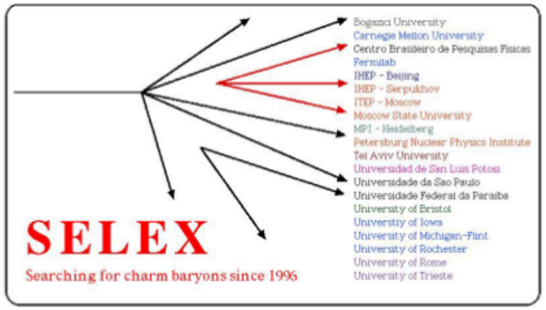

Measurement of the charged kaon correlations at small relative momentum in the SELEX experiment

Grigory Nigmatkulov
(National Research Nuclear University "MEPhI")
on behalf of the SELEX collaboration

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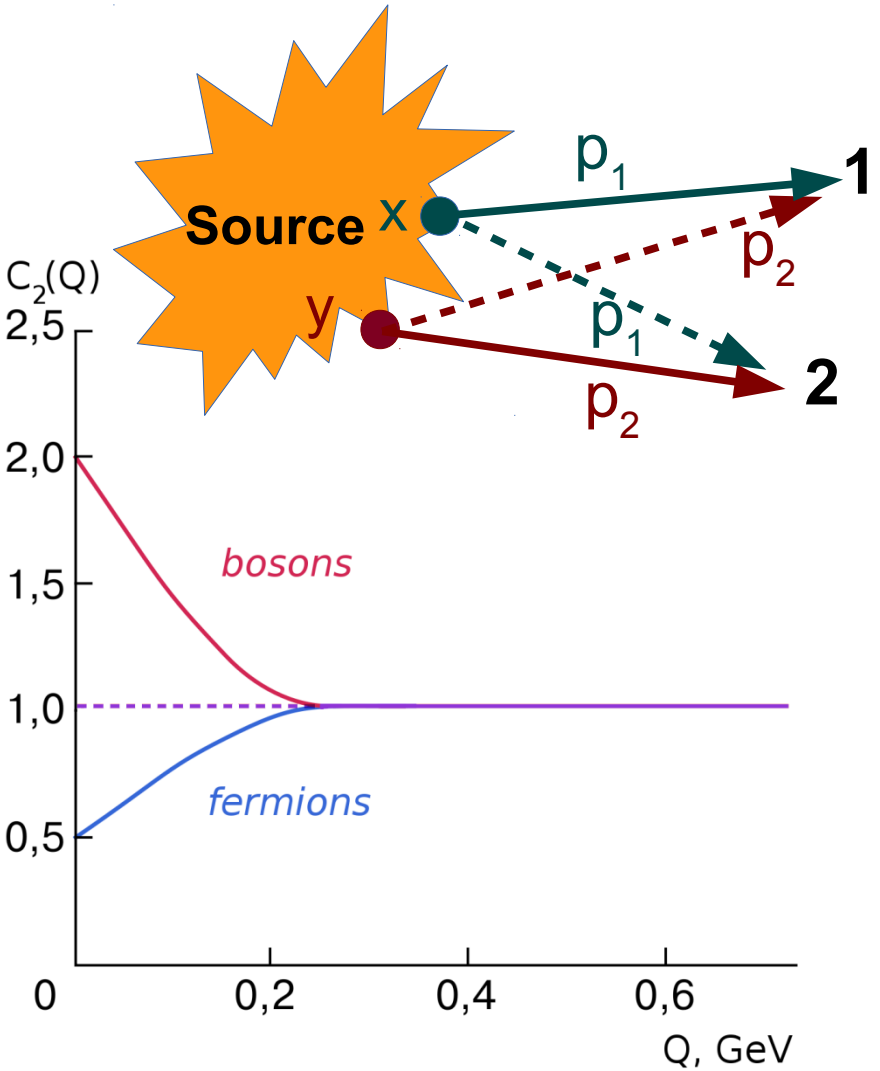
Correlation femtoscopy: QS momentum correlations



- Two-particle correlation function:

$$C_2(p_1, p_2) = \frac{P(p_1, p_2)}{P(p_1)P(p_2)}$$

- Experimentally:

