Further Investigation of the β-Ursa Minorids

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Abstract

This work analyzes the data collected by observers of the Polish *Comets and Meteors Workshop* in August 1999-2001 with the aim of looking for the β-Ursa Minorid shower. The radiant of this shower is clearly visible and its coordinates are $\alpha = 202°$ and $\delta = +65°$. The activity period of the shower lasts from around August 5 to August 11 with maximum around August 9. The best radiant picture is obtained from a geocentric velocity $V_\infty = 13$ km/s.

1 Discovery of the β-Ursa Minorids (Kochabids).

The first information about a new minor stream with a radiant in the vicinity of Kochab was published by Olech & Kwinta (1999). Using $T_{eff} = 19$ hours of data collected in the period 1999 August 2 - 12, they used the RADIANT software (Arlt 1992) to produce the best radiant picture. It was obtained for $V_\infty = 14$ km/s and its equatorial coordinates were $\alpha = 223°$ and $\delta = 73°$. The highest Zenithal Hourly Rates (ZHRs) were observed between $\lambda_\odot = 136°$ and $\lambda_\odot = 138°$ (see their Fig. 1).

2 Data reduction for 1999-2001.

Meteor observers of the *Comets and Meteors Workshop (CMW)* made a major effort to observe meteors using the plotting method even until 10th August (Table 1). The equatorial coordinates of meteors were taken using the COOREADER software (Samujłło & Olech 1999) during the *CMW* summer observing camps.

year	2/3	3/4	4/5	5/6	6/7	7/8	8/9	9/10	10/11	11/12
1999	10.00	8.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00
2000	25.50	10.25	4.80	23.50	6.00	8.25	5.55	6.85	16.20	6.35
2001	6.32	0.00	0.00	0.00	1.95	2.23	3.50	15.09	6.33	0.00

Table 1: *The T_{eff} of observations with plotting from August 2-12 in 1999-2001*

From the larger set of data, we could tell more about the existence and activity of the Kochabids through the suspected period of August 2-12. First we analyzed the RADIANT software tracing output for different periods of time. We concluded that meteors between August 5 and 12 give the highest impact to Fig. 1. Thus we decided to compute the tracings map again, but this time only using meteors plotted from this period (Fig. 2 b).

