PAVOL JOZEF ŠAFÁRIK UNIVERSITY IN KOŠICE

Faculty of Science

Statistical error for cosmic rays modulation evaluation by 1-D model

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Parker`s equation (SDE set)

1 – D case:

$$\frac{\partial f}{\partial t} = \frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2 K_{diff}\frac{\partial}{\partial r}f\right) - \frac{1}{r^2}\frac{\partial r^2 V_{sw} f}{\partial r} + \frac{1}{3}\left(\frac{1}{r^2}\frac{\partial r^2 V_{sw}}{\partial r}\right)\frac{1}{p^2}\frac{\partial}{\partial p}(p^3 f)$$

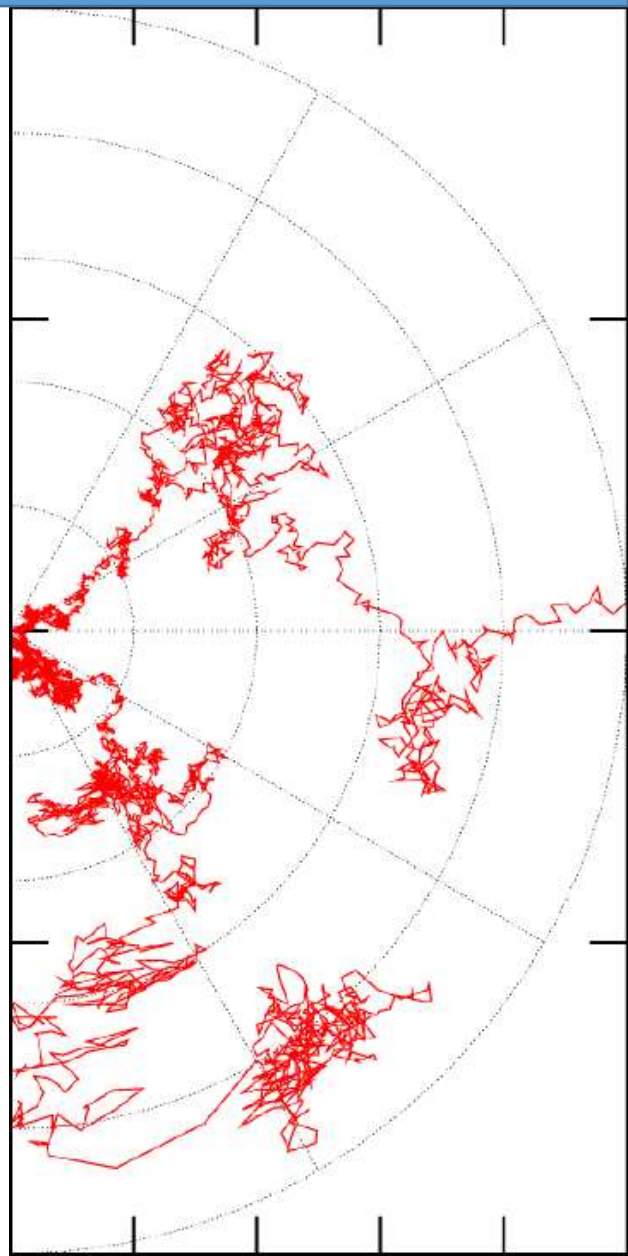
$$K_{diff} = K_0 \beta P.$$

Set of forward - in - time SDE F-p:

