1. EXPERIMENTS ON THE SATELLITES.

INTERBALL.

The energetic particle experiment DOK-2 was working on Interball tail probe until October 15, 2000 almost until the end of the satellite's function. DOK-2 and its simplified version DOK-S have been developed and constructed at the Institute of Experimental Physics, Slovak Academy of Sciences in Košice (IEP SAS) in the co-operation with the Space Research Institute, Moscow, Russia and with the Demokritos University of Thrace, Xanthi, Greece. The measurements provide detailed data on flux, the energy spectra and angular distribution of ions and electrons with the energies from ~ 20 keV up to ~ 600 keV in various regions of the outer magnetosphere and near the bow shock. Figure 1 shows examples of spectrograms of the particles in two different regions.

CORONAS-F.

The «CORONAS-F» satellite, the second one of CORONAS satellite series, was launched on July 31, 2001 in Russia into a circular orbit with the altitude 507±21 km and 82.5 degree inclination. The satellite is oriented towards the Sun. A complex of instruments measuring predominantly corpuscular energetic emissions from the Sun (SKL, coordinated by Skobeltsyn Inst. of Nucl. Physics, Moscow, Russia) is a part of experimental devices. Institute of Experimental Physics, SAS, Košice, Slovakia participated at a device measuring energetic neutrons, gammas and protons (Figure 2).

ISS.

The participation of the Slovak scientists (Institute of Experimental Physics, SAS, Košice) on ISS started by the passive measurements of the tracks of products induced by cosmic rays and other energetic particles inside the Russian module of the station. The stack of detectors is a small part of the complex experiment SCORPION (coordinated by Skobeltsyn Inst. of Nucl. Physics, Moscow, Russia, with the participation of several other laboratories). The stack was delivered to the ISS by the end of November 2001.

