# Kaon femtoscopic measurements from 200 GeV p+p and Au+Au collisions at STAR

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5th International Conference on New Frontiers in Physics
July 6-14, 2016

# Outline

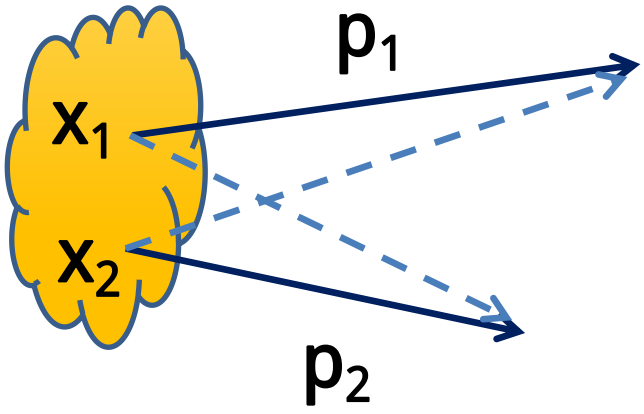
- Introduction
- Basics of the correlation femtoscopy
- Kaon femtoscopic measurements
  - p+p collisions at $\sqrt{s}$=200 GeV
  - Au+Au collisions at $\sqrt{s_{NN}}$=200 GeV
- Summary

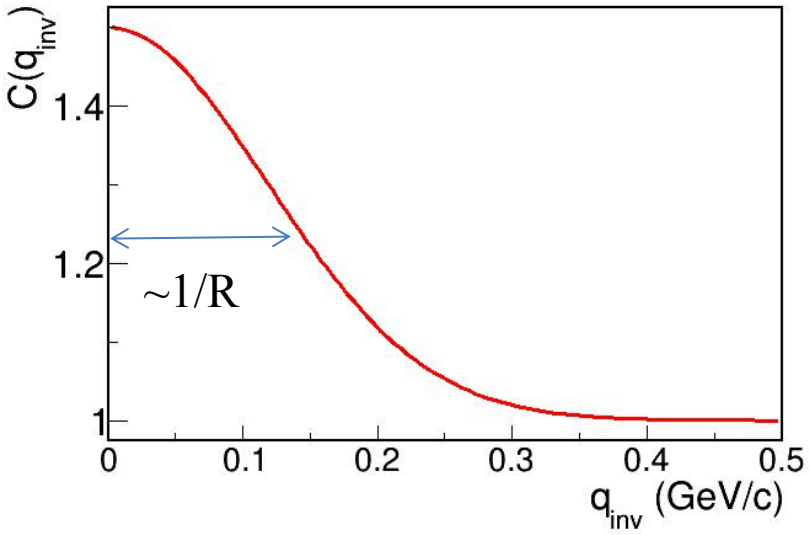
# Charged kaon correlation femtoscopy

- Femtoscopy with strange particles
  - Kaon scattering cross-sections are smaller than those for pions, hence kaons may provide information about a different stage of the collision evolution
  - Access to the higher transverse mass regions compared to pions

- Clean probe of the emitting source
  - Smaller contamination from the resonance decays compared with pions

# Correlation femtoscopy




• Allows to extract **spatial and temporal parameters of the emitting source** by using particle correlations due to the quantum statistics (QS)

• Two-particle correlation function (CF):

$$C(p_1,p_2) = P_2(p_1,p_2)/P_1(p_1)P_1(p_2)$$

•Experimentally:

$$C(q_{inv})=A(q_{inv})/B(q_{inv})$$

$q_{inv}$ - relative 4-momentum of the pair

$A(q_{inv})$ - pair distribution from the same event (contain QS correlations)

$B(q_{inv})$ - uncorrelated reference sample (event mixing technique)

