

# Computing normalized spin-correlations through expanded ratios

A. Behring (arnd.behring@kit.edu)

*Institute for Theoretical Particle Physics, KIT, Karlsruhe, Germany,*

M. Czakon (mczakon@physik.rwth-aachen.de),

*Institute for Theoretical Particle Physics and Cosmology, RWTH Aachen University,  
D-52056 Aachen, Germany,*

A. Mitov (adm74@cam.ac.uk),

A. Papanastasiou (andrewp@hep.phy.cam.ac.uk) and

R. Poncelet (poncelet@hep.phy.cam.ac.uk)

*Cavendish Laboratory, University of Cambridge, Cambridge CB3 0HE, UK.*

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To evaluate the expansion of a normalized differential cross section we consider the following perturbative expansions

$$\sigma = \sigma^0 + \alpha_S \sigma^1 + \alpha_S^2 \sigma^2 \quad (1)$$

$$\frac{d\sigma}{dX} = \frac{d\sigma^0}{dX} + \alpha_S \frac{d\sigma^1}{dX} + \alpha_S^2 \frac{d\sigma^2}{dX} \quad (2)$$

To specify the used PDFs we consider

$$\sigma^{\text{LO}} = \sigma^0 \quad \text{all } \sigma^i \text{ with LO PDFs,} \quad (3)$$

$$\sigma^{\text{NLO}} = \sigma^0 + \alpha_S \sigma^1 \quad \text{all } \sigma^i \text{ with NLO PDFs,} \quad (4)$$

$$\sigma^{\text{NNLO}} = \sigma^0 + \alpha_S \sigma^1 + \alpha_S^2 \sigma^2 \quad \text{all } \sigma^i \text{ with NNLO PDFs} \quad (5)$$

and similar for the differential ones. We expand the normalised differential cross section in the following way

$$R = \frac{1}{\sigma} \frac{d\sigma}{dX} = R^0 + \alpha_S R^1 + \alpha_S^2 R^2 \quad (6)$$

$$R^0 = \frac{1}{\sigma^0} \frac{d\sigma^0}{dX}, \quad (7)$$

$$R^1 = \frac{1}{\sigma^0} \frac{d\sigma^1}{dX} - \frac{\sigma^1}{\sigma^0} \frac{1}{\sigma^0} \frac{d\sigma^0}{dX}, \quad (8)$$

$$R^2 = \frac{1}{\sigma^0} \frac{d\sigma^2}{dX} - \frac{\sigma^1}{\sigma^0} \frac{1}{\sigma^0} \frac{d\sigma^1}{dX} + \left( \left( \frac{\sigma^1}{\sigma^0} \right)^2 - \frac{\sigma^2}{\sigma^0} \right) \frac{1}{\sigma^0} \frac{d\sigma^0}{dX} \quad (9)$$

in  $\alpha_S$ .

To again specify the used PDFs we define analogous:

$$R^{\text{LO}} = R^0 \quad \text{all } \sigma^i \text{ with LO PDFs,} \quad (10)$$

$$R^{\text{NLO}} = R^0 + \alpha_S R^1 \quad \text{all } \sigma^i \text{ with NLO PDFs,} \quad (11)$$

$$R^{\text{NNLO}} = R^0 + \alpha_S R^1 + \alpha_S^2 R^2 \quad \text{all } \sigma^i \text{ with NNLO PDFs} \quad (12)$$