COMMENTS (II) to the Internal Report[1] *201107001*: V. Baum, L. Keopke and G. Kroll, *A study of SN alarms in IC40, IC59 and IC79 - the role of atmospheric muons*

by Samvel Ter-Antonyan

NOW ABOUT CORRELATIONS

These computations were performed on the basis of Lutz's assertion about absence of significant right shoulder of DOM noise rate distribution and corresponding significant contribution of correlating DOM noise due to background muons.

Input parameters of simulation:

a) Number of strings - 85 for i=1,..,60 position of DOMs.
b) DOM noise rate fluctuations without muon contribution (no-muon noise rate) is Gaussian with $<r_0>$=270 Hz and σ_0 =25 Hz parameters.
c) Background muon rate for entire IceCube volume is 4700 Hz with Poison fluctuations.
d) Muon hit distribution is Log-Gaussian with parameters $<Ln(\mathrm{m})>$ =2.5 and σ_{m}=0.7.
The simulated distribution in comparison with CORSIKA+GEANT computation results (red line) and ICECUBE data (dashed blue line) are presented in Fig.1.
e) Correlations ($\rho_{i,i+1}$) between adjacent DOM hits (***i*** and ***i+1***) were computed for given 6 pairs of DOM positions: ***i*** ≡1,11,21,31,41,51 and 3 strings (j=10,20,30).
f) Timebase is 1 s.

Strategy of simulation for each event

1. No-muon DOM noise rates $\{r_0\}_{j,i}$ for each DOM (j=1,..85, i=1,..60) were simulated according to formalism (a,b,f).
2. Muon hit simulations $\{\mathrm{r}_\mu\}_{j,i}$ were performed according to (a,c,d,f) formalism.
3. Total DOM nose rate was computed according to $\mathrm{r}_{total}=r_0+\mathrm{r}_\mu$ for given (j,i).

Results

i. Average and RMS of total DOM noise rate are $<r_{total}>$ =284.344 Hz and σ_r =30.61 Hz respectively.
ii. Significance distribution of total DOM noise rate (red line) and no-muon noise rate (black line) for 10^7 events (seconds) is presented in Fig.2.
iii. Correlation coefficients between adjacent DOMs (upper panel), total average DOM noise rate (middle panel) and corresponding RMS (lower panel) versus DOM position are presented in Fig.3.

Conclusion

Maximal correlation between adjacent DOMs is equal to $\rho_{1,2}$=0.08 and quickly drops depending on position of DOM.
Average value of correlation coefficient is about 0.02 and obviously is not statistically significant.

