

1 **Charged kaon and pion femtoscopy in the RHIC Beam**
2 **Energy Scan at the STAR experiment**

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8 The RHIC Beam Energy Scan (BES) program aims to study the properties of strongly
9 interacting matter in relativistic heavy-ion collisions at various energy densities and tem-
10 peratures. Correlation femtoscopy technique is a useful tool to study systems undergoing
11 QCD phase transitions, and can extract valuable information about the size, shape, and
12 lifetime of the particle-emitting source in heavy-ion collisions.

13 This study presents the first comprehensive femtoscopic analysis of identical kaons and
14 pions produced in Au+Au collisions at $\sqrt{s_{NN}} = 14.6 - 200$ GeV from the RHIC Beam
15 Energy Scan phases I and II, focusing on charge, transverse momentum, and centrality-
16 dependent properties. The charge-dependent analysis reveals differences at the level of
17 correlation functions for both kaons and pions for the first time at these energies. This
18 observation is consistent with Coulomb field effect due to residual charge after the colli-
19 sion and hadronic final state effects, as implemented in UrQMD. The three-dimensional
20 femtoscopic analysis reveals that the extracted radii, assuming Gaussian distribution for
21 emission source, increase with collision energy, decrease with transverse mass, and are gen-
22 erally larger for kaons compared to pions under the same conditions. The study compares
23 experimental data with different model scenarios and discusses the implications of the
24 trend of the extracted size and lifetime of the particle source with the change of collision
25 energy.