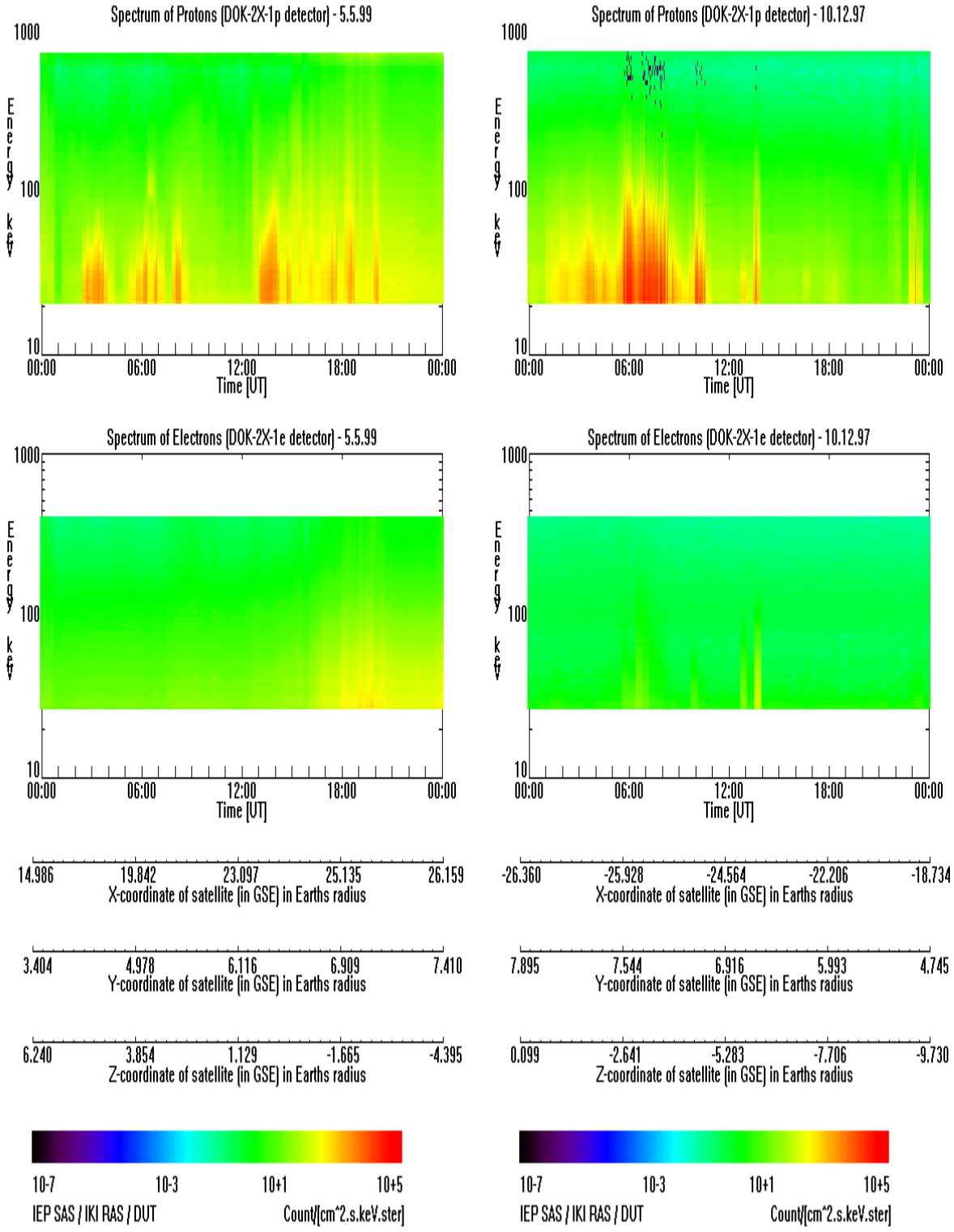

Fig. 1. Spectrograms of ions and electrons (upper and lower panels) during one day measurements by DOK-2 on Interball-1 in the region upstream from the bow shock (left) and in the geomagnetic tail (right). The review spectrograms in this form are available on daily basis at IEP SAS Košice and cover the interval August 1995 – October 2000.