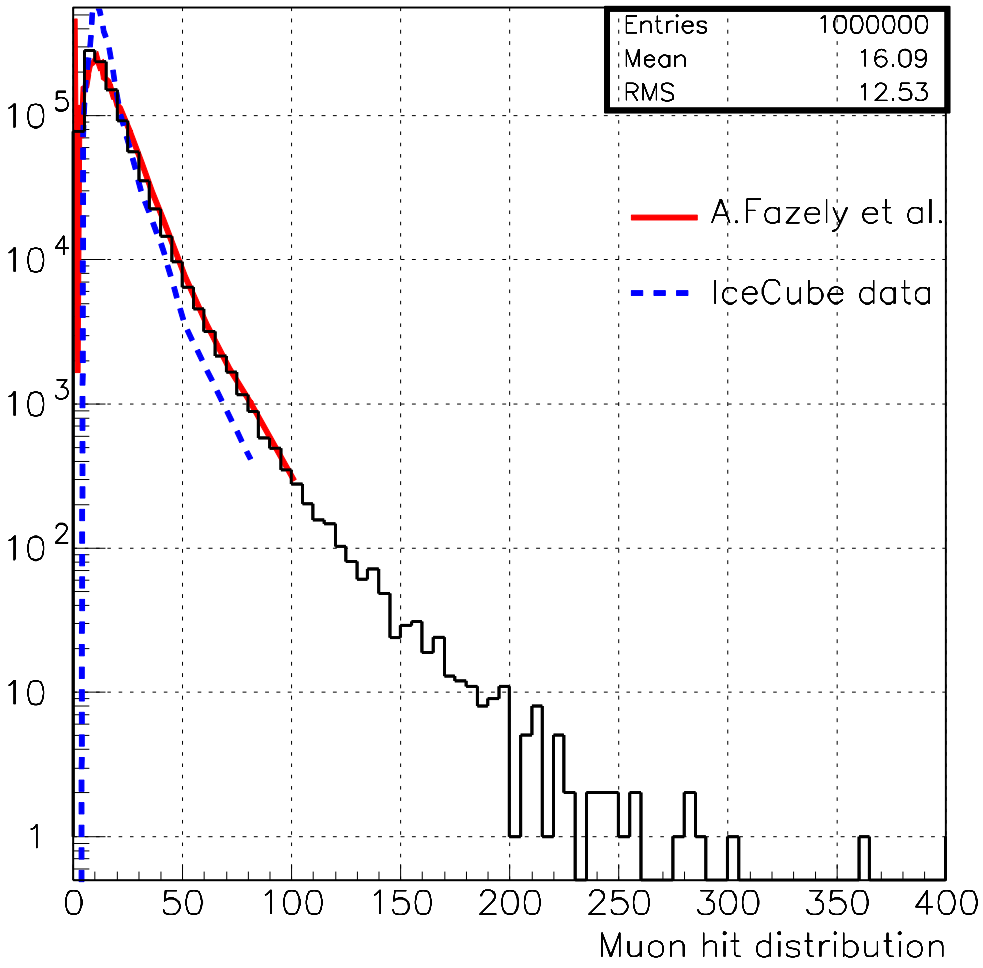

Fig.1. Simulated muon hit distribution (histogram line) in comparison with CORSIKA+GEANT simulated expected spectrum (red line) and IceCube data (blue dashed line).

