Error propegation for background normalization in the L-S and S-B methods

$$\bar{x}_i = \frac{A x_i}{\sum_j x_j}$$

Where: * A is the background under the peak area calculated from the fit;

* x_i are the bin contents of the jet p_T distribution in the L-S or S-B.

* $\bar{x}_i$ are the bin contents after normalization

$$(\Delta \bar{x}_i)^2 = (\Delta A)^2 \left|\frac{\partial \bar{x}_i}{\partial A}\right|^2 + \sum_k \left|\frac{\partial \bar{x}_i}{\partial x_k}\right|^2 (\Delta x_k)^2$$

$$\frac{\partial \bar{x}_i}{\partial x_i} = \frac{A \sum_j x_j - A x_i}{\left(\sum_j x_j\right)^2} = A \frac{\sum_{j \neq i} x_j}{\left(\sum_j x_j\right)^2}$$

$$\left.\frac{\partial \bar{x}_i}{\partial x_k}\right|_{k \neq i} = -A x_i \frac{1}{\left(\sum_j x_j\right)^2} = -\frac{A x_i}{\left(\sum_j x_j\right)^2}$$

$$\frac{\partial \bar{x}_i}{\partial A} = \frac{x_i}{\sum_j x_j}$$

$$(\Delta \bar{x}_i)^2 = (\Delta A)^2 \frac{x_i^2}{(\sum_j x_j)^2} + (\Delta x_i)^2 A^2 \frac{(\sum_{j\neq i} x_j)^2}{(\sum_j x_j)^4} +$$

$$+ \frac{A^2 x_i^2}{(\sum_j x_j)^4} \sum_{k\neq i} (\Delta x_k)^2 =$$

$$= \frac{1}{(\sum_j x_j)^2} \left[(\Delta A)^2 x_i^2 + \frac{A^2}{(\sum_j x_j)^2} \left((\Delta x_i)^2 \left(\sum_{j\neq i} x_j \right)^2 + x_i^2 \sum_{k\neq i} (\Delta x_k)^2 \right) \right]$$