Two-proton correlation function for the $pp \to pp+\eta$ and $pp \to pp$+pions reactions

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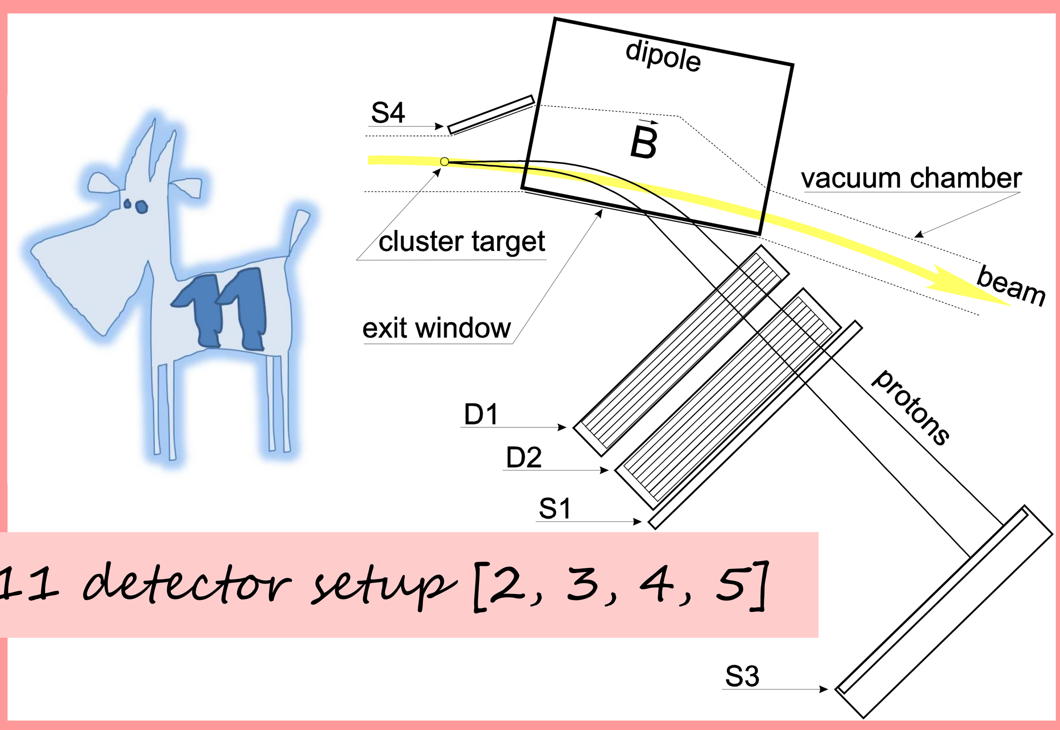
$pp \to pp\eta$ reaction measured @ p_B = 2.0259 GeV/c [1]



COSY-11 detector setup [2, 3, 4, 5]