# Fitting procedures

- Correlation functions are fitted by a Bowler-Sinyukov function:

$$C(q_{inv})=N(1-\lambda+K(q_{inv})(1+\exp(-R_{inv}^2 q_{inv}^2))D(q_{inv})$$

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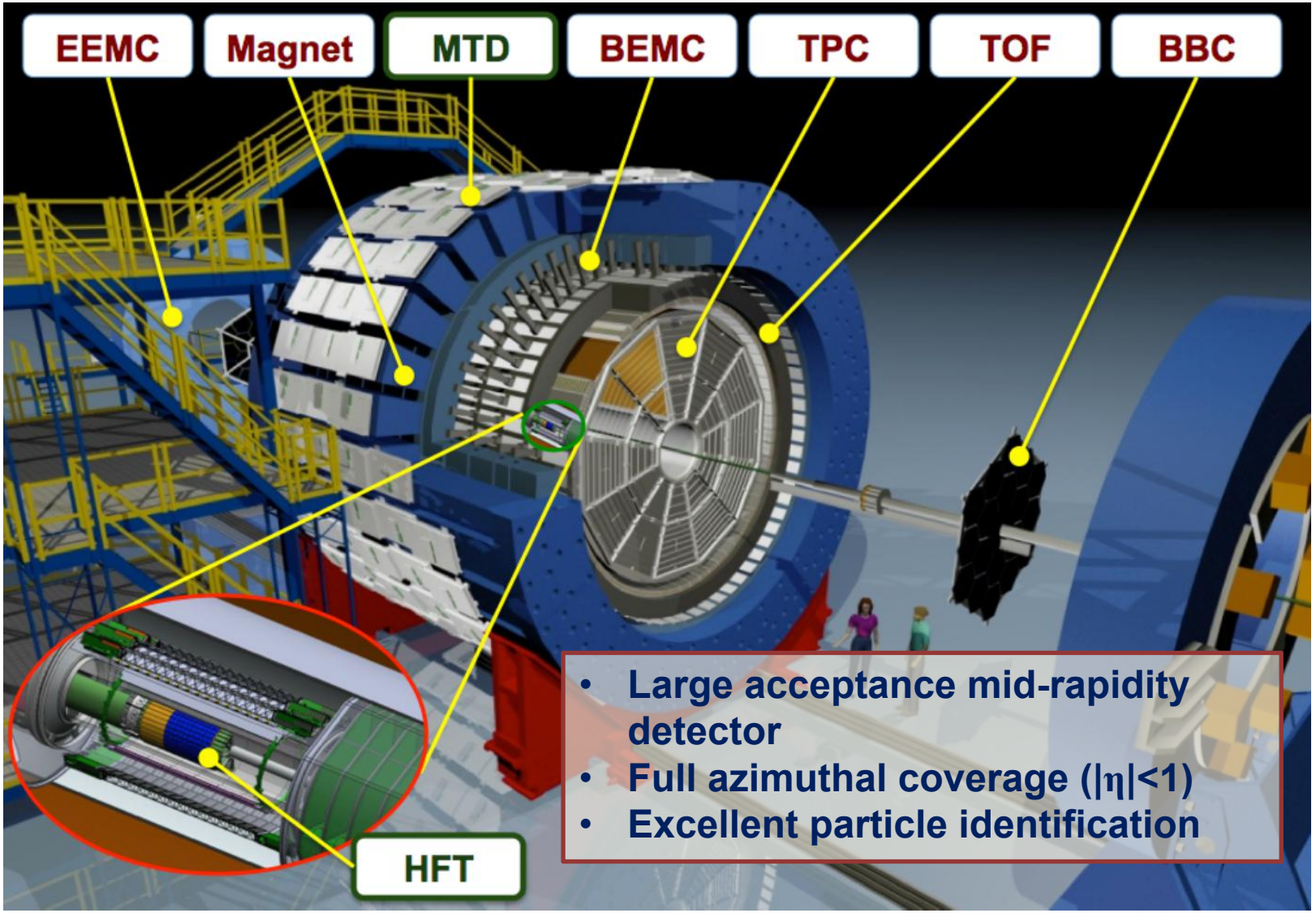
  - $N$ - normalization factor
  - $\lambda$ - correlation strength
  - $K(q_{inv})$ - Coulomb function integrated over a spherical source
  - $D(q_{inv})$ - baseline function, that takes into account non-femtoscopic correlations (important for p+p collisions)