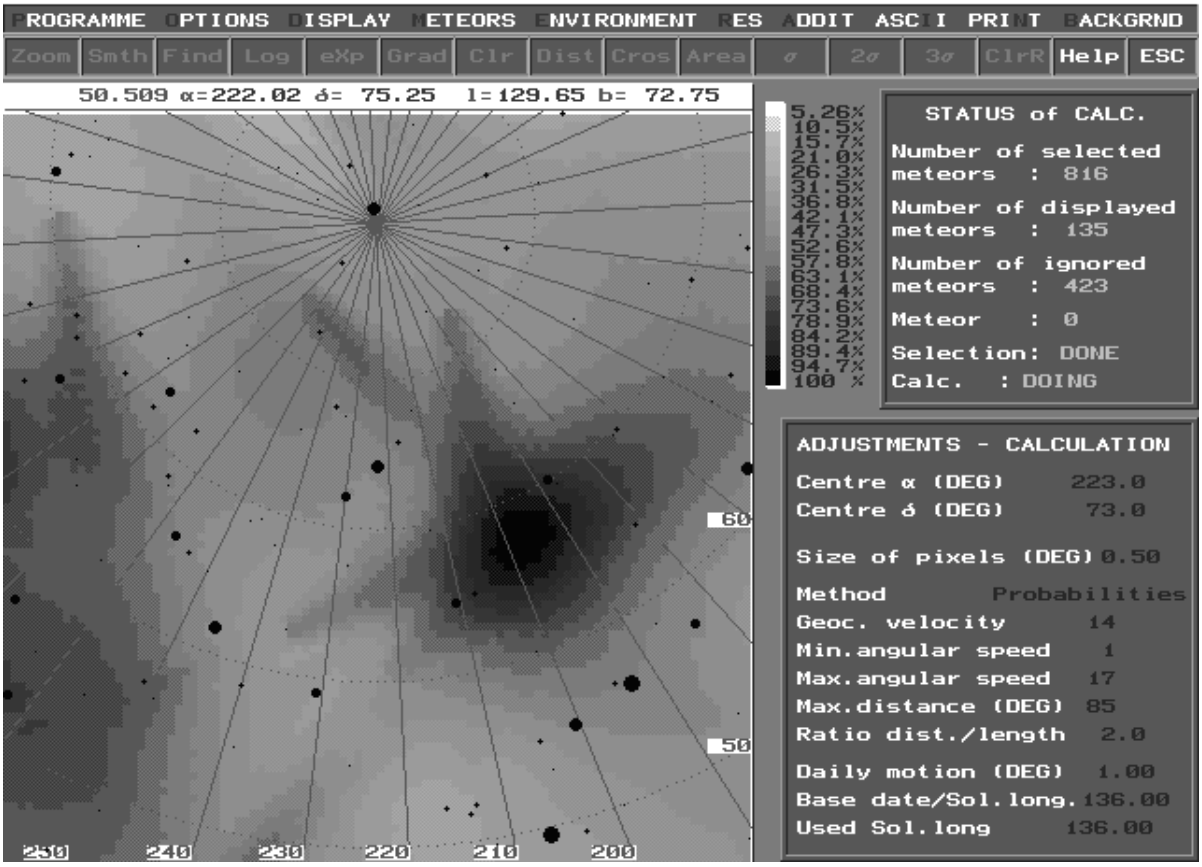

Figure 1: *The* RADIANT *software output, base* $\lambda = 136°$, $\Delta\lambda = 1°/day$, *maximum meteor distance* $85°$.

Comparing the picture shown in Fig. 2 a) with the RADIANT tracing output for the period of August 2-5, 1999-2001 presented in Fig. 2 b), we concluded that Kochabids activity in this period is almost undetectable. Week activity of Kochabids before 5-th of August can be also seen at RADIANT probability output (Fig. 3).

In the first calculations using the 1999-2001 data we obtained the position of the Kochabids' radiant shifted to $\alpha = 202°$ and $\delta = 65°$ as against the coordinates given by Olech & Kwinta (1999). The most compact picture of the radiant (i.e. fitting of the two-dimensional Gaussian function to give the smallest value of the χ^2 parameter) appeared for $\lambda_\odot = 137°$ and $\lambda_\odot = 138°$. To produce this picture (Fig. 4) we used 740 meteors, 95 of which were taken into account after applying the following parameters: maximum distance from the center $80°$ and angular velocity in the range $1 - 17°/s$.

Finally we tested the Kochabids' radiant pictures selecting different geocentric velocities. As can be seen from Fig. 5 and Fig. 6, the geocentric velocity of Kochabids were reduced to $V_\infty = 13$ km/s in comparison with $V_\infty = 14$ km/s given by the discoverers. There is almost no trace of them using the velocity $V_\infty = 18$ km/s and higher.