$$dr = \left(\frac{2K_{diff}}{r} + V_{sw}\right)dt + \sqrt{2K_{diff}}dW$$

$$dp = -\frac{2V_{sw}p}{3r}dt$$

$$L = -\frac{4V_{sw}}{3r}$$



Statistical error evaluation

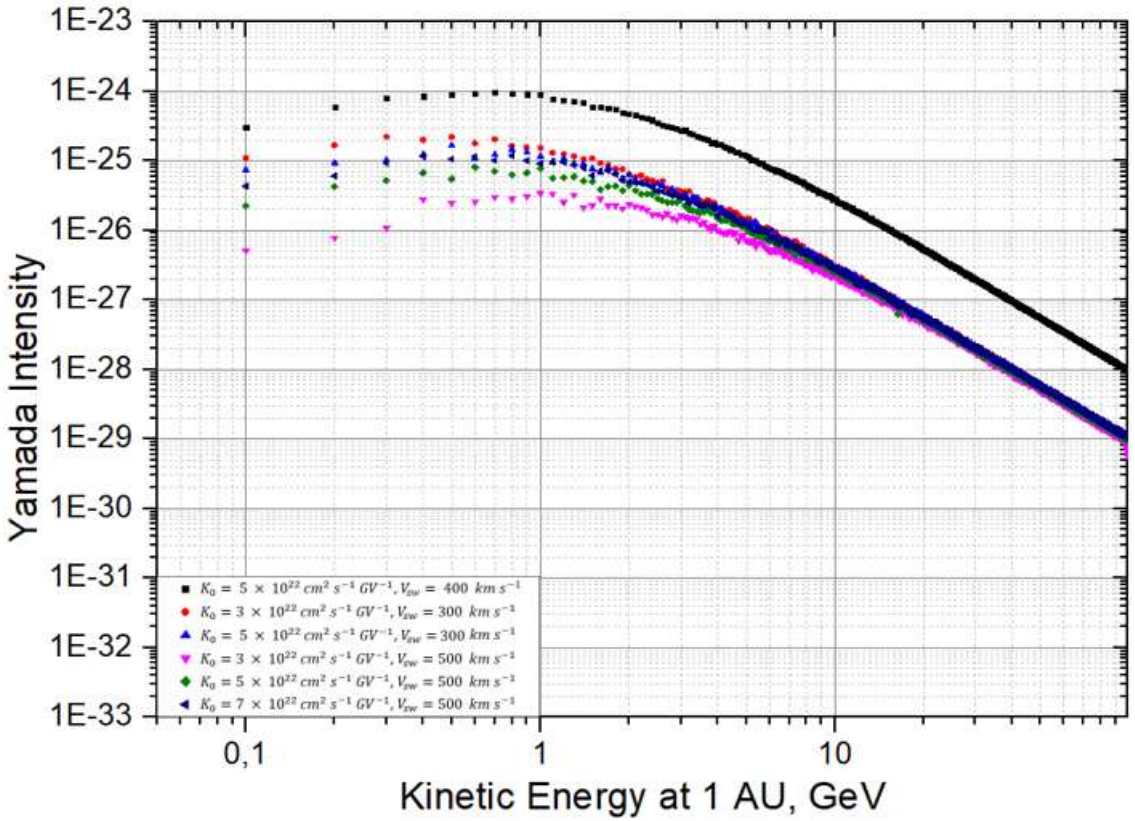


Fig. 1. Spectra at 1 AU evaluated for different sets of input parameters.

