

# Bose-Einstein Correlations of Charged Kaons in Central Pb+Pb Collisions at 158 AGeV<sup>G,B</sup>

In-Kwon Yoo<sup>2</sup>, C.Blume<sup>2</sup>, R.Bramm<sup>1</sup>, P.Buncic<sup>1</sup>, P. Dinkelaker<sup>1</sup>, M.Gazdzicki<sup>1</sup>, T.Kollegger<sup>1</sup>, I.Kraus<sup>1</sup>, A.Mischke<sup>2</sup>,  
R.Renfordt<sup>1</sup>, A.Sandoval<sup>2</sup>, H.Sann<sup>2</sup>, R.Stock<sup>1</sup>, H.Ströbele<sup>1</sup>, A.Wetzler<sup>1</sup>, J.Zaraneck<sup>1</sup> for the NA49 Collaboration.

<sup>1</sup>Universität Frankfurt, <sup>2</sup>GSI Darmstadt

We present data from an experimental study of Bose-Einstein (BE) correlations between charged kaons emitted in 780,000 Pb+Pb collisions (5% most central) at 158 AGeV measured by the NA49 spectrometer (described in detail in [1]) at the CERN SPS. We compare the results with those from an earlier analysis of pion data for the same reaction. The combination of large-volume TPCs with a high-resolution TOF detector allows for a good kaon identification in the midrapidity region.

The distribution of relative four momenta  $q$  for charged kaons was extracted from the data and normalized to a mixed-event distribution. Assuming an expanding Gaussian source-distribution, the four momenta can be parameterized in a representation of  $q_{\perp} = \sqrt{(\Delta p_x)^2 + (\Delta p_y)^2}$ ,  $q_{\parallel} = \Delta p_z$  and  $q_0 = E_1 - E_2$  given by Yano-Koonin-Podgoretskii (YKP) [2], or of  $q_{long}$  ( $= q_{\parallel}$ ) and the transverse components  $q_{out}$ ,  $q_{side}$  suggested by Bertsch-Pratt (BP). The Fourier conjugates of each  $q$ -component deliver therefore the spatial or temporal extent  $R_i$  ( $i = \parallel, \perp, 0$  or  $i = long, out, side$ ). As reference frame, the so-called fixed local center-of-mass system is taken considering the limited rapidity range ( $y \in [y_{CM}, y_{CM} + 0.5]$ ).

The Coulomb correlation between like-sign kaons was corrected in the raw two-kaon correlation functions by using an iterative theoretical calculation suggested by [5]. The Coulomb-corrected two particle correlations are shown in Figure 1 with 3-dimensional fit to data. Since the HBT radius parameters depend on the transverse mass as a consequence of the collective expansion of the source, we show in Figure 2 the earlier pion data [3] for the same reaction together with the kaon results as well as those from the CERN experiment NA44 [4] as a function of  $m_{\perp}$ .

According to the relation:  $R_{\parallel} = \tau_f \sqrt{\frac{T}{m_{\perp}}}$  based on a hydrodynamic expansion model [6], where  $\tau_f$  and  $T$  are the freeze-out time and temperature of the particles ( $T \simeq 120$  MeV from [3]), respectively, the freeze-out time is extracted as  $9.5 \pm 1.5$  fm/c from its gradient (in Figure 3a), which is consistent with the previous result in [3]. Furthermore, the dependence of  $R_{\perp}$  on  $m_{\perp}$  is in good agreement with a model calculation applied in [3], which delivers a transverse expansion velocity  $\beta_{\perp}$  around 0.55 (Figure 3b).

