

Fig.1. Time profiles of 9.1 GHz radio- (Curve) and high energy γ -ray emission (histogram) and suggested function of neutron production (lines) during the 15 June 1991 solar flare. Neutron production function: 1 - the only act of proton acceleration followed by trapping; 2 - proton acceleration at the post-impulsive phase of the flare; 3 - proton acceleration at the impulsive phase.

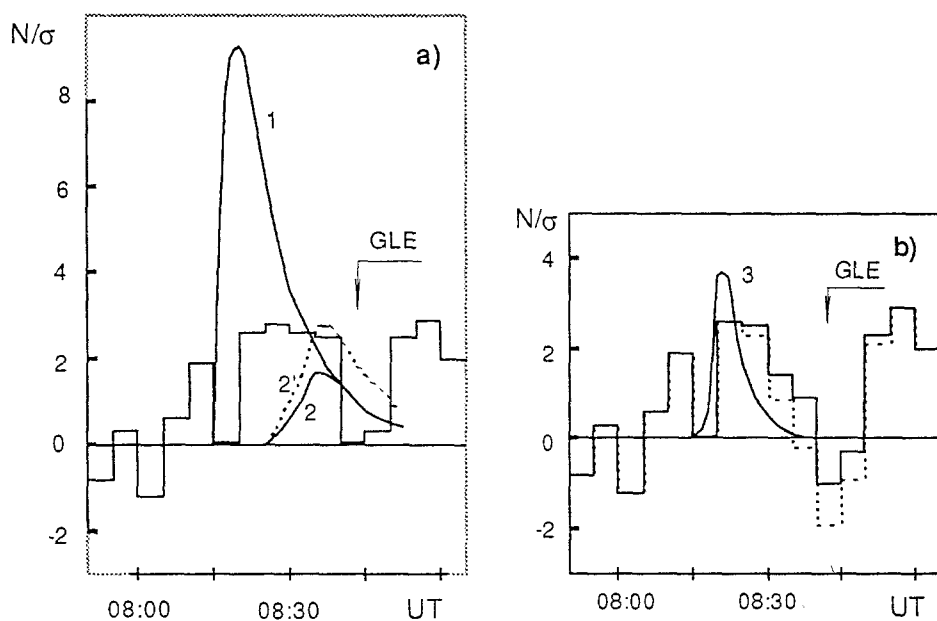


Fig.2. Detected (the histogram a) and calculated (curves) response of Alma-Ata neutron monitor for neutrons from the 15 June 1991 solar flare. The histogram b) is the rest of the detected response when the calculated one (Curve 2 or 2' in Fig.2a) is subtracted. Numbers of curves correspond to numbers for the neutron production function in Fig.1.

We consider this rest to be caused by neutrons produced at the impulsive phase of the flare. We calculated expected response of the monitor for those neutrons under the assumption that the neutron spectrum was $N(E) \sim \exp(-E/E_0)$. We suggested that the temporal behaviour of the neutron production function at the impulsive phase followed the time profile of microwave radio-emission (see Curve 3 in Figure 1). The calculated response fits the rest of recorded Alma-Ata count rate when the neutron spectrum is soft enough ($E_0 < 100$ MeV) because there was no significant response during 08:15-08:20 UT interval. The total number of the neutrons injected from the Sun during the impulsive phase was $N(>300 \text{ MeV}) = (0.5 \div 2.0) \times 10^{27} \text{ sr}^{-1}$. For instance, Curve 3 in Figure 2b shows the calculated response for $E_0 = 50$ MeV and $N(>300 \text{ MeV}) = 1.0 \times 10^{27} \text{ sr}^{-1}$.

4. CONCLUSION

The total response of Alma-Ata neutron monitor for solar neutrons (08:15-08:40 UT) from the 15 June 1991 solar flare can be explained under the assumption of two acts of neutron production at impulsive and post-impulsive phases of the flare. These acts correspond to two acts of proton acceleration. The first acceleration act took place at $\approx 08:15$ UT and the spectrum of the primary protons was rather soft. The second acceleration act was at the post-impulsive phase of the flare as it was proposed earlier (Kocharov *et al.*, 1994). It is interesting to note that the spectrum of protons accelerated during the impulsive phase of the 1991 June 15 flare turned out to be rather similar to the spectrum which was discovered recently (Kocharov *et al.* 1994a) for protons accelerated in the beginning of the 1990 May 24 flare. Thus, in comparison with the 24.05.1990 flare the 15.06.1991 flare demonstrated presence of additional acceleration of high-energy protons at the post-impulsive phase. This conclusion is in favour for the idea that a number of acceleration processes may take place. However their relative contribution varies with class of a flare.

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