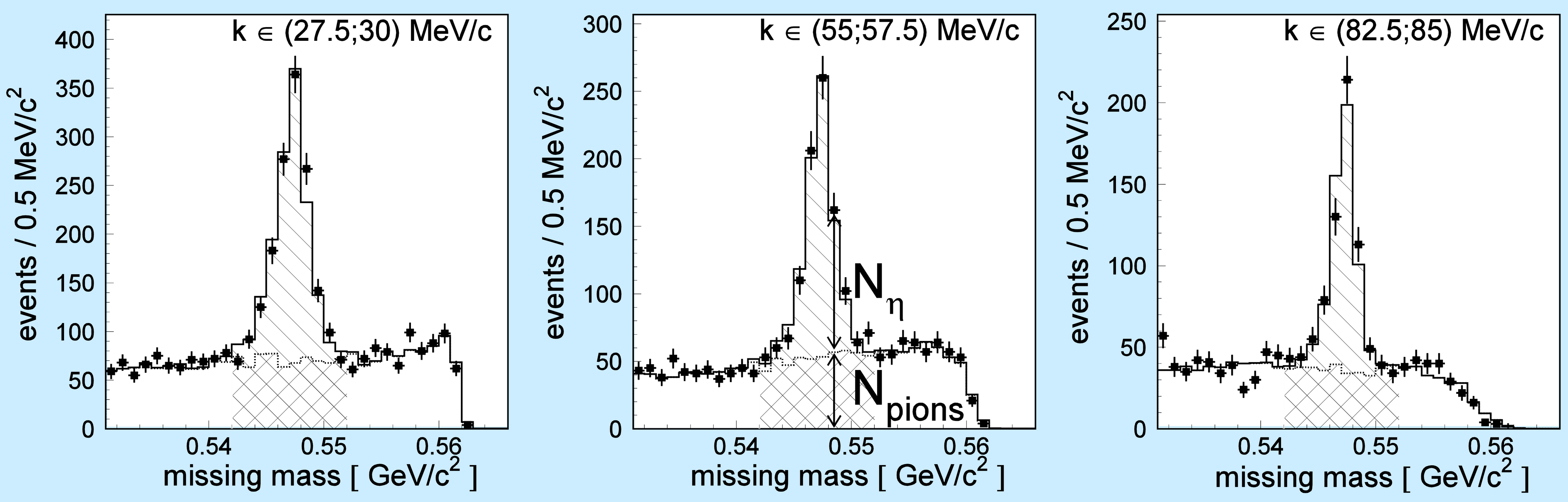
correlation femtoscopy [6]

this technique [7, 8, 9] permits to determine the duration of the emission process and the size of the source from which the particles are emitted, based on the **correlation function** calculated as a ratio of the momentum (k) dependent reaction yield $Y(k)$ to the uncorrelated yield $Y^*(k)$:

$$R(k)+1 = C\,\frac{Y(k)}{Y^*(k)}$$

where C denotes an appropriate normalization constant. $Y^*(k)$ was derived from the uncorrelated reference sample obtained by using the event mixing technique [10]

$pp+\eta$ and pp+pions system events separation [11, 1, 12]

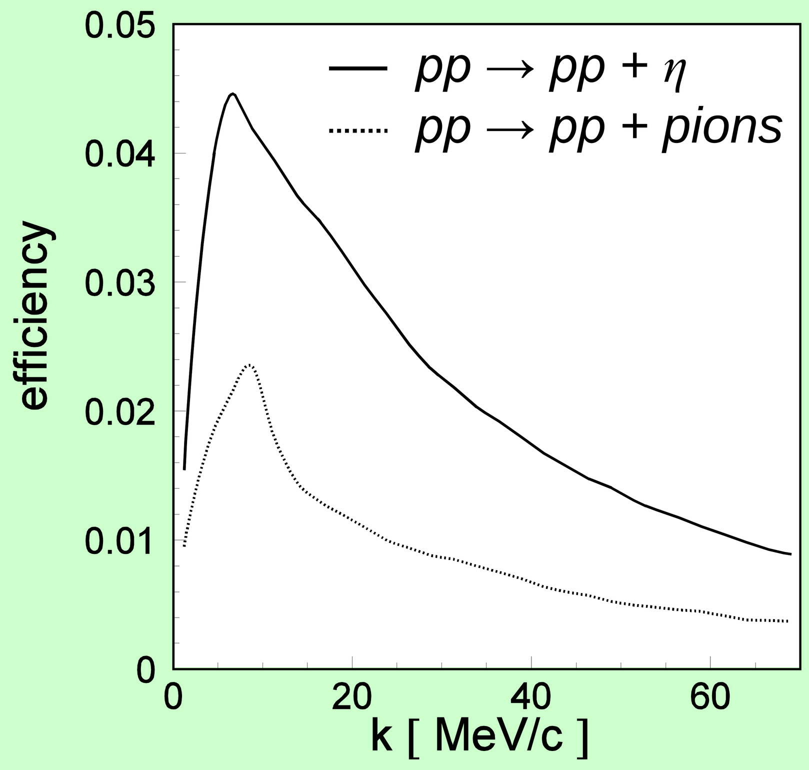


the probability ω_i, that the i^{th} $pp \to ppX$ event with a missing mass m_i and a relative momentum of k_i corresponds to a $pp \to pp\eta$ reaction was estimated according to the formula:

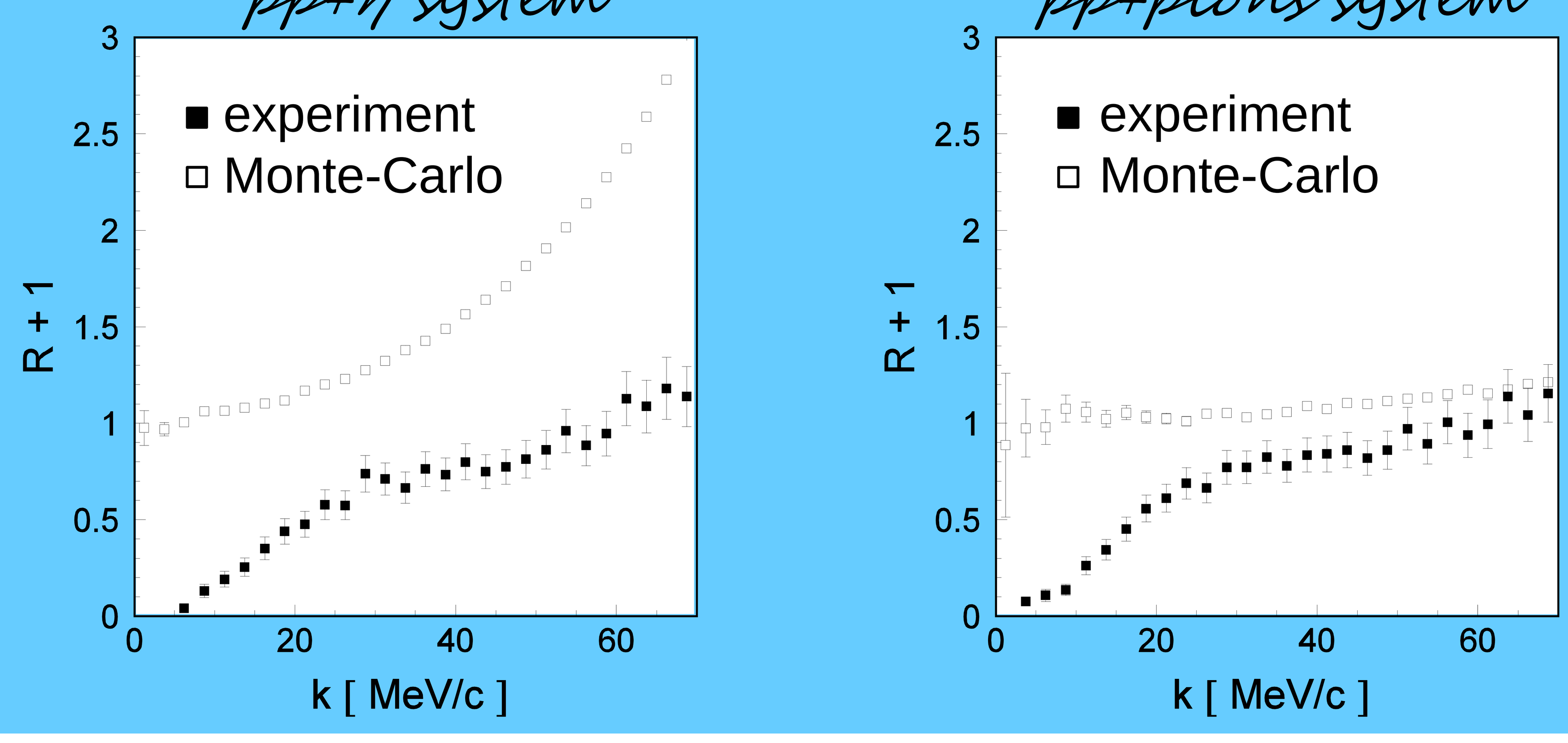
$$\omega_i = \frac{N_\eta(m_i,k_i)}{N_\eta(m_i,k_i)+N_{pions}(m_i,k_i)}$$