## References

- [1] S. Afanasiev *et al.*, Nucl. Instrum. Meth. **A430** (1999) 210
- [2] F. B. Yano *et al.*, Phys. Lett. **B78** (1978) 556
- [3] H. Appelshäuser *et al.*, Eur. Phys. J. **C2** (1998) 661; H. Appelshäuser, Dissertation (1997); S. Schönfelder, Dissertation (1997)
- [4] I. Bearden *et al.*, Phys. Rev. Lett **87** (2001) 112301
- [5] Y. M. Sinyukov *et al.*, Phys. Lett. **B432** (1998) 248
- [6] A. N. Makhlin, Z. Phys. **C39** (1988) 69

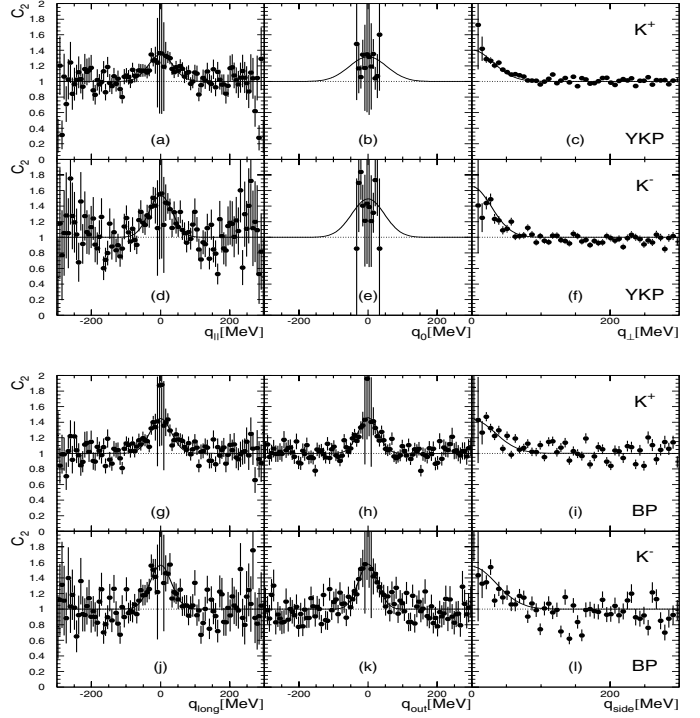


Figure 1: The Coulomb-corrected 3-dimensional correlation between like-sign kaons with  $q_j \leq 30$  MeV ( $j \neq i$ ) in YKP (top) and BP (bottom) parameterizations.

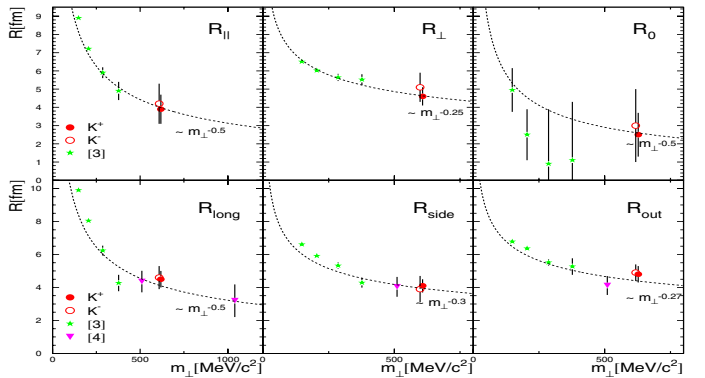


Figure 2: Comparison of HBT radii of kaons and pions as a function of  $m_{\perp}$ .

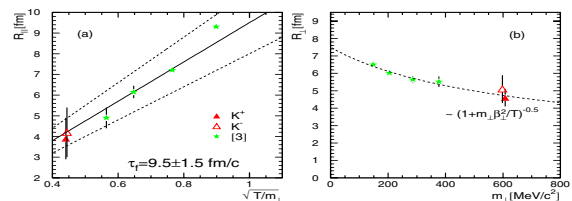


Figure 3: (a)  $R_{\parallel}$  as a function of  $\sqrt{T/m_{\perp}}$ . (b)  $R_{\perp}$  as a function of  $m_{\perp}$ .