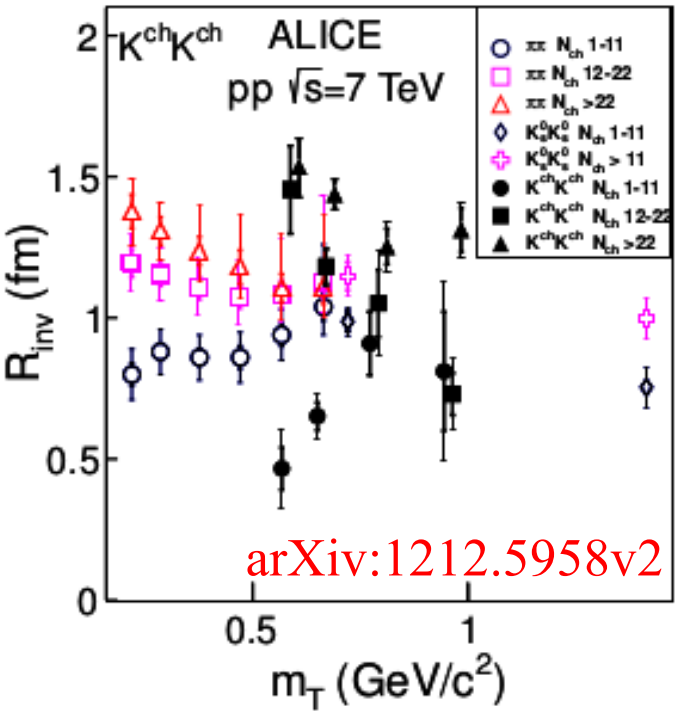
$$C_2(Q) = \frac{A(Q)}{B(Q)}$$

A(Q) – pair 4-momentum difference from the same event (contain BE correlations)

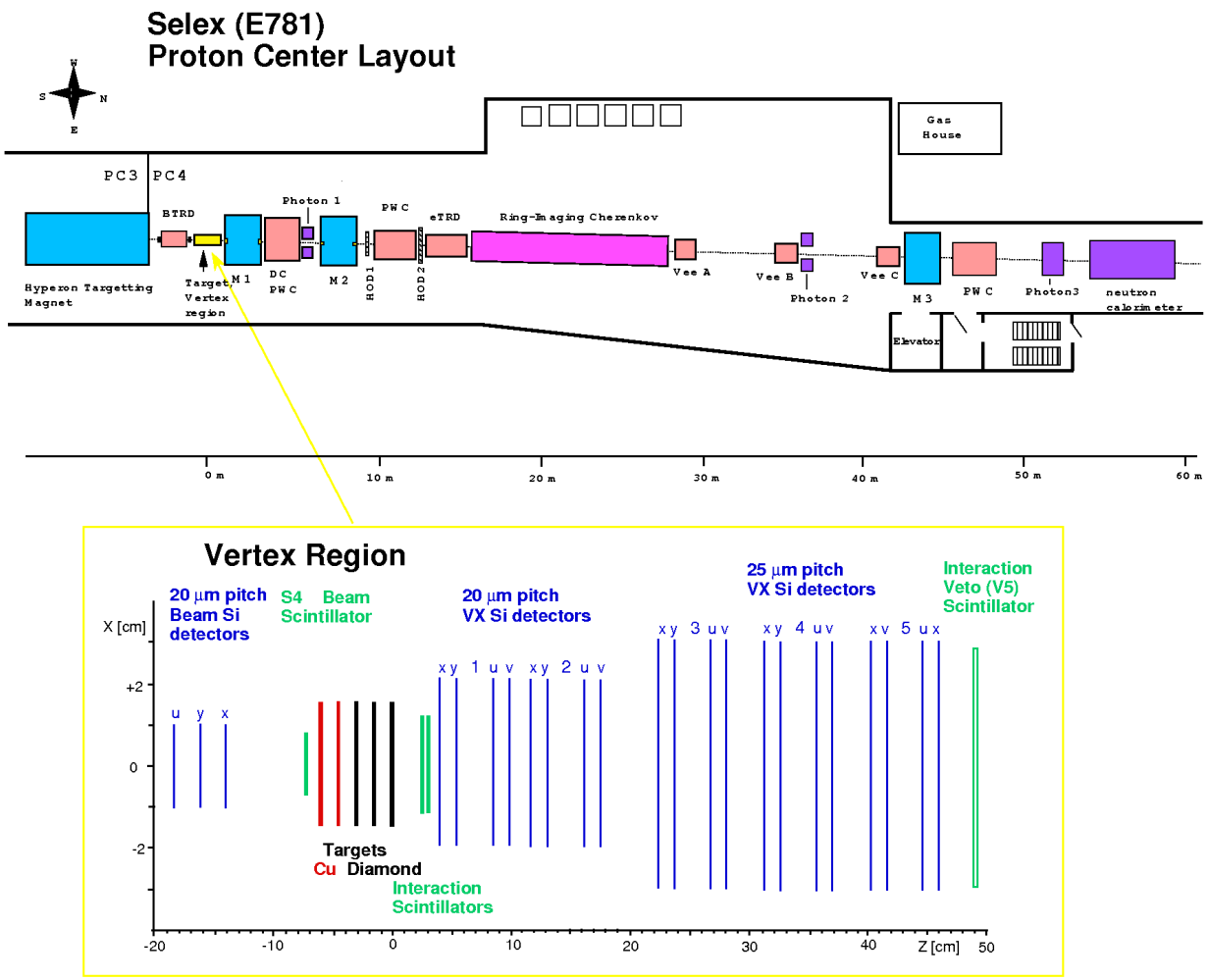
B(Q) – pairs from different events (BE correlations are absent)

Physical motivations:

- Study of spacetime characteristics of the particle production in elementary particle collisions
- Comparison of source parameters depending from the initial state:
  - 3 beam types
  - study of the beam particle fragmentation
- k_T dependences: $k_T = \frac{|\vec{p}_{T1} + \vec{p}_{T2}|}{2}$
  - collective behavior
  - cleaner signal due to small contribution from the resonance decays



SEgmented LargE X_F baryon spectrometer (E-781)

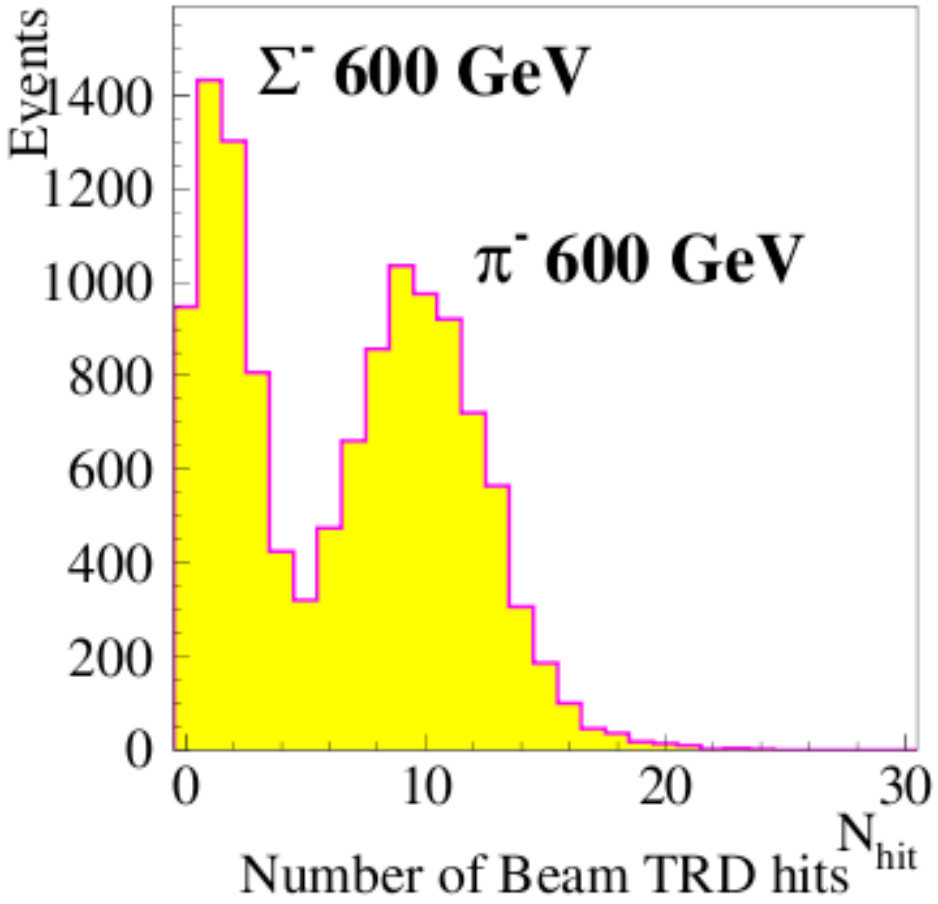


- 600 GeV/c Σ^- and π^- beams
- 540 GeV/c *p* beam
- Copper and carbon composite target with 5% of an interaction length for protons
- ~10^9 trigger events
- Momentum resolution:

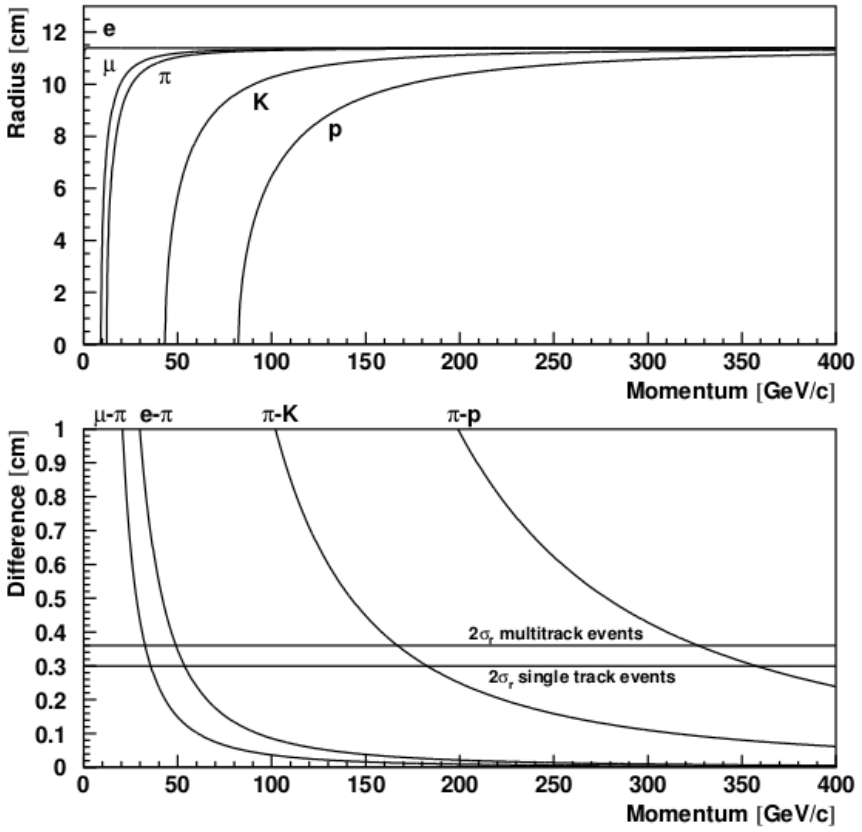
  $\sigma_p/p_z \approx 1\%$ and $\sigma_p/p_t \approx 0.5\%$

