



Implementation of Q-Pythia v8

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Objective

- Modify the final state parton shower in the C++ simulator PYTHIAv8

Motivation

- Technical motivation
- Get insight on the differences in FSR introduced by the use of different ordering variables for the shower.

Things to do

- Modification of the DGLAP splitting functions
- Consideration of energy degradation of the parton, and its position inside the medium to compute the medium characteristics that the radiating parton sees.

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- The modification is due to the fact that heavy ion collision in final state radiation FRS takes place inside the extended colored medium which affects the parton branching.
 - These may considered the origin of the medium induced energy loss which was observed at RHIC

- The medium effects are introduced as an additive contribution to the standard vacuum splitting functions.
- $g \rightarrow gg, q(q^-) \rightarrow gq(q^-)$

$$P_{\text{tot}}(z) = P_{\text{vac}}(z) \longrightarrow P_{\text{tot}}(z) = P_{\text{vac}}(z) + \Delta P(z, \mathbf{k}_T^2, \hat{q}, L, E).$$

$$t \simeq \mathbf{k}_T^2 / [z(1-z)] \quad \omega_c = \hat{q} L^2 / 2.$$

- The medium modify splitting function are computed through their relation to the single-gluon radiative spectrum obtained in formalism for medium induced gluon radiation.

$$\Delta P(z, t, \hat{q}, L, E) \simeq \frac{2\pi t}{\alpha_s} \frac{dI^{\text{med}}}{dzdt}.$$



Energy degradation and computation of the parton position

- Include the kT^2 dependence.
- Implement energy degradation varies during the shower evolution, and the modification of the medium parameters along the cascade

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- The space time picture of the shower used in the previous works will be used

Conclusion

- The benefits of this work reside in the introduction in the event generator of medium effects required for the analysis and interpretation of jets measurements in heavy-ion collisions that are under development at RHIC, and will be one of the topics in the heavy-ion program at the LHC.

References

- [1] N. Armesto, L. Cunqueiro and C. A. Salgado, "Q-PYTHIA: a medium-modified implementation of final state radiation," *Eur. Phys. J. C* 63 (2009) 679 [arXiv:0907.1014 [hep-ph]]; <http://igfae.usc.es/qatmc/>.
- [2] N. Armesto, G. Corcella, L. Cunqueiro and C. A. Salgado, "Angular-ordered parton showers with medium-modified splitting functions," *JHEP* 0911 (2009) 122 [arXiv:0909.5118 [Unknown]].
- [3] N. Armesto, L. Cunqueiro, C. A. Salgado and W. C. Xiang, "Medium-evolved fragmentation functions," *JHEP* 0802 (2008) 04 [arXiv:0710.3073 [hep-ph]].
- A. D. Polosa and C. A. Salgado, "Jet Shapes in Opaque Media," *Phys. Rev. C* 75 (2007) 041901 [arXiv:hep-ph/0607295].