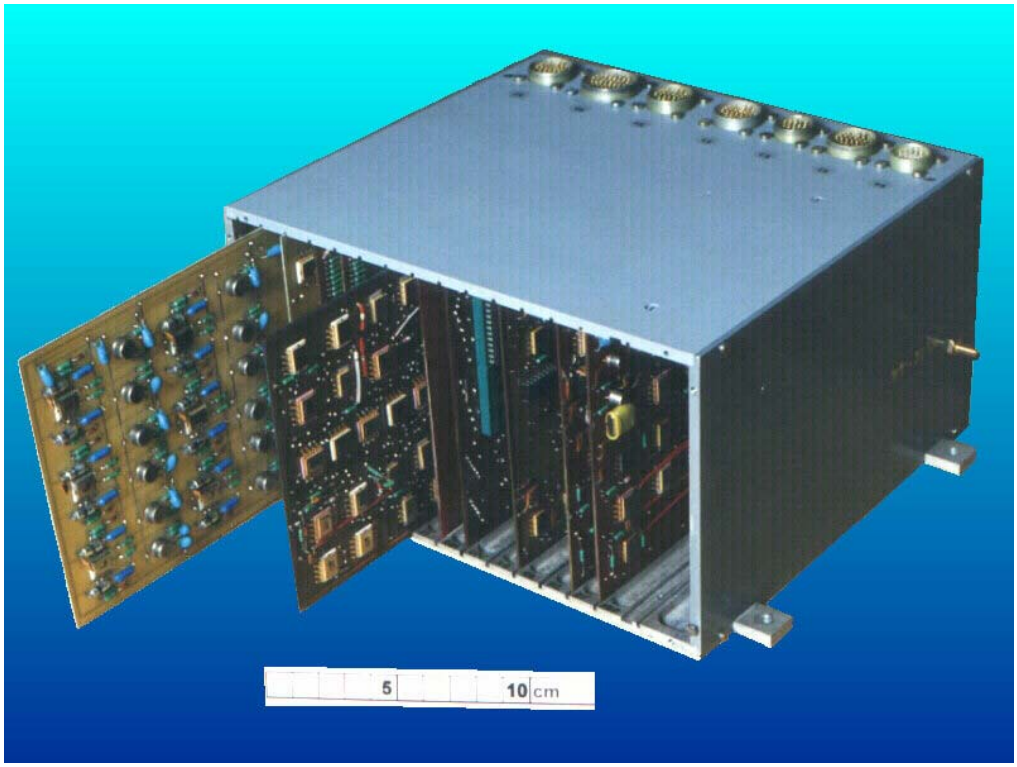

Fig.2. One of the experiments within the complex of energetic particle devices SKL onboard CORONAS-F satellite is SONG (the acronym for SOlar Neutrons and Gammas). It is a joint experiment of Skobeltsyn Inst. Nuclear Physics, Moscow State University, Russia and the Institute of Experimental Physics, SAS, Košice, Slovakia, where the block of electronics displayed in the figure was developed, constructed and tested.

The dynamics of cosmic particles with the energies well below those of cosmic rays and well above those of solar wind (from few tens of keV up to several MeV) have been studied by the ***Institute of Experimental Physics, SAS, Košice*** (its Department of Space Physics) in the co-operation with the laboratories in abroad. In addition, the measurements of secondary cosmic rays observed by ground based method have been analysed. The analysis of the data obtained both from the low altitude and high apogee satellites, as well as development and construction of new instruments for the future studies continued in the period 2000-2001.

Both case and statistical studies of energetic particle dynamics within the magnetosphere, near its boundary regions, in the geomagnetic tail and in the foreshock were studied with using measurements by DOK-2 and DOK-S in the Interball project [13,20,24,25,28,29,30,32-36,43,44]. Figure 3 shows the results of extensive statistical study by DOK-2 experiment (tail probe) and Figure 4 illustrates the fine energy spectra and their temporal evolution observed on auroral probe. Comparison with the wave, magnetic field and plasma experiments on the same satellite as well as with the energetic particle measurements on POLAR and SOHO were done. Comparison of spectra obtained by DOK-1 on Prognoz-10 with the spectra of ions in another positions was done in [46].

Measurements by SONG instrument on CORONAS-I satellite were used for the comparison of low energy part of the cosmic ray spectra with the ground based neutron observations during a Forbush decrease. The detailed distribution of gamma ray flux at altitude 500 km was obtained. The spatial distribution of gamma rays associated with trapped particles was analysed. Comparison of SONG measurements on CORONAS-I with SAMPEX observations started recently. The results from CORONAS-I can be found in [10-12,27]. Preliminary analysis of LET spectra observations on MIR are presented in [16].

New experiments for measurements of energetic particles in future missions are in progress in the collaboration with several institutes in abroad e.g. with STIL Maynooth, Ireland [45]. Figure 5 illustrates the energetic particle spectrometer MEP-1. A photostimulation method for evaluation of pile-up effects was developed [6,7].

Cosmic ray measurements by neutron monitor at Lomnický Štít became available in real time (http://neutronmonitor.ta3.sk). The modulation of cosmic rays in the heliosphere and sensitivity of neutron monitor to galactic cosmic rays was studied in [41,42]. Connections between cosmic rays, solar variability and

space weather effects, as well as temporal evolution of various quasiperiodicities in cosmic ray records were examined in the series of papers [1-5,14,15,21,22,26,31,37]. The geomagnetic effects on cosmic rays have been checked by methods of trajectory computations in model geomagnetic field [8-10,23,38-40].