Charged particle identification

Beam TRD



Ring Imaging Cherenkov detector



≥2σ K/(π,p) separation
46 to 165 GeV/c

Particle selection

- Primary tracks
- Distance of closest approach between reconstructed track and primary vertex < 20 μm
- $46 \leq P \leq 160$ GeV/c
- Track has segments in the vertex detector and in forward PWC
- Particle was identified as a kaon in RICH detector

Correlation function parametrization:

- Correlation functions are fitted by a single-Gaussian (Goldhaber paremetrization):

$$C_2(Q) = N\left(1 - \lambda + \lambda\, K(Q) \mathrm{e}^{-R^2 Q^2}\right) B(Q)$$

- λ – strength of the correlations
- R – size of the emission source
- *K(Q)* is the Coulomb function integrated over a spherical source of 1 fm.

M. Bowler, Phys. Lett.B 270,69(1991)

Y.Sinyukov, R.Lednicky, S.V.Akkelin, J.Pluta, B.Erazmus, Phys. Lett.B 432,248(1998)

- *B(Q)* - "baseline", takes into account all non-femtoscopic correlations, including the long-range correlations due to energy-momentum conservation.
- Baselines are fitted by a standard 2nd order polynomial:

$$B(Q) = 1 + a\,Q + b\,Q^2$$

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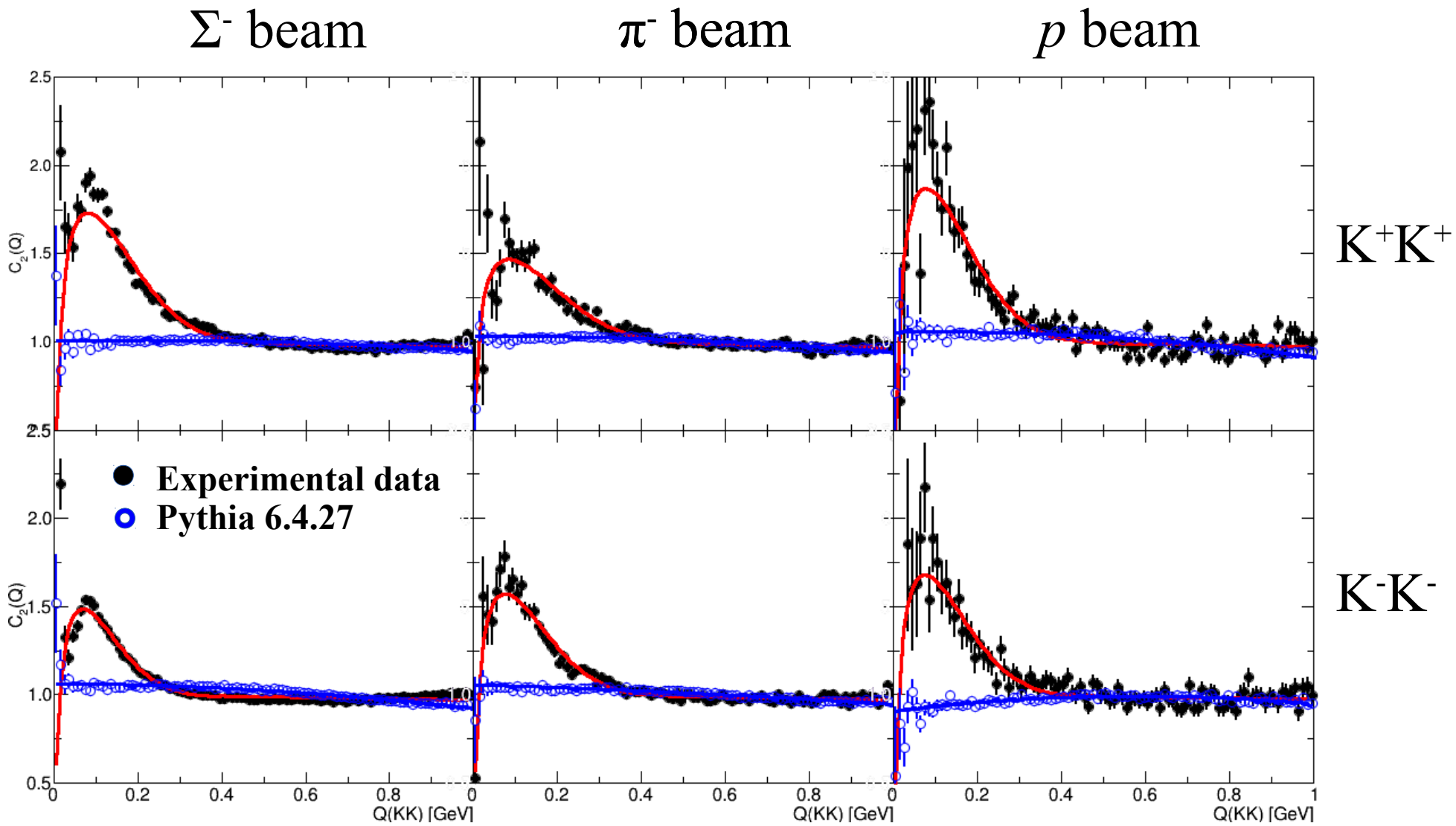
- In order to obtain systematic errors other functions with derivatives equal to zero at $Q = 0$ were used:

