Technical justification for the proposal "Detection of the background position noise due to non-stationary of the Galactic gravitational field. Pilot project."

1 Justification of the sample size

Considering Gaussian distribution of errors, the standard variations of the variance is $\sigma_v = \sqrt{2/(n-1)}\ \sigma^2$, where σ^2 is the second moment of the distribution. Observing N sources in each group, we can determine the variance of the variance of arc length in the group $\bar{\sigma_v} = \sqrt{2/N(n-1)}\ \sigma^2$. The goal of the program is to determine the difference in variances among the sources in the galactic plane active galaxy nuclei (AGN) and the control group. The significance of the differences is determined as $S = \frac{\sigma_g^2 - \sigma_c^2}{\sigma_c^2}$, where subscripts g and c denote the group of galactic plane AGNs and the control group. Denoting the variance of the excessive noise due to the non-stationarity of the Galactic gravitational field as ε^2, we get the significance of the rms differences between these two group is

$$S = \sqrt{N(n-1)/2}\,\frac{\varepsilon^2}{\sigma_c^2} \tag{1}$$

We propose to observe groups of 20 sources for 5 years, 6 times a year, in total, 30 epochs. Then, $S \approx 17\frac{\varepsilon^2}{\sigma_c^2}$. The theoretical prediction of the average ε among the group of Galactic plane AGNs is 20 μas.

Table 1 shows the significance of the rms differences for different rms of the arc lengths in the control sample. We expect the rms of the time series of a given arc in the control sample be in a range of 30–50 μas. Analysis of this table shows that observing two groups of 20 sources, we can get a significant result if the scatter of arc lengths will be in a range of 30 to 50 μas.

Table 1: Significance of the rms differences as a function of the rms in arc lengths in μas of the control group.

σ_c	S
20	17
30	8
40	6
50	3
60	2