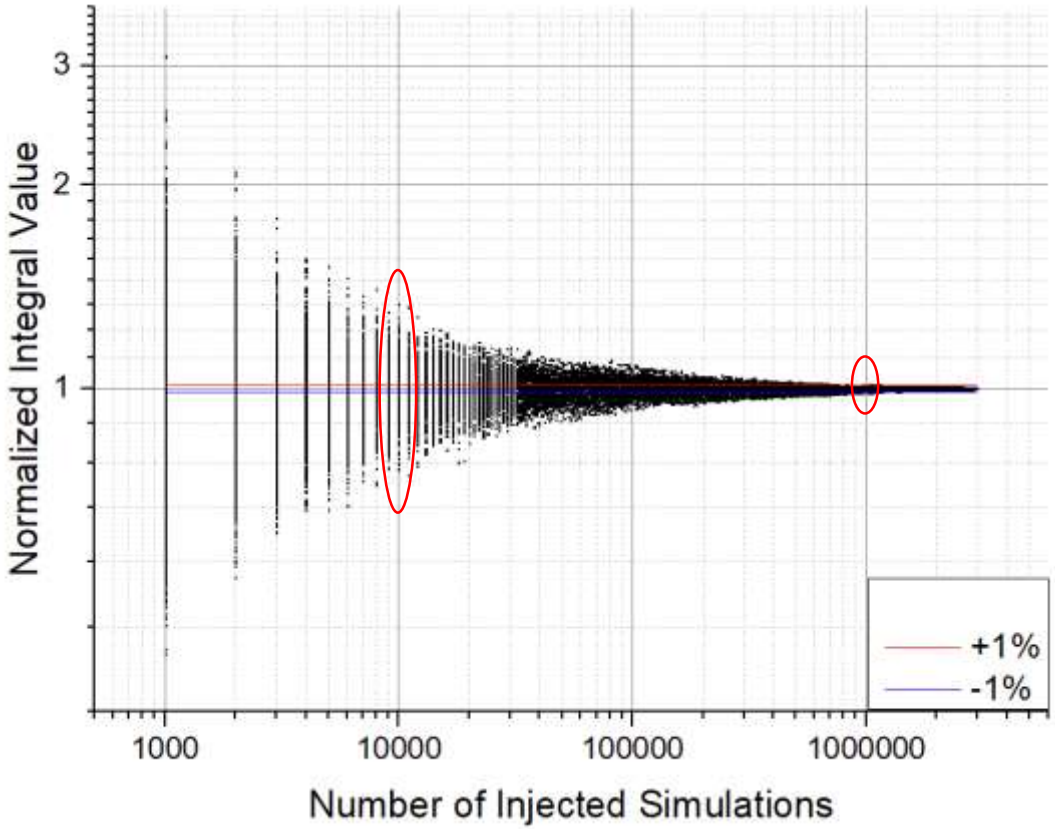


Fig.2. Normalized integral of whole spectrum[0 – 100GeV] value distribution with respect to number of injected simulations. For the chosen set of input parameters ($K_0 = 5 \times 10^{22}\ cm^2\ s^{-1}\ GV^{-1}$, $V_{sw} = 400\ km\ s^{-1}$).