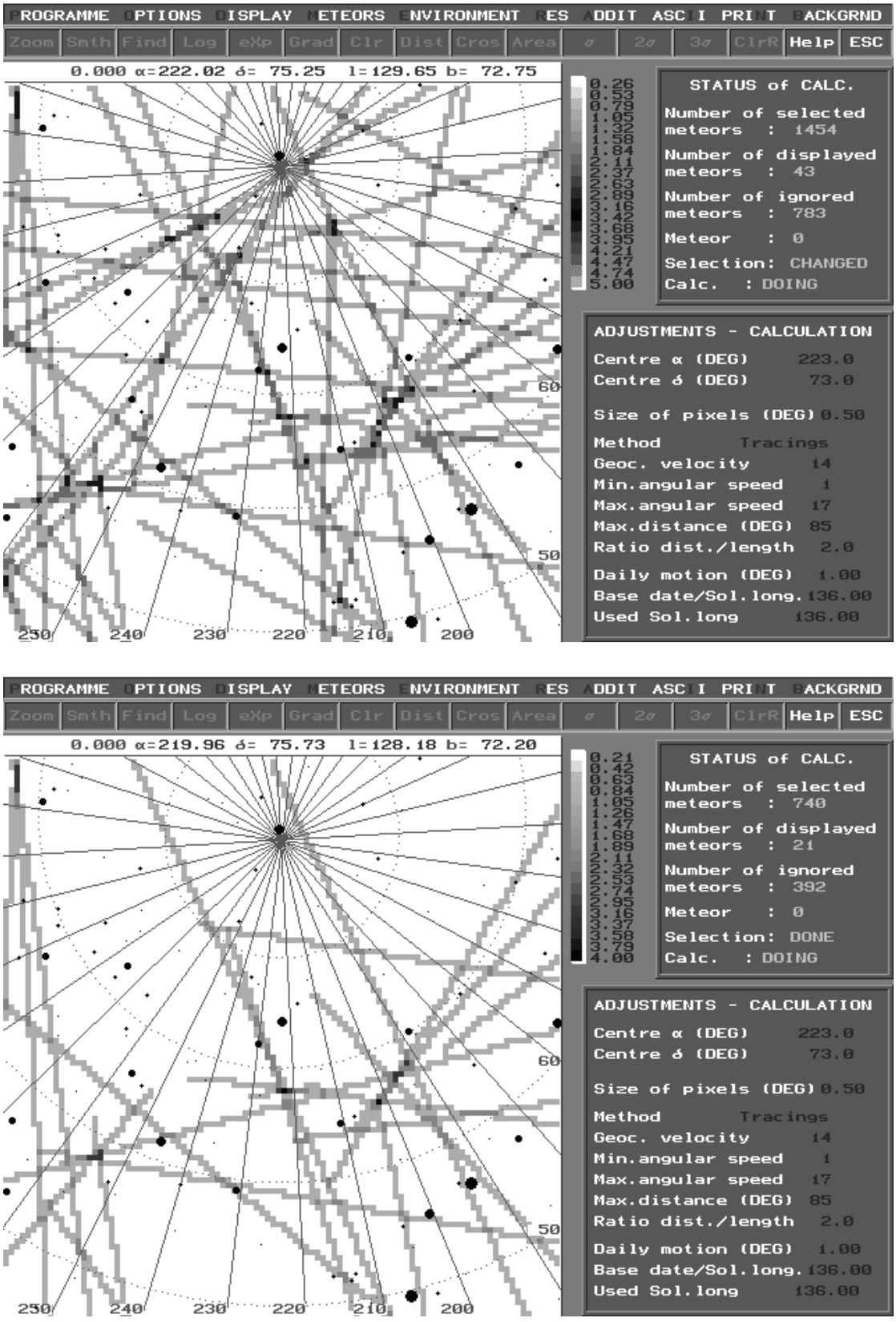

Figure 2: a) *Selected period 1999 August 2-12,* $\alpha = 223°$, $\delta = 73°$, b) *Selected period 1999 August 5-12,* $\alpha = 223°$, $\delta = 73°$.

