THE FRENCH-RUSSIAN 3 SATELLITE $\gamma$-BURST EXPERIMENT*

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Abstract. A $\gamma$-burst monitoring network, involving an eccentric satellite and two interplanetary spacecraft, is planned for completion in 1977. The satellite in earth orbit will have 2 sets of scintillation counters with moderate spatial resolution, covering an energy range of 20 keV–1 MeV, and viewing about $2\pi$ steradians. Each of the interplanetary probes will have one set of scintillation counters. The intersatellite timing accuracy will be about 10 ms, which will permit the determination of the arrival direction within about 5 arc min. Special attention is given to fine time resolution and the detection of bursts with relatively long onset times.

The gamma-ray burst experiment described in this paper is being developed as part of a continuing French–Russian program of scientific cooperation; it is an outgrowth of the SIGNE I project (Melioransky et al., 1975; Albernhe et al., 1975), which was launched successfully aboard a Prognoz satellite, for the study of solar gamma-ray emission. The burst experiment, which will become operational in 1977, involves one Prognoz satellite in an eccentric earth orbit, and two interplanetary spacecraft. The Prognoz experiment is designated SIGNE II M P, and the interplanetary experiments go by the designation SIGNE II M S.

The primary scientific objectives of this experiment are the following:

1. The determination of the direction of arrival of gamma-ray bursts with a precision of about 5 arc min by triangulation.

2. To study the fine time structure of bursts, with a time resolution of 15.6 ms, or for very strong bursts, 1.95 ms.

3. To study the evolution of the energy spectrum of bursts in time, in the energy range 20–1000 keV, and with a time resolution of 0.25 s.

Figure 1 shows the SIGNE II M P (Prognoz) experiment. The spin axis of this satellite points towards the Sun, and the detector assembly ‘S’ is placed on this sunward side. On the side of the satellite there is a lateral detector assembly ‘L’ which consists of two X-ray telescopes, one collimated in the solar, and the other in the...


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Fig. 1. The Prognoz (Earth orbit) experiment. The spin axis (axe de spin) points towards the Sun (Soleil).

antisolar direction. The sunward detector consists of an NaI crystal 37 mm thick by 90 mm in diameter, whose light output is viewed by a photomultiplier in anticoincidence with an 8 mm plastic jacket. This assembly views a solid angle of about $2\pi$. In the burst mode of operation, the main detector signal goes into a 6-channel pulse height analyzer covering the range 80–1000 keV.

The two telescopes of the lateral assembly are identical, each consisting of a 14 mm thick, 38 mm diameter NaI crystal in a CsI(Na) well which collimates the field of view to 20°. The main detector signals are analyzed in a 6-channel PHA covering 20–280 keV, when a burst is detected.

Each interplanetary spacecraft will carry two detectors, identical to the type 'S' described above, placed so as to cover a 4$\pi$ solid angle. Spectral analysis is done by a 5-channel PHA covering the range 80–800 keV, when a burst is detected.

The entire burst experiment thus consists of seven detectors, and each detector has several different modes of operation, that is, several different ways in which the associated memory circuits can be used. The most important is the burst mode of operation; the burst detection system is illustrated schematically in Figure 2. Here a detector has been turned on at time $t_0$; the background is sampled for 32 s up to time $t_0 + 32$ s. Starting at time $t_0 + 64$ s, the detector count rate is sampled for periods