision energy. Furthermore, $\bar{\Lambda}/\bar{p}$ ratios extracted from the feed-down corrected SPS data are in good agreement with UrQMD model calculations with $B\bar{B}$ annihilation. This suggests that $\bar{\Lambda}/\bar{p}$ enhancement can not be interpreted as a direct signature for strangeness enhancement and $B\bar{B}$ annihilation has a significant role to play.

Primary author(s) : Ms NANDY, Ekata (Variable Energy Cyclotron Centre (VECC)); Prof. CHATTOPADHYAY, Subhasis (VECC)

Presenter(s) : Ms NANDY, Ekata (Variable Energy Cyclotron Centre (VECC))

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