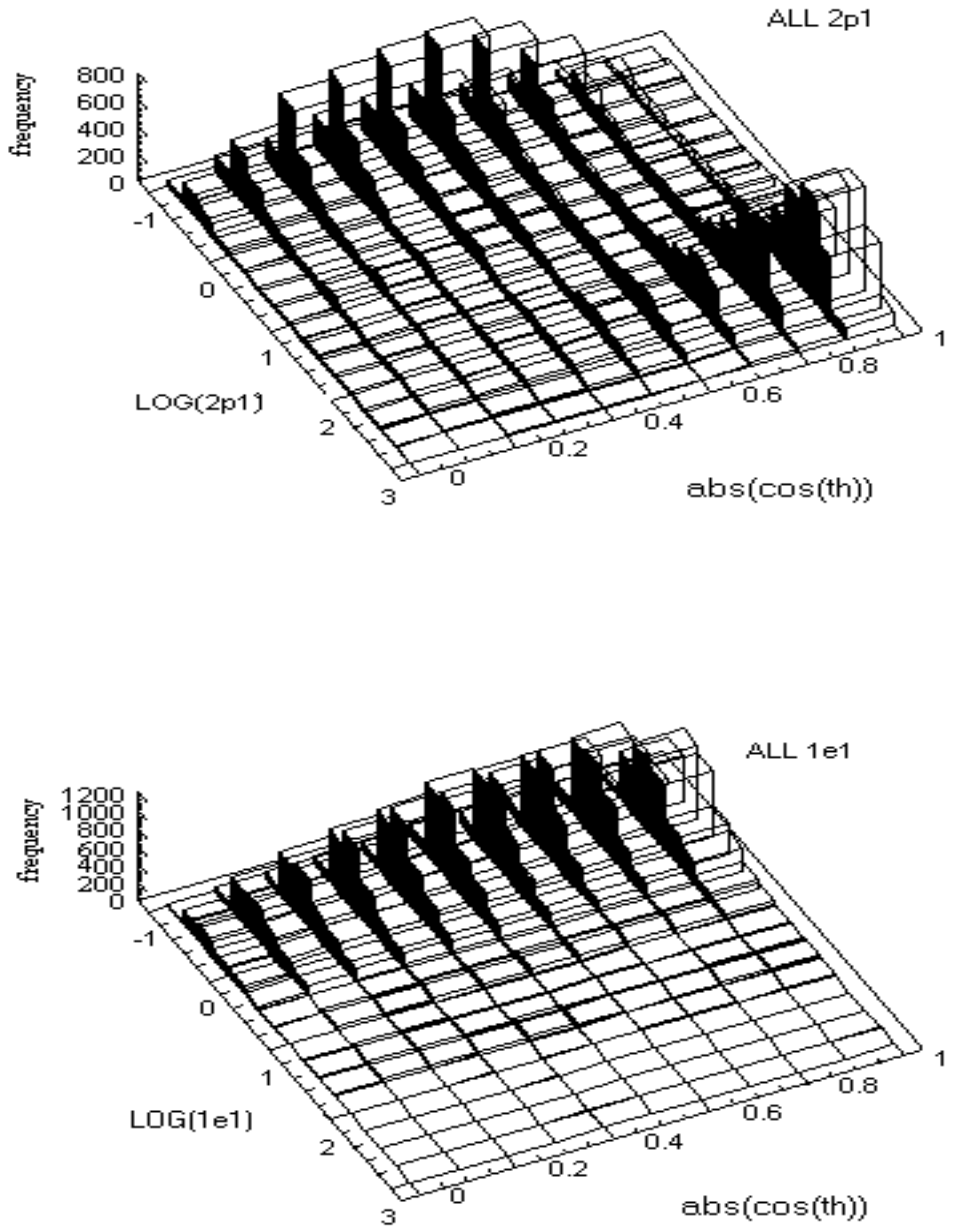

Fig. 3. Distribution of the 2 minute averages of logarithm of ion and electron fluxes observed in the region upstream of the Earth's bow shock by DOK-2 instrument on Interball-1 (tail probe) during 4 years. The upper and lower panels display the ions (20.6 to 26.7 keV) and electrons (21.2 to 25.7 keV) respectively. It is apparent that high ion fluxes are more frequently observed for quasi-parallel geometry than for quasi-perpendicular one. Th is the angle between the magnetic field line vector and the normal to the bow shock at the model connection point. The electrons do not indicate such type of dependence. Altogether ~25000 measurements are reviewed.