$$B(Q) = \sqrt{1 + a\,Q + b\,Q^2}$$

$$B(Q) = 1 + \mathrm{e}^{-aQ^2}$$

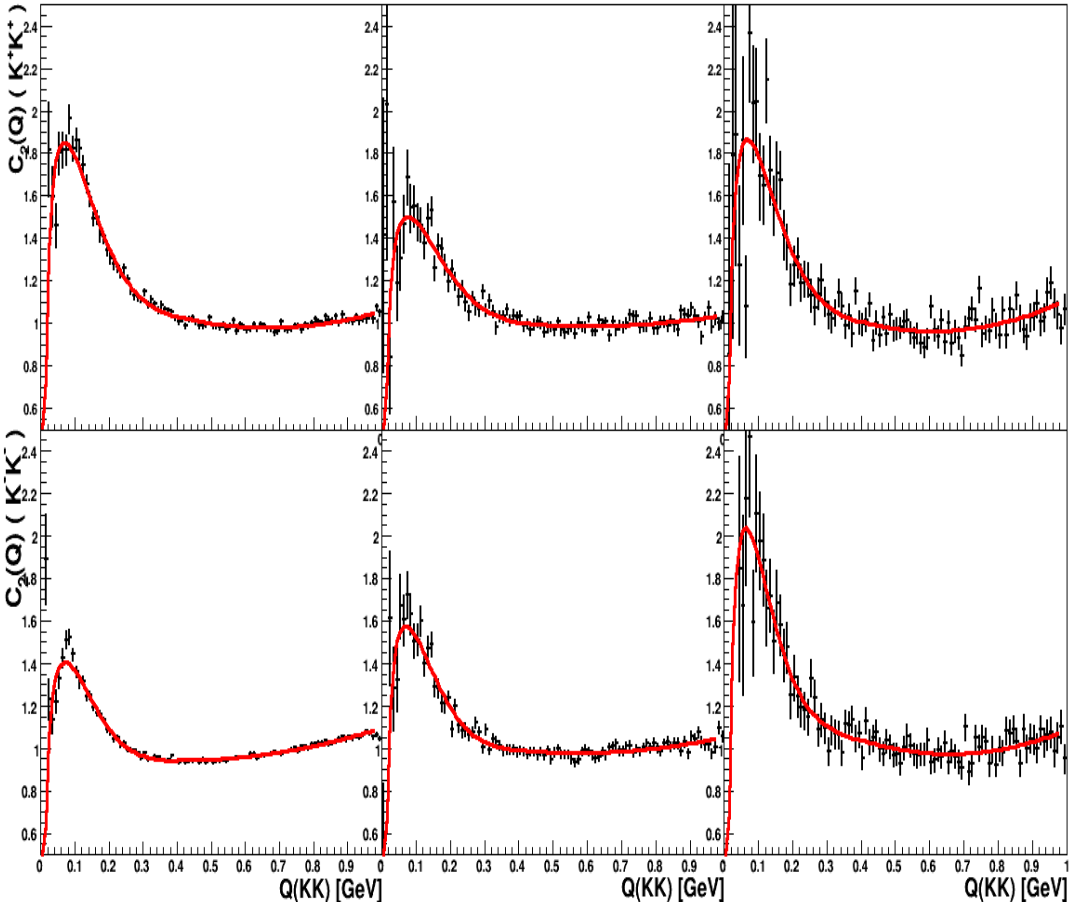
Correlation functions



Dependence of the emission source parameters on the target material

