On the possible method of identification of two probably cognate Extensive Air Showers


Lorentz-invariant verifying parameters:

Time \textbf{Sequencing} parameter

\[ S = \text{arsinh} \left( c \left( \tau + |δt|/2 \right)/|δr| \right) \]

Showers’ historical \textbf{Proximity} parameter

\[ P = -\ln \left( |Δ|/(k \cdot σ_Δ) \right) \]

Combined verifying criterion of possible historical proximity of both observed showers

\[ K = \frac{2}{\pi} \Psi = \frac{2}{\pi} \arctg \left( \frac{S}{P} \right) \]

\[ Δ(t) = \left[ δr - \langle n \rangle (c \cdot δt) \right] + \left( c \cdot δn \right) \cdot t \]

\[ τ = -\frac{1}{c} \cdot \frac{\left( δr^T \cdot δn \right)}{\left( δn^T \cdot δn \right)} \]

\[ Δ = Δ(τ) = δr - (c \cdot δt) \cdot \langle n \rangle - \left( δr^T \cdot δn \right) \cdot δn \]

Radius-vectors of two showers’ cores

\[ r_{01}, r_{02}; \quad \hat{δr} = r_{02} - r_{01} \]

observation points

\[ M_1, M_2; \quad M = M_1 + M_2 \]

with their covariance matrices

\[ \hat{δt} = \hat{t}_{02} - \hat{t}_{01} \]

The times of those showers’ observations

\[ \sigma_{11}^2, \sigma_{12}^2; \quad \sigma_{δt}^2 = \sigma_{t1}^2 + \sigma_{t2}^2 \]

with their dispersions

Unit vectors of the showers fronts’ motion directions

\[ n_1, n_2; \quad δn = n_2 - n_1; \quad \langle n \rangle = (n_1 + n_2)/2 \]

with their covariance matrices

\[ D_1, D_2; \quad D = D_1 + D_2; \quad D/4 \]

Variable vector connecting two moving showers’ ancestors

\[ \Delta(t) = \left[ δr - \langle n \rangle (c \cdot δt) \right] + \left( c \cdot δn \right) \cdot t \]

Time of the closest approach of the showers’ ancestors

\[ τ = -\frac{1}{c} \cdot \frac{\left( δr^T \cdot δn \right)}{\left( δn^T \cdot δn \right)} \]

Vector of the closest approach of the showers’ ancestors

\[ Δ = Δ(τ) = δr - (c \cdot δt) \cdot \langle n \rangle - \left( δr^T \cdot δn \right) \cdot δn \]

Unrealizable approach in the future

Unreliable proximity in the past

Possibly related showers

Sequencing S

Proximity P

Unrealizable approach in the future

Unreliable proximity in the past

Possibly related showers

K