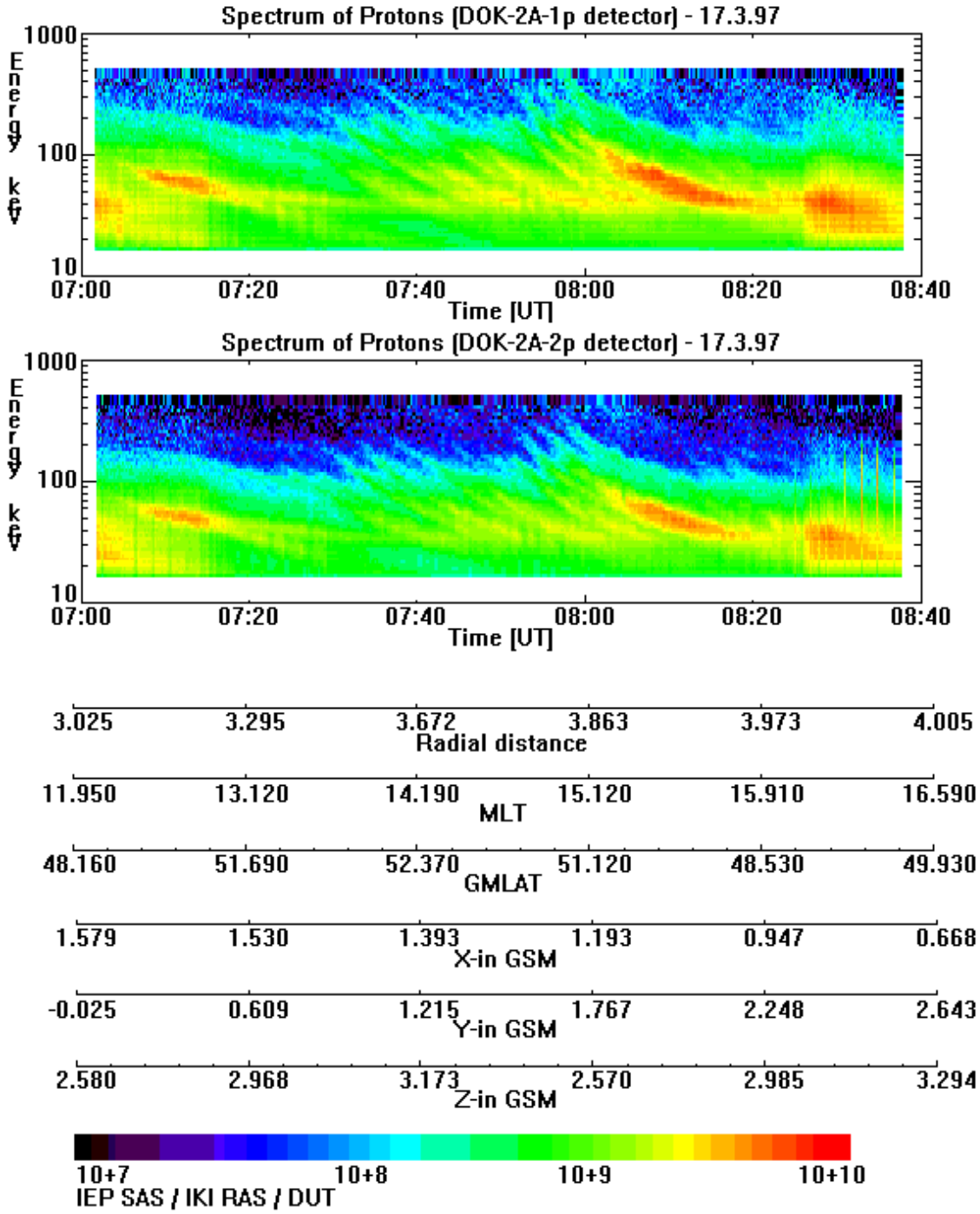

Fig. 4. Example of sequence of dispersive events of ions observed in the outer magnetosphere by DOK-2 on Interball-2 (auroral probe) in the postnoon sector of magnetic local time. The values correspond to $J(E)*E^3$, where J(E) is differential intensity (#/cm^2.s.ster.keV) and E is in keV.