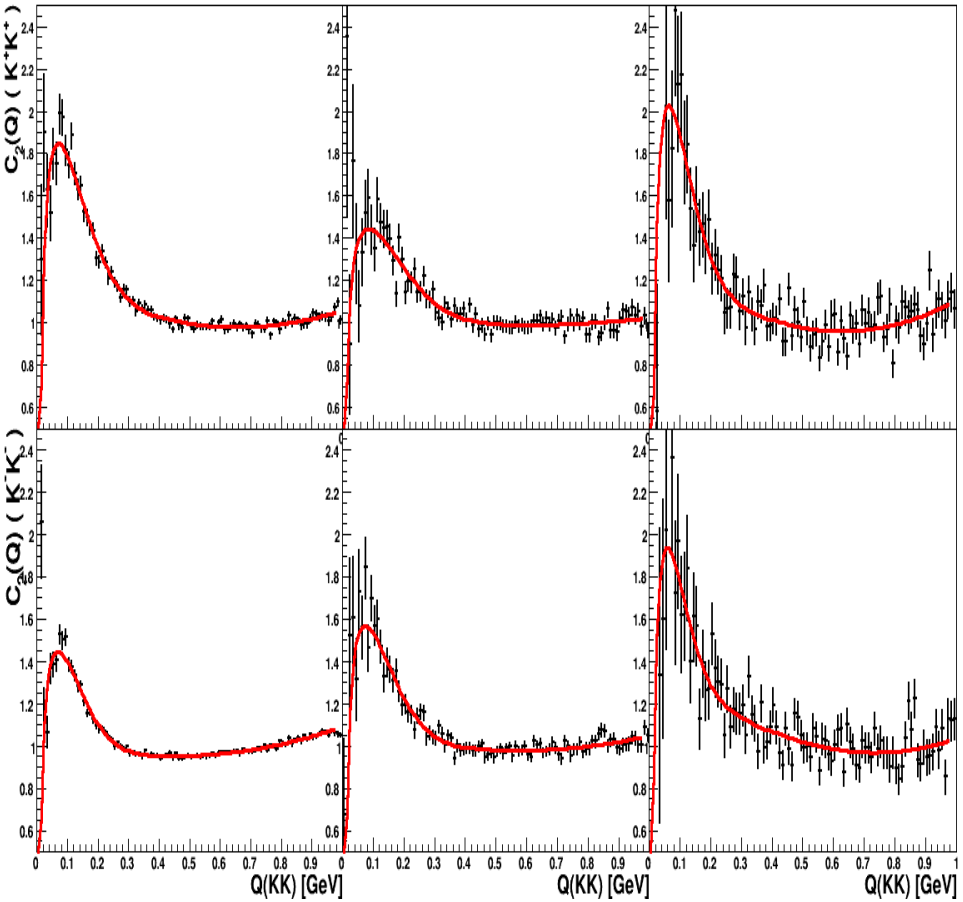
Copper

Σ^- beam π^- beam p beam



Carbon

Σ^- beam π^- beam p beam



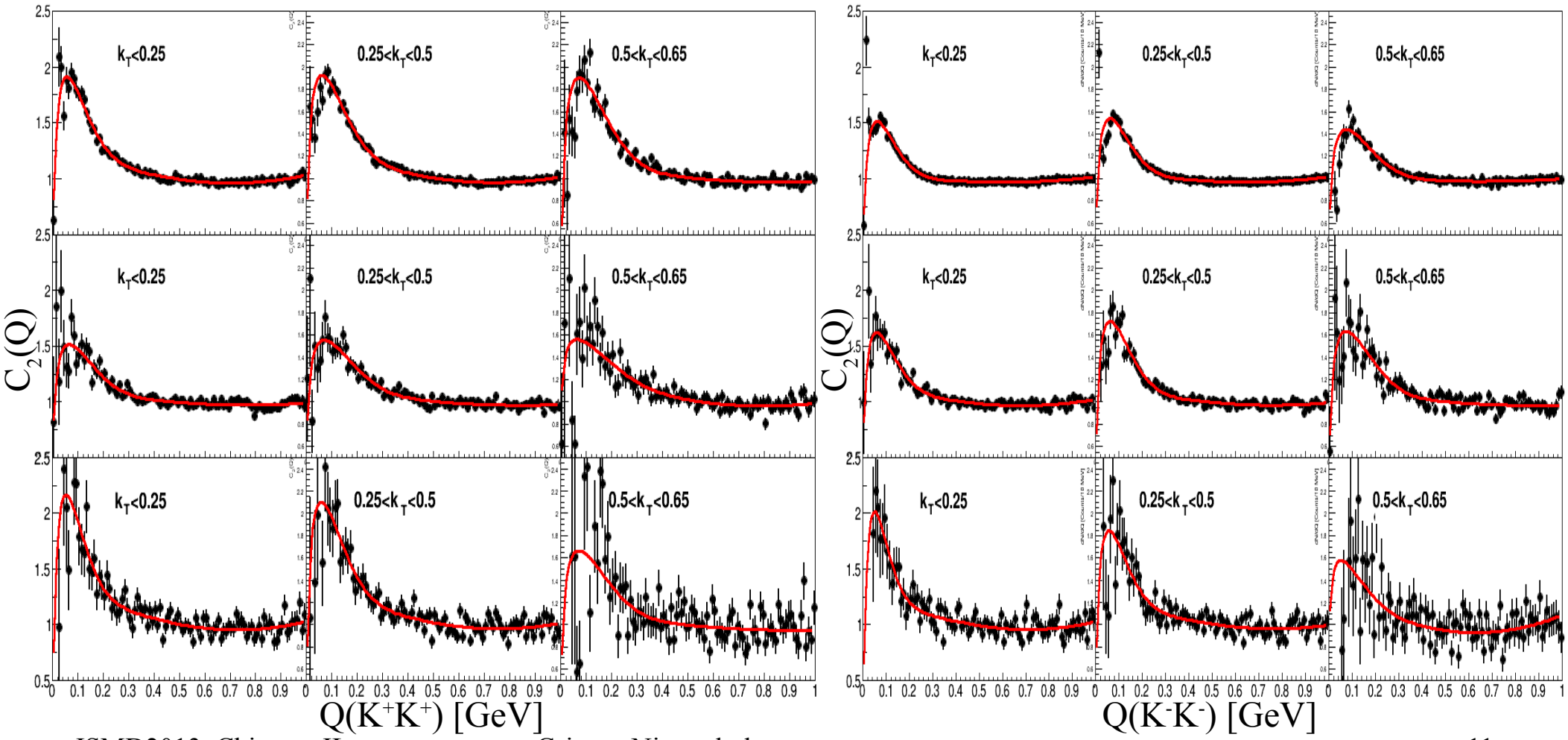
Dependence of the emission source parameters on the target material