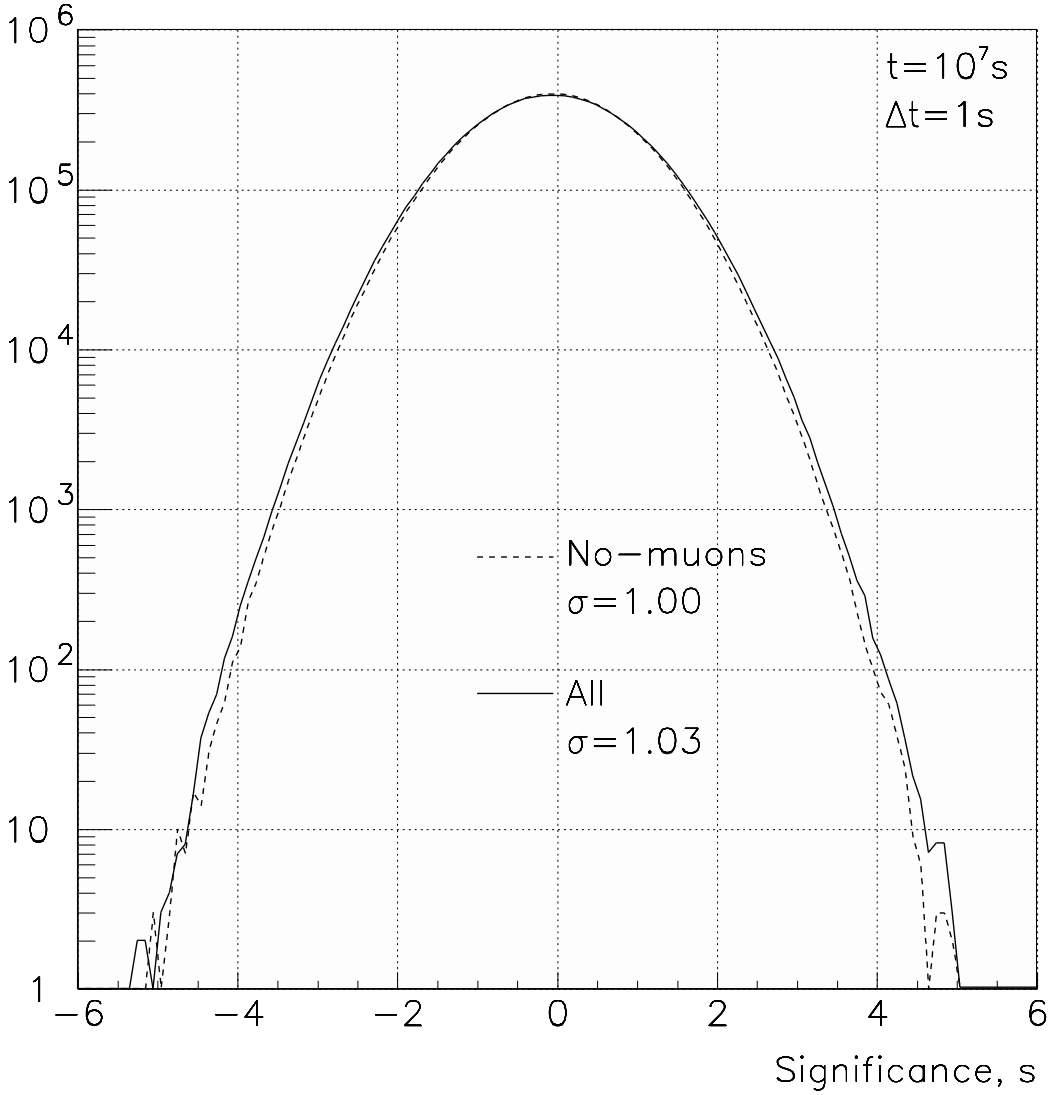

Fig.2 Significance distribution for ideal Gaussian DOM noise rate without muon hits (dashed line) and with correlated muon hits (line). Number of simulated events is 10^7 for timebase - 1 s.

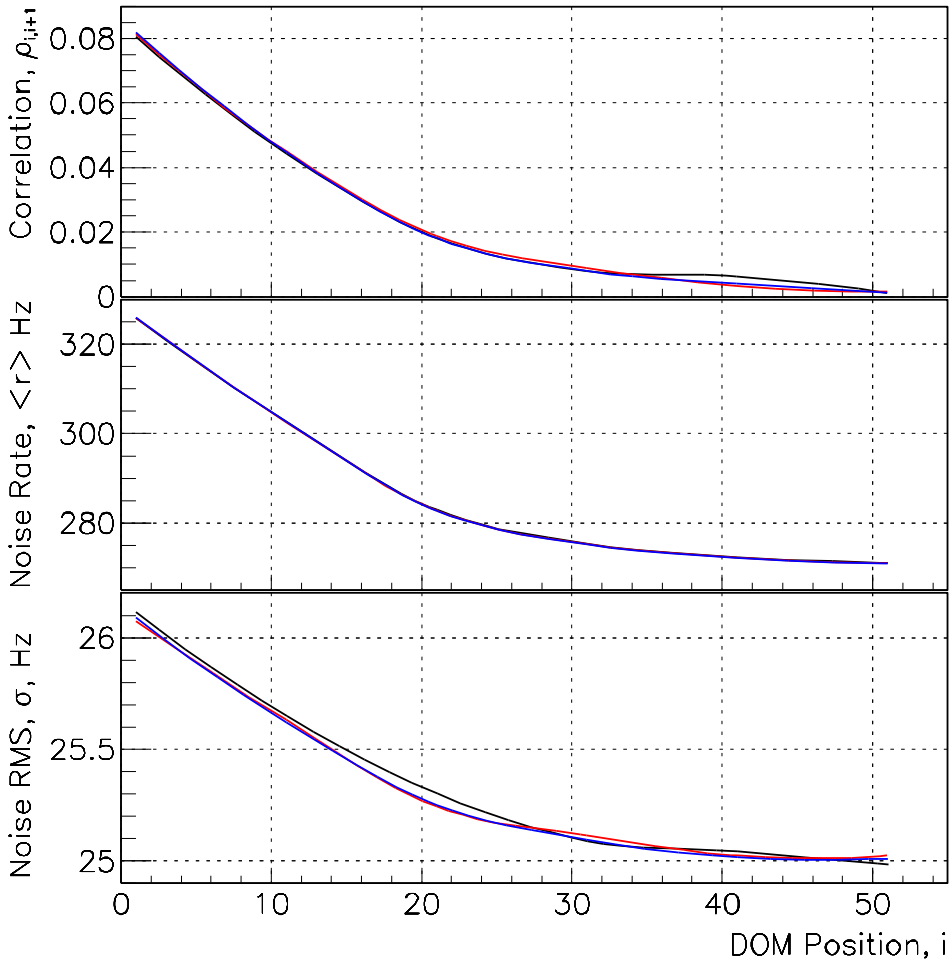

Fig.3 Correlation coefficient (upper panel), average total DOM noise rate (median panel), and RMS of total DOM noise rate for given 6 pairs {(i,i+1)≡(1,2), (11,12), ... (51,52)} of adjacent DOMs. Results are presented for given 3 (numbers= 10,20,30) strings (black, red, blue lines) to show the fluctuation of simulated data.

09/26/11