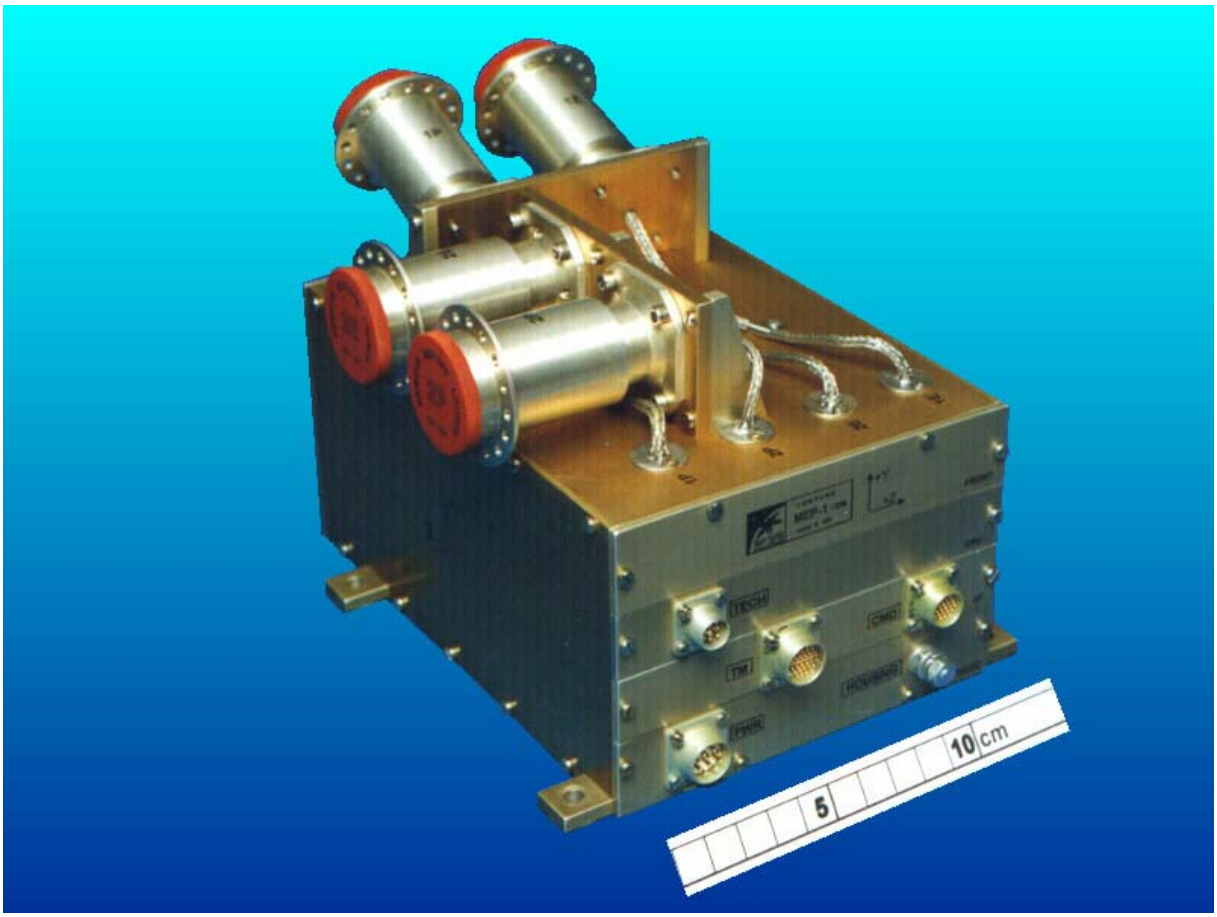

Fig. 5. Spectrometer of electrons and protons (MEP-1) developed, constructed and tested at IEP SAS Košice in the collaboration with scientists in abroad. The device was originally scheduled for the satellite of the project COMPASS. It is a relatively simple monitoring type of instrument for measurements of energetic electrons and ions (tens of keV up to several MeV) with high flexibility of the measurement modes. It can be used e.g. for the microsatellites or for another missions (scientific and well as commercial satellites) for monitoring of flux and energy spectra of energetic particles with relevance to space weather effects.

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