Beam type	Target material	K^+K^+		K^-K^-	
		λ	R [fm]	λ	R [fm]
Σ^-	*Cu+C*	**0.77 ± 0.02 ± 0.09**	**1.18 ± 0.03 ± 0.06**	**0.65 ± 0.02 ± 0.04**	**1.23 ± 0.02 ± 0.04**
	Cu	**0.77 ± 0.03**	**1.19 ± 0.03**	**0.65 ± 0.02**	**1.24 ± 0.02**
	C	**0.77 ± 0.04**	**1.16 ± 0.04**	**0.64 ± 0.02**	**1.28 ± 0.03**
π^-	*Cu+C*	**0.48 ± 0.05 ± 0.06**	**0.99 ± 0.06 ± 0.03**	**0.69 ± 0.05 ± 0.06**	**1.21 ± 0.05 ± 0.05**
	Cu	**0.50 ± 0.07**	**1.03 ± 0.08**	**0.69 ± 0.06**	**1.26 ± 0.07**
	C	**0.52 ± 0.09**	**0.91 ± 0.08**	**0.67 ± 0.07**	**1.15 ± 0.07**
p	*Cu+C*	**0.92 ± 0.13 ± 0.12**	**1.31 ± 0.09 ± 0.08**	**0.78 ± 0.14 ± 0.09**	**1.42 ± 0.13 ± 0.08**
	Cu	**0.84 ± 0.15**	**1.19 ± 0.11**	**0.86 ± 0.17**	**1.35 ± 0.13**
	C	**1.01 ± 0.24**	**1.47 ± 0.18**	**0.75 ± 0.31**	**1.71 ± 0.37**