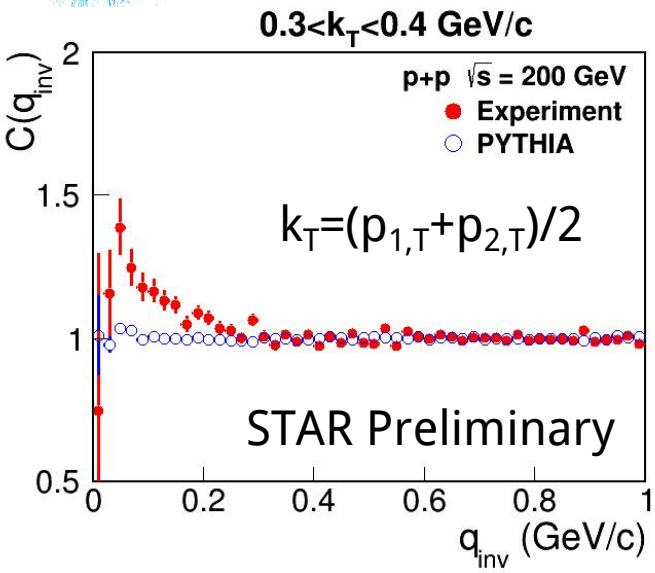
- In order to eliminate possible biases due to the construction of the reference sample in p+p collisions , the measured CFs are corrected on the simulated distributions (contain neither QS correlations nor Final State Interactions) by constructing the double ratio before the fitting:

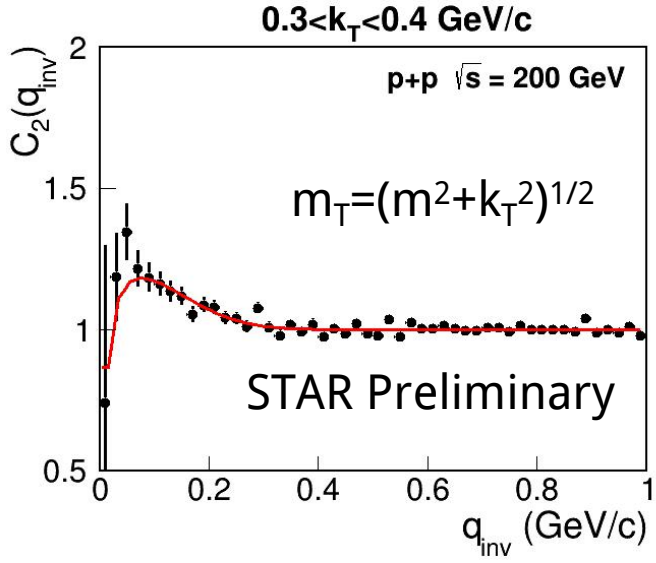
$$C(q_{inv}) = \frac{dN^{exp}(q_{inv})/dq_{inv}/dN_{ref}^{exp}(q_{inv})/dq_{inv}}{dN^{MC}(q_{inv})/dq_{inv}/dN_{ref}^{MC}(q_{inv})/dq_{inv}}$$