acceptance corrections [12, 13]

$$A(k) = \frac{N_{ACC}(k)}{N_{GEN}(k)}$$



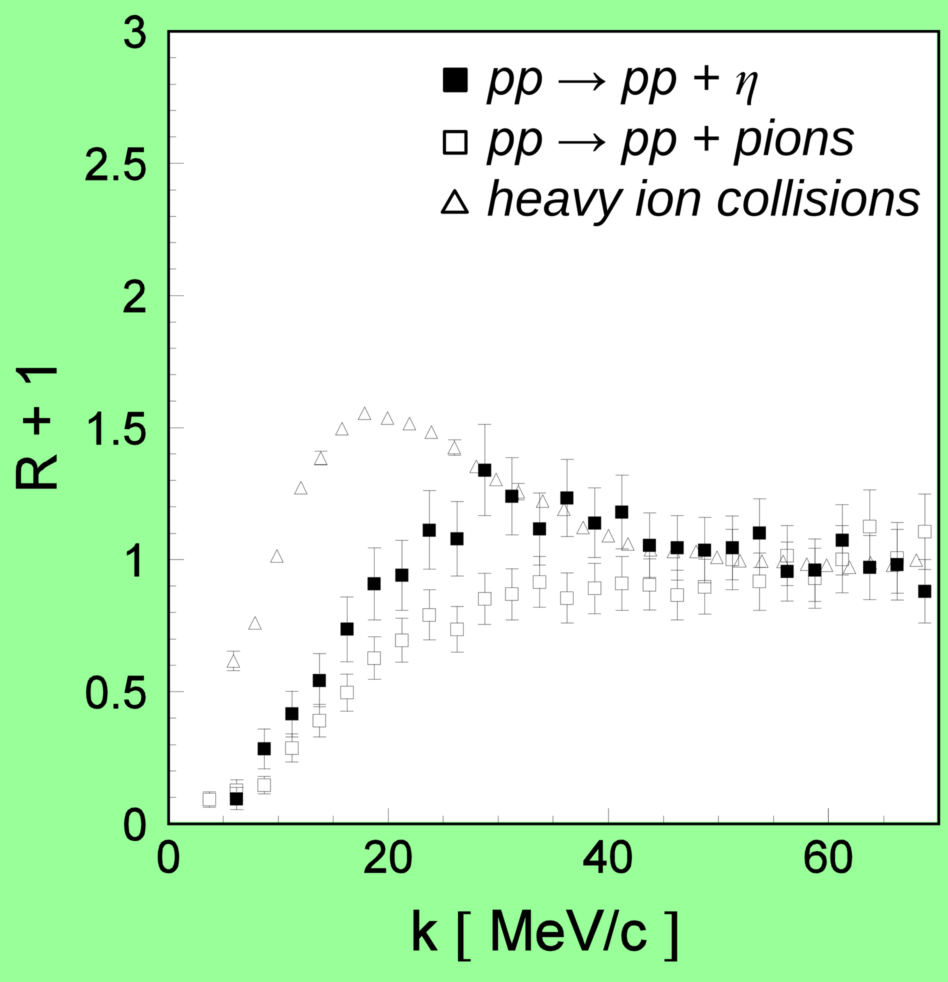
acceptance corrected two-proton correlation functions



double ratio

$$R(k)+1 = Const\left(\frac{Y_{exp}(k)}{Y^*_{exp}(k)} \Big/ \frac{Y_{MC}(k)}{Y^*_{MC}(k)}\right)$$

experimental results of COSY-11 [13] compared to the two-proton correlation function from heavy ion collisions [14]



based on semi-quantitative predictions [15] one can estimate that the system must have a radius in the order of 4 fm. This makes the result interesting in context of the predicted quasi-bound ηNN state [16] and in view of the hypothesis [17] that at threshold the proton-proton pair may be emitted from a large Borromean like object whose radius is about 4 fm.

references

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