Pair k_T dependence of the emission source parameters

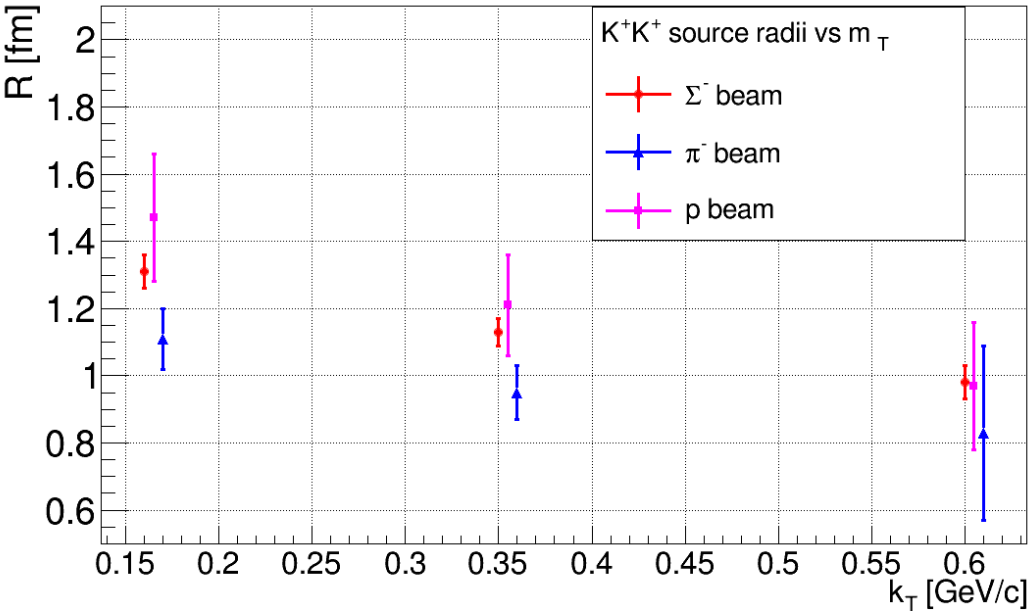
K^+K^+

K^-K^-

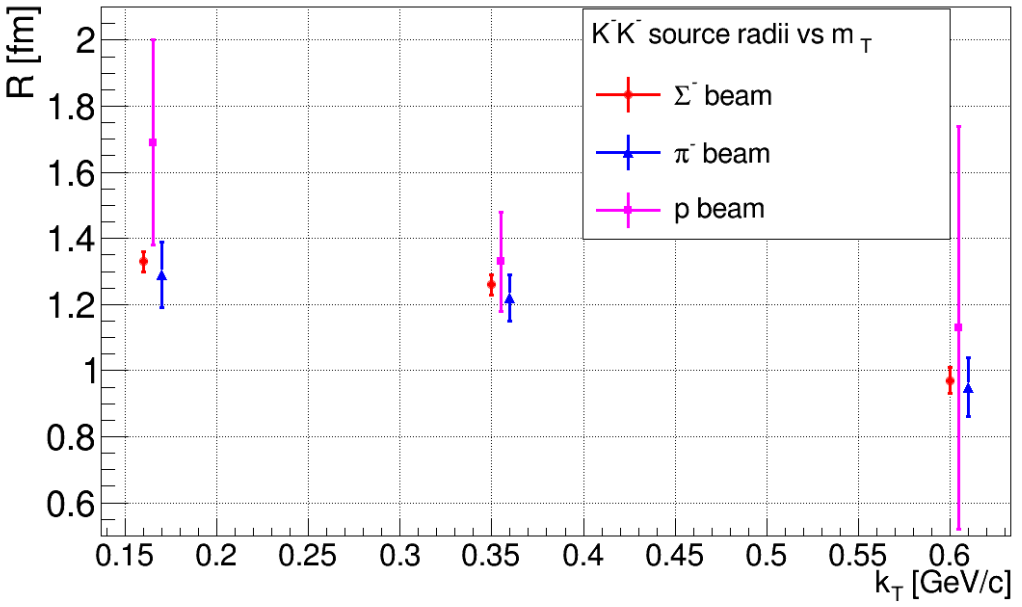


Pair k_T dependence of the emission source parameters

K^+K^+



K^-K^-



Pair k_T dependence of the emission source parameters

Beam type	Pair k_T [GeV]	K^+K^+		K^-K^-	
		λ	R [fm]	λ	R [fm]
Σ^-	0.00-0.25	**0.78 ± 0.06 ± 0.09**	**1.31 ± 0.05 ± 0.08**	**0.71 ± 0.03 ± 0.03**	**1.33 ± 0.03 ± 0.04**
	0.25-0.50	**0.76 ± 0.04 ± 0.09**	**1.13 ± 0.04 ± 0.05**	**0.65 ± 0.02 ± 0.04**	**1.26 ± 0.03 ± 0.04**
	0.50-0.65	**0.96 ± 0.05 ± 0.06**	**0.98 ± 0.05 ± 0.03**	**0.58 ± 0.04 ± 0.03**	**0.97 ± 0.04 ± 0.03**
π^-	0.00-0.25	**0.53 ± 0.08 ± 0.06**	**1.11 ± 0.09 ± 0.03**	**0.62 ± 0.08 ± 0.06**	**1.29 ± 0.10 ± 0.07**
	0.25-0.50	**0.54 ± 0.09 ± 0.07**	**0.95 ± 0.08 ± 0.02**	**0.78 ± 0.07 ± 0.05**	**1.22 ± 0.07 ± 0.04**
	0.50-0.65	**0.32 ± 0.17 ± 0.09**	**0.83 ± 0.26 ± 0.12**	**0.71 ± 0.15 ± 0.07**	**0.95 ± 0.09 ± 0.01**
p	0.00-0.25	**0.95 ± 0.23 ± 0.11**	**1.47 ± 0.19 ± 0.11**	**1.02 ± 0.33 ± 0.09**	**1.69 ± 0.31 ± 0.20**
	0.25-0.50	**0.85 ± 0.18 ± 0.11**	**1.21 ± 0.15 ± 0.07**	**0.76 ± 0.19 ± 0.09**	**1.33 ± 0.15 ± 0.06**
	0.50-0.65	**0.70 ± 0.43 ± 0.13**	**0.97 ± 0.19 ± 0.04**	**0.34 ± 0.31 ± 0.13**	**1.13 ± 0.61 ± 0.12**

Summary

- Kaon-kaon correlations at small relative momentum are measured in the SELEX experiment
- No dependence of the emission source parameters on the target material (*C* and *Cu*) was observed
- For all beam types (Σ^-, π^-, *p*) the decreasing of the emission source radii *R* with the pair k_T was observed
- Outlook
  - Study the dependence of the emission source parameters on Feynman scaling variable
  - Study of the 3D kaon-kaon correlation functions vs k_T and vs x_F