# iProgress working report

Pavel Bezyazeekov (Irkutsk State University)
Supervisor: D. Kostunin (IKP)

## Obtained results

General goal of my work at KIT was test of the methods of primary particle reconstruction for Tunka Radio Extension (Tunka-Rex) experiment. I used about 300 Tunka-133 simulated events for two initial particles such as proton and iron with calculated radio emission. For energy estimation I used lateral distribution function (LDF). I tested two possible parametrizations: simple exponential $\varepsilon(r) = \varepsilon_{r_0} \exp\left[-\eta(r - r_0)\right]$, and the gaussian $\varepsilon(r) = \varepsilon_{r_0} \exp\left[-a(r - r_0)^2 + b(r - r_0)\right]$. Also I tested the improvement could be given by asymmetry correction. The results are presented in the Fig.1. I found that generally correction gives an improvement, but gaussian parametrization significantly better.

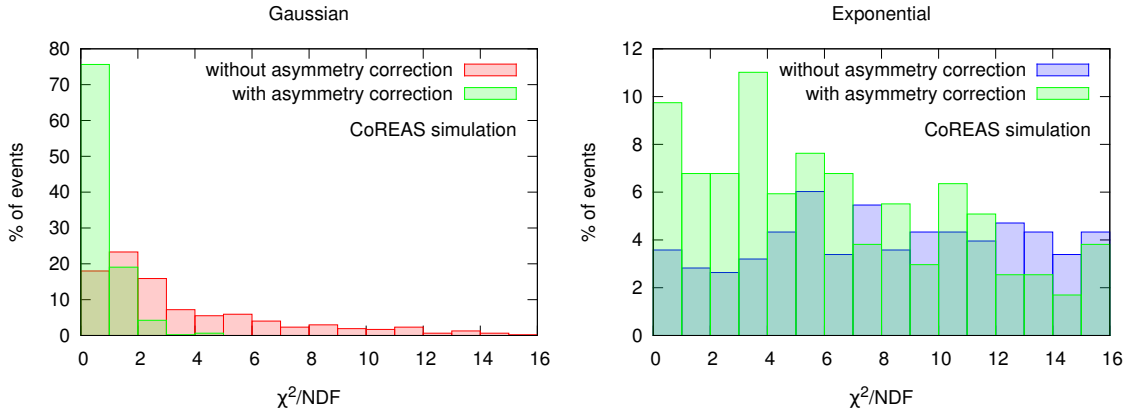


Figure 1: Comparison between fitting quality for different methods.

For the energy reconstruction I used the general formula

$$E_{\mathrm{pr}} = \kappa \left( \frac{\mathcal{E}_{\mathrm{corr}}(r_0)}{\mu\mathrm{V/m}} \right)^b .$$

I changed $r_0$ distance from 0 to 500 m with 1 m step and found a case with the best correlation and precision by applying fitting results to current distance. As it was obtained best correction and precision for both particles are located at the same distances, approximately at 115-125 m (see Fig.2, left). Using the general formula for energy reconstruction from Tunka magnetic field $B = 60.3\,\mu$T and Tunka-Rex hardware I obtained the following

results

$$
\begin{aligned}
r_0 &= 118 \pm 1\,\mathrm{m}\,, \\
\kappa &= 410.1 \pm 49.2\,\frac{\mathrm{EeV}}{\mu\mathrm{V/m}}\,, \\
b &= 0.93 \pm 0.01\,.
\end{aligned}
$$

One can see, that non-linear parametrization a slightly better than linear. After applying the developed method on the real data I made a comparison between energy reconstructed by radio and Cherenkov (see Fig.2, right).

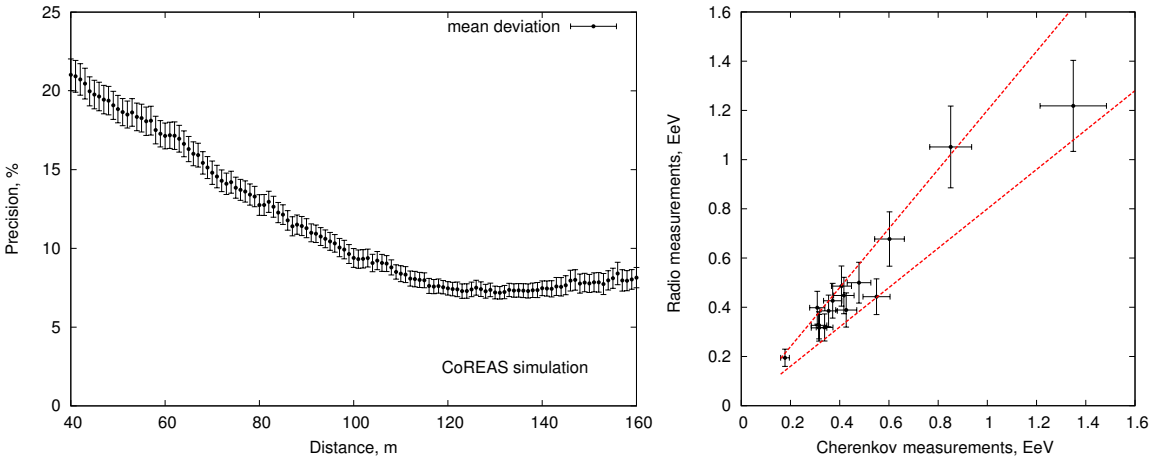


Figure 2: At left plot: averaged precision of energy reconstruction for both particles. At right plot: comparison of energy from cherenkov data and energy from our fit

## Given talks

- Internal IKP meeting, 5th December 2014
- TAIGA collaboration meeting, 13th December 2014 (given by D. Kostunin)