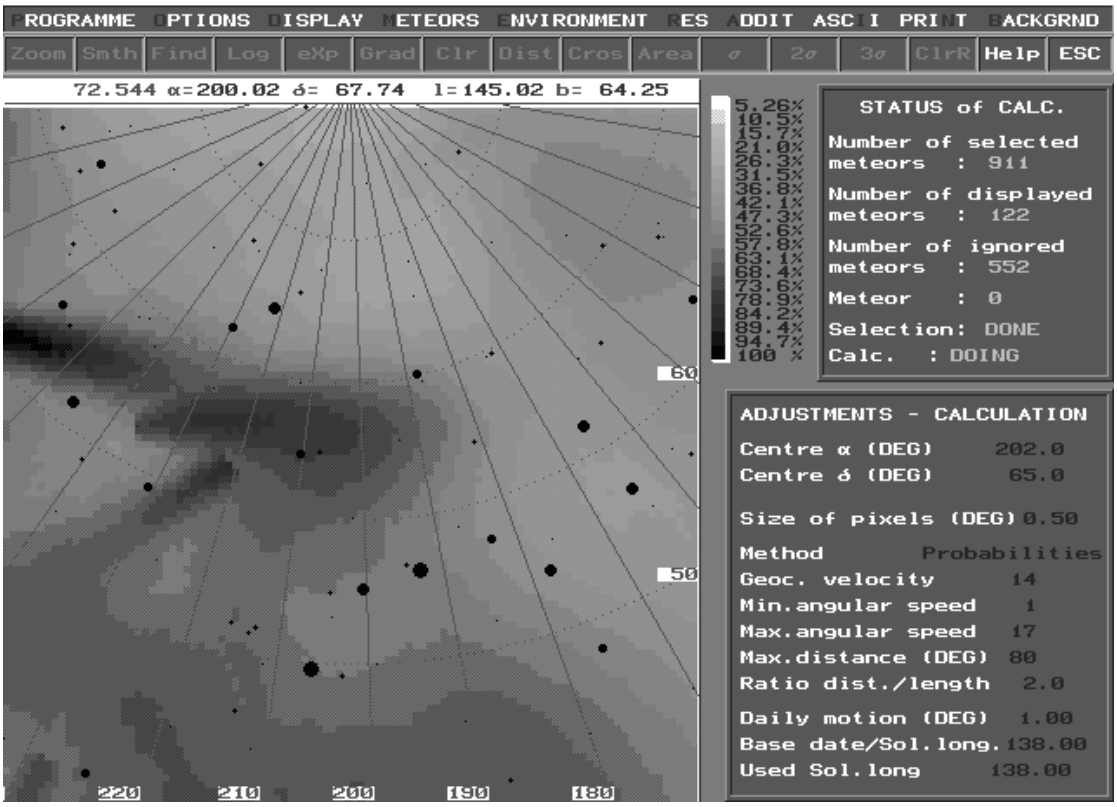

Figure 3: *The* RADIANT *probability output:* $\alpha = 202°$, $\delta = 65°$, *period selection August 2-5, 1999-2001.*

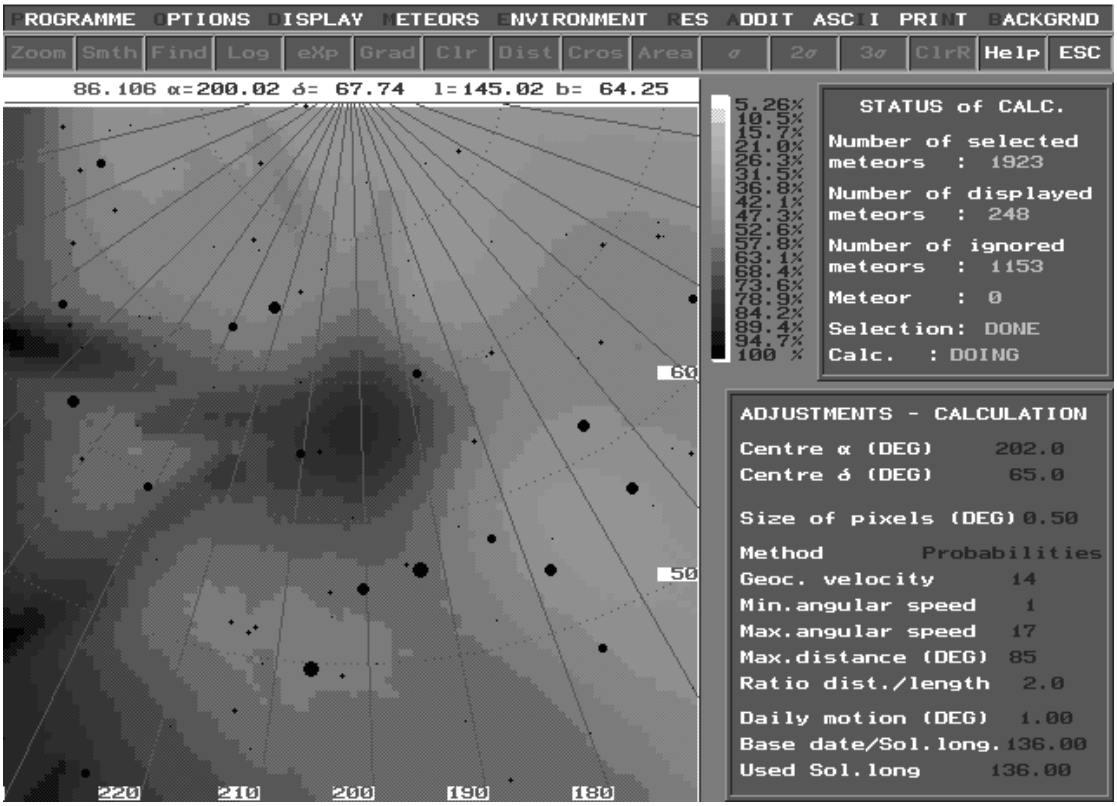

Figure 4: *The* RADIANT *probability output for* $\lambda_\odot = 138°$. *Pixel size* $0.5°$ *and* $V_\infty = 14$ *km/s.*