Statistical error evaluation

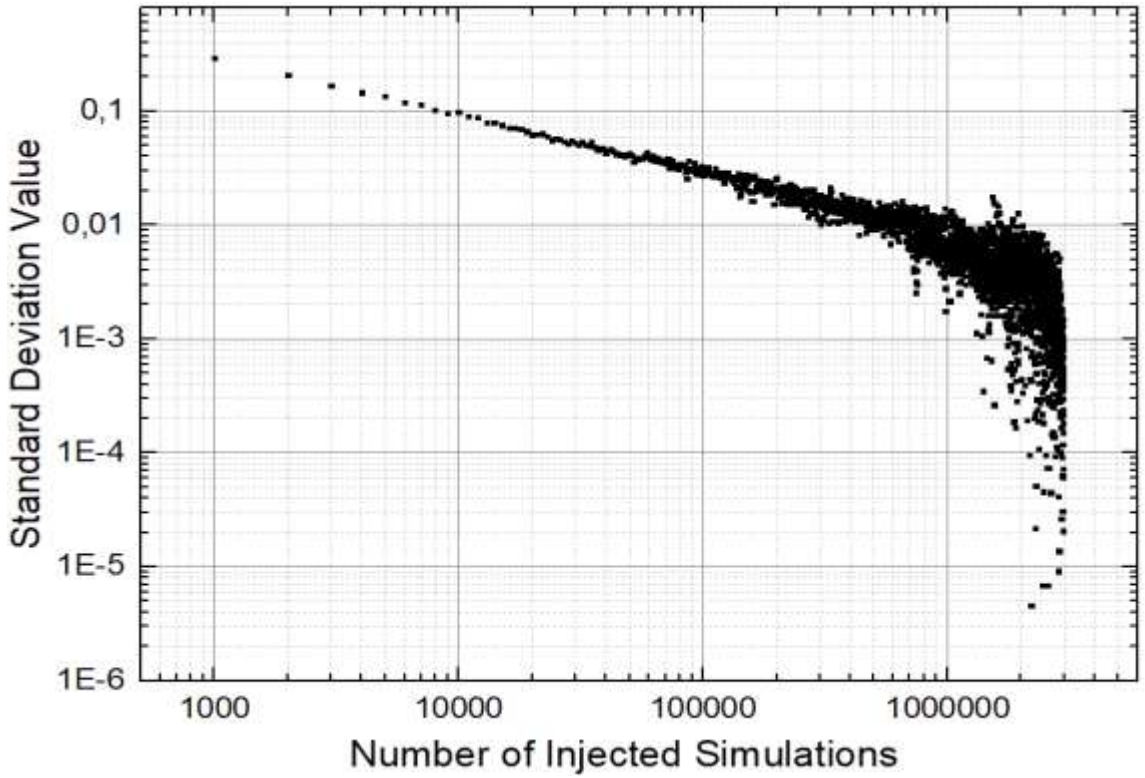


Fig. 3. Standard deviation evaluated from normalized integrals ($K_0 = 5 \times 10^{22}\, cm^2\, s^{-1}\, GV^{-1}$, $V_{sw} = 400\ km\, s^{-1}$) .

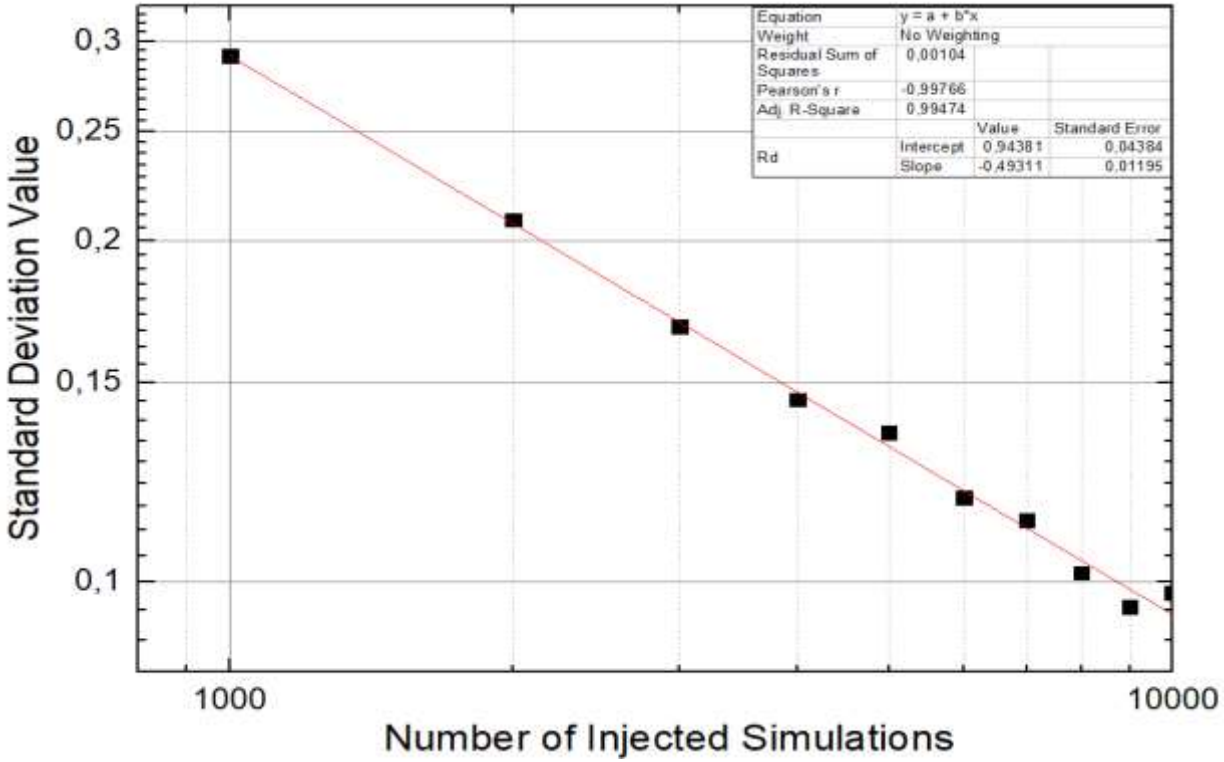


Fig. 4. Linear fit evaluated from standard deviation distribution in range from 1000 to 10000 simulations ($K_0 = 5 \times 10^{22}\, cm^2\, s^{-1}\, GV^{-1}, V_{sw} = 400\ km\, s^{-1}$).