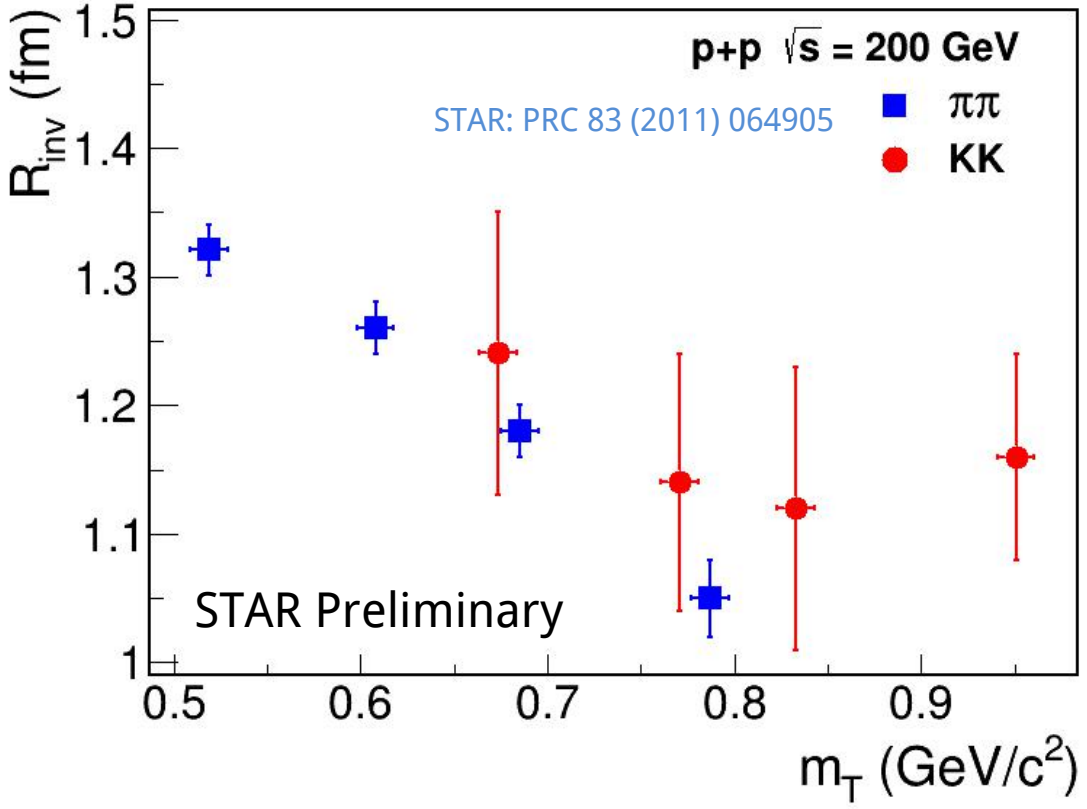
# STAR detectors



# Like-sign charged kaon femtoscopy in p+p collisions



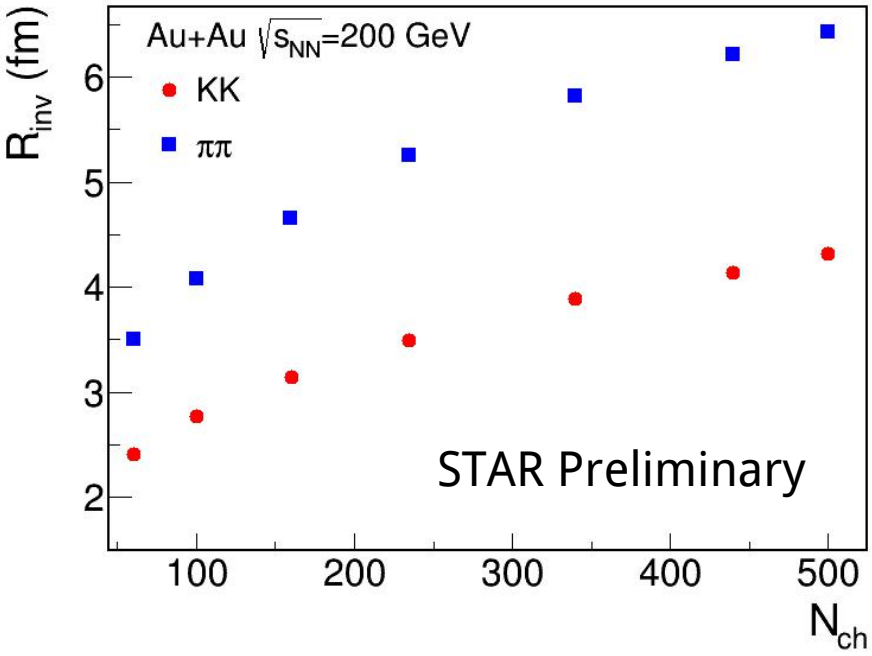



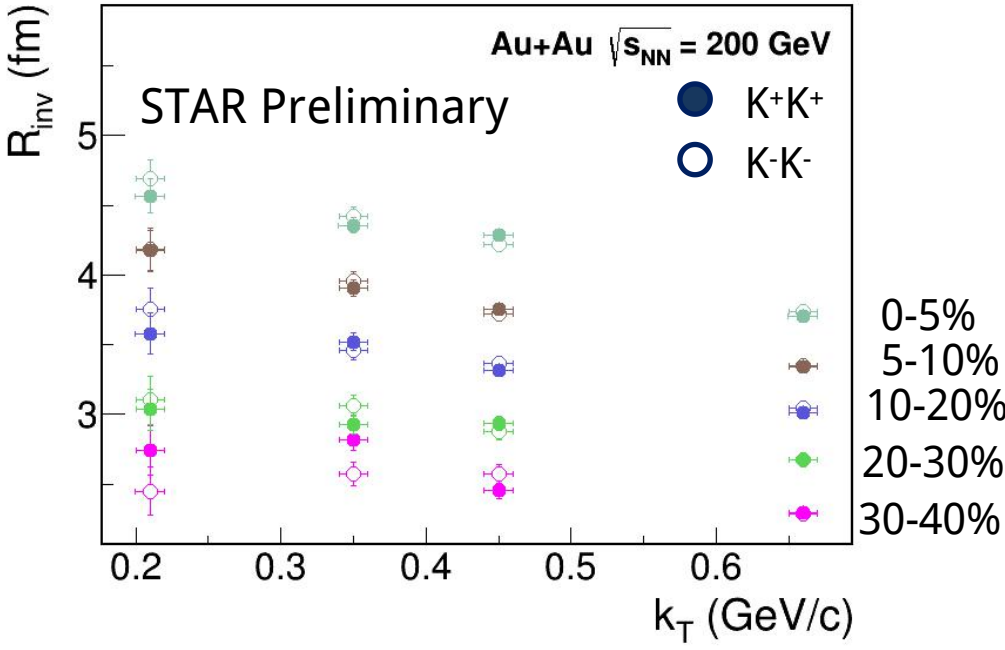

- MC generator PYTHIA-6.4.28 with Perugia0 tune is used to describe the non-femtoscopic correlations
- For overlapping $m_T$, the radius parameters for pions and kaons are consistent with each other within uncertainties

# Like-sign kaon femtoscopy in Au+Au collisions

Statistical uncertainties only

Also see Jindřich Lidrych talk




- Source radii for positively and negatively charged kaons are consistent within the uncerainties
- The emitting source radii increase with centrality (multiplicity) and decrease with pair transverse momentum
- For the given multiplicity, the kaon source radii are smaller than those for pions → kaons and pions are not emitted from the same space-time position for Au+Au collisions

# Conclusions

## Like-sign kaon femtoscopy in p+p collisions

- Slight decrease of the charged kaons source radii with increasing $k_T$
- Radius parameters for pions and kaons are consistent with each other within uncertainties for the overlapping $m_T$

## Charged kaon correlations in Au+Au collisions

- The source radii of positively and negatively charged kaons are consistent within the uncertainties
- The emitting source radii of charged kaons decrease with increasing pair transverse momentum and increase with the collision centrality
- Kaon source size is smaller compare to pions for the given multiplicity