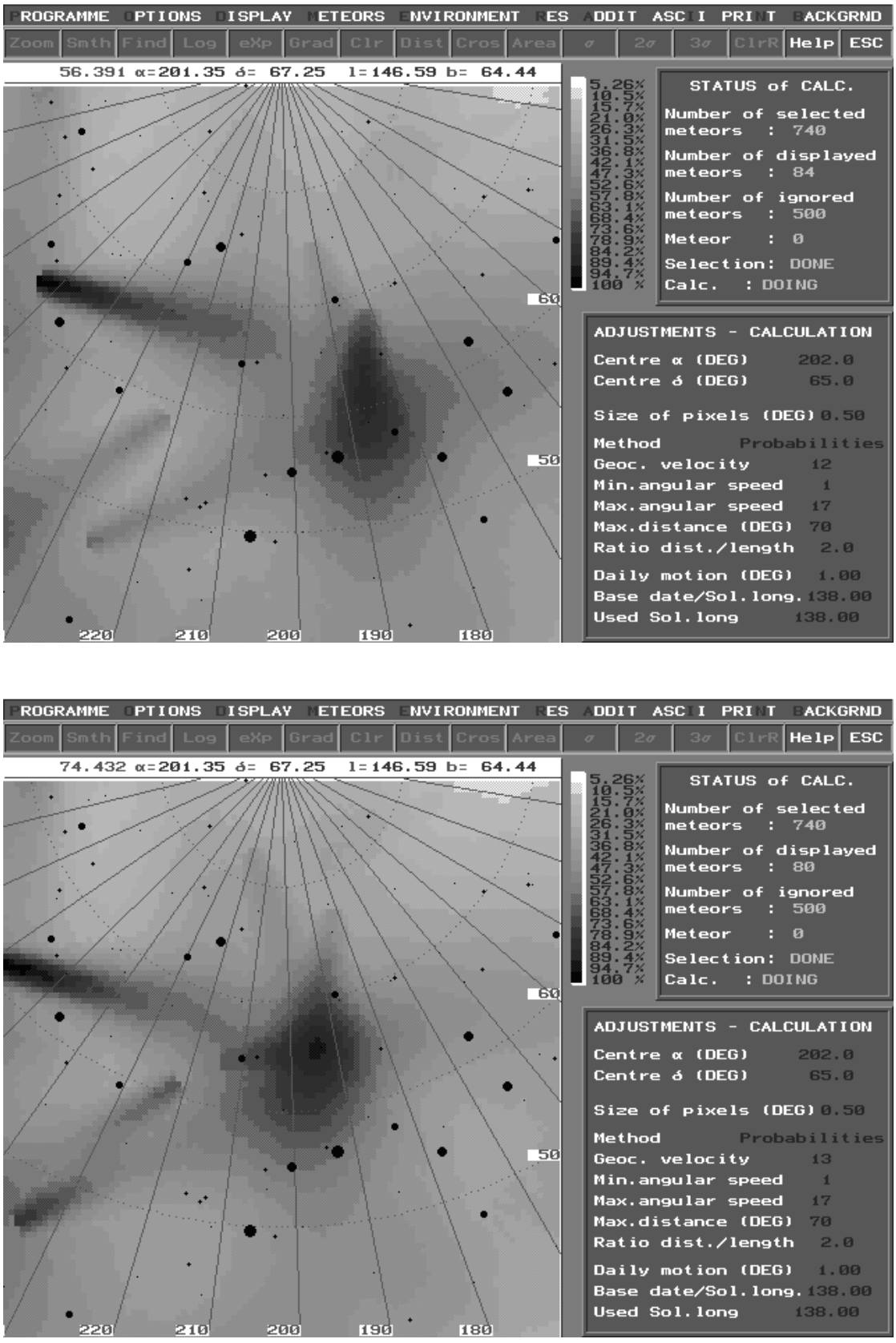

Figure 5: a) $V_\infty = 12$ *km/s*, b) $V_\infty = 13$ *km/s*.

