Spectrometric complex of the RATAN–600

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The spectrometric complex of the RATAN-600 is intended for the study of radio lines at cm-wavelengths and allocated in the secondary mirror cabin N 2. It consists of microwave receivers and spectrum analyzers which parameters are tabulated below. There is a system of stable computer driven by local oscillators that have accuracy about 10^{-8}.

Wavelength cm	Type of LNA	T_n, K LNA	T_n, K Syst.	T_{phys} K
21-18	HEMT	40	70	290
6.2	HEMT	30	60	290
1.35	HEMT	80	120	80

Spectrum analyzers	Bandwidth MHz	Number of channels	Resolution kHz
Filter bank	1.2	42	30
Acoustic optical	50	1000	110
Autocorrelational	2.5	128	38

A user has an opportunity to arrange the necessary spectrometer structure. Spectrometer driving system accomplished with two DVK-4 computers and one IBM PC gives the possibility to develop radio line observations on the frequency band pass of the input low noise amplifiers (LNA): 1.3 – 1.8 GHz (radio lines of HI at wavelength of 21 cm, all four lines of OH at wavelength of 18 cm), 4.5 – 5.5 GHz (H_2CO line at 6.2 cm), 21.5 – 22.5 GHz (H_2O line at 1.35 cm).

The performance of spectrometric complex is controlled by the program driving system (PDS) and the data gathering and recording system (DGS). DGS realizes attaching cycles of gathering of the spectral channels to the real sidereal time scale, converts analogues signals to digital codes, synchronizes PDS operating with digital recording system. The digital recording system is fulfilled in CAMAC standard on the base of IBM PC.

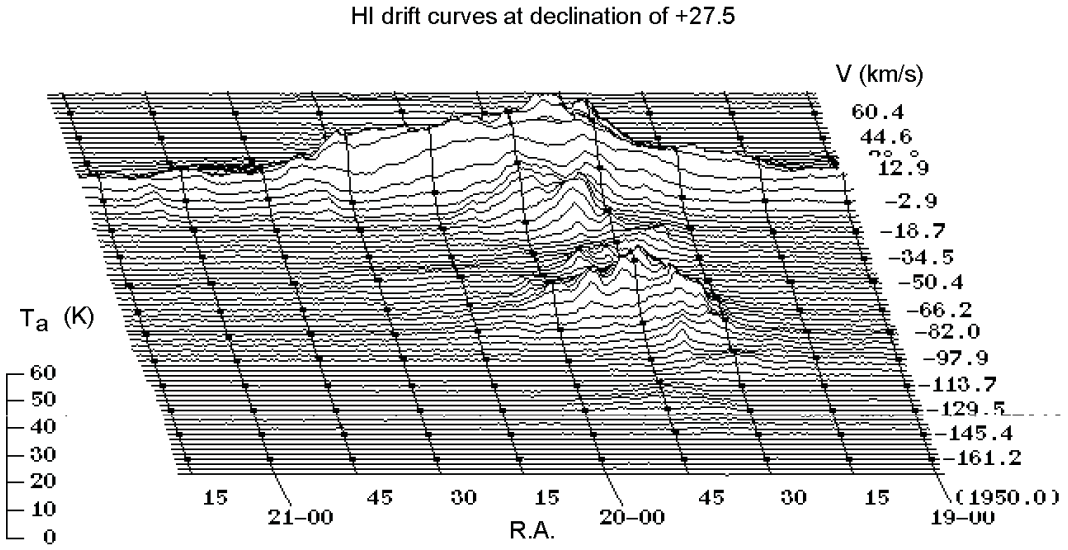
For adjustment of the spectral reseivers for changing observation conditions the following preparatory operations are automatically fulfilled before each observation:
– arrangement of necessary spectrometer gain depending on the level of system noise signal on the wide band channel detector;
– compensation of noise signals difference in the semiperiods of antenna and its equivalent.

Special software batch was created for carrying out of spectrometric observation in the various modes:
– long-term observations with drift of sky through fixed beam of radio telescope;

– tracking of the sources with moving of primary horn in the region where aberrations are unessential;
– reference sources observations with the reduction and output of the results immediately when observations are completed.

PDS supplies modulation and compensation modes of spectrometer operations. The last one is implemented with acoustic optical analyzer in the range of integration time up to 20–30 min and gives gain in sensitivity by two times.

The data obtained are recorded to the computer hard disk and immediately displayed on the monitor. Then these data may be reduced to antenna temperature scale, cleaned from interferences and arranged to the format choosed. Further they may be transmitted through the local network of the RATAN-600 to the central server or to any computer in the network. They may be accumulated on the Zip-diskettes too. An example of HI drift curves is shown on the Figure.



The special software was created for consequent reduction. It makes possible, in the first place, to see obtained data on the screen and to take any hard copy of drift curves, profiles or contours in any coordinates. Secondly, data may be reduced for finding and eliminating interferences, selecting and excluding extensive background with the help of spline interpolation, Gauss analysis along with R.A. axis for selecting of the local components and measuring of their parameters. Spectral analysis with the help of fast Fourier transform and computation of structural functions is also available. All these functions work with displaying results on the screen and store them on the files. For three dimensional data (α, δ, V) there is an opportunity to obtain a cross-section with any pairs of coordinates.

The equipment and software are in operation during many years and have displayed their high operational quality. The losses of observational time due to equipment failure are no more than 3%, that is much less than due to weather conditions, power supply or operator mistakes.

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