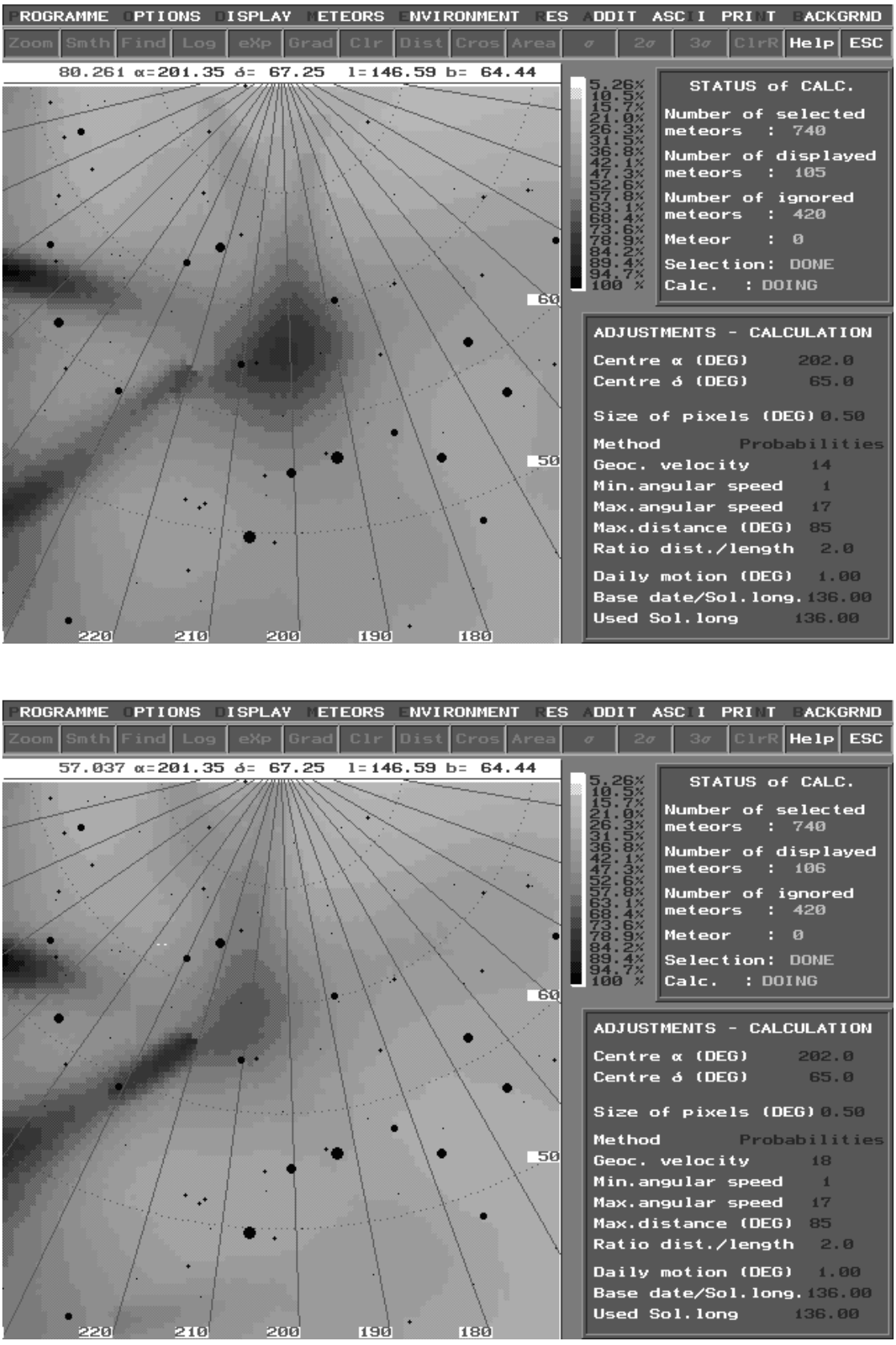

Figure 6: *a)* $V_\infty = 14$ *km/s, b)* $V_\infty = 18$ *km/s.*

3 Summary.

The radiant of the Kochabids is detectable in the years 1999-2001 and its center is close to $\alpha = 202°$, $\delta = 65°$; the geocentric velocity is slightly lower then previously expected and is 13 km/s. The best Gaussian fit to the radiant picture is visible for $\lambda_\odot = 137°$ and $\lambda_\odot = 138°$ (August 9-10). The most probable activity period of the shower is August 5-11. We can not exclude the possibility that the activity lasts longer but it is very difficult to state due to the lack of observations with plotting around the Perseid maximum.

4 Observation needs.

There are very few observations made by the *CMW* observers between August 10 and 12. Plotting all sporadic meteors close to the Perseid maximum would be very valuable for investigating late activity of the β-Ursa Minorid shower. We also hope that an analysis of the video, photographic and telescopic data would help. The Kochabids, due to their low speed, are an ideal target especially for video and photographic observations and if they really exist their meteors should be easy detectable in these databases.

Acknowledgments

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References

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