The Solar Flare on 9 July 1996 : Preliminary COMPTEL Results

11 August 1996, UNH G. Rank

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Introduction

During the year 1996 the sun is in the minimum of its activity cycle. However, on 8 July 1996 the active region AR-7978 evolved into a complex δ-configuration. During the next days it produced a number of flares, including 2 M-class and 1 X-class events. It rotated off the visible disk on 13 July.
A part of this active period happened during CGRO observation period 523, when the Sun was within the FOV of COMPTEL (primary target was the Orion region). Particularly, the X2.6 class flare on 9 July happened shortly before re-orientation to observation period 524. The GOES-9 spacecraft gives start and peak times of the SXR emission to be at 09:05 and 09:11 UT. The flare occured in the COMPTEL FOV at COMPTEL coordinates Zenith = 38.2, Azimuth = 353.5.

Preliminary COMPTEL Results

We used the "Rapid Burst Response" which was implemented at UNH by Marc Kippen as a fast response tool to GRBs, to produce preliminary results within about 2 days. Some of the figures shown here were presented at the COMPTEL Team-Meeting held 23-26 July in Munich and figures 2b and 4b went into the CGRO Senior Review presented by Neil Gehrels in Washington on 29 July 1996.

Figure 1 (a) shows the time profile in the whole COMPTEL energy range. The middle curve (purple) and the lowest curve (green) give the raw signals during the flare and background interval, respectively. The flare signal is also shown after the correction of livetime effects (red curve). The used selection criteria are indicated. The Earth Horizon Angle was allowed a wider range as the flare occurs shortly before sunset. In figure 1 (b) the resulting signal, corrected for livetime effects and background subtracted, is given with 1σ statistical error bars. We use background periods that are 15 and 16 orbits apart from the flare. In this case only two background periods from the day before the flare are available, as the satellite was re-oriented shortly after the flare.

Figure 2 (a) shows the raw count rate spectrum for the time interval 9.125 to 9.40 UT. The livetime corrected flare and background data are given in the same color-coding as in figure 1a. The resulting count rate spectrum is shown in figure 2 (b). The 2.2 MeV line is clearly present, but one bin low in energy. The features at 1.25 MeV and 1.5 MeV do not correspond to any expected line. The dominant lines expected in this region are at 1.37 MeV (^{24}Mg) and 1.64 MeV (^{20}Ne). Above 3 MeV only one significant feature appears at about 6 MeV.

The livetime during this event (figure 3) declines to a minimal value of about 25%. As in the large solar flare events in June 1991, the livetime curve is driven by the veto-system. However, at the onset of the flare, the major limitation comes from the telemetry for the duration of one superpaket. This curve was compiled from IGSE data and the glitch at 33300 s might not be real.

In figure 4 (a) the profiles in the energy band 2.0-2.4 MeV and 4-7 MeV have been plotted separately. The 4-7 MeV emission occurs promptly within 50 s. The interval which is dominated by the delayed emission in the 2.2 MeV neutron capture line, is dragged out over at least 150 s. This appearance of the time profile resembles the flare on 24 October 1991.
Figure 4 (b) displayes the time profiles of both the telescope mode and the burst detectors (provided by Alanna Connors). The peak flux of the telescope occurs about 1 min after the simultaneous peaks in the burst modules. It has to be investigated, whether live time correction or unsuitable event selections are responsible for this shifting.

Remarks:
— we are able to obtain useful results of a flare within about 1-2 days.
— for the first time we see results from the Low Range Burst Detector for a solar flare event.
— the spectrum shows a number of line features, however, the line positions are not accurate.
— the peak times of the telescope and burst mode do not coincide.
— the flare occured at quite high zenith angle. Mark McConnell generated locatization pictures which give a quite elongated feature.

Further analysis:
— the results should be revised when the fully processed data files arrive from MPE.
— the event selections have to be checked. The largely open EHA might influence the time profile too much. It may also be an advantage to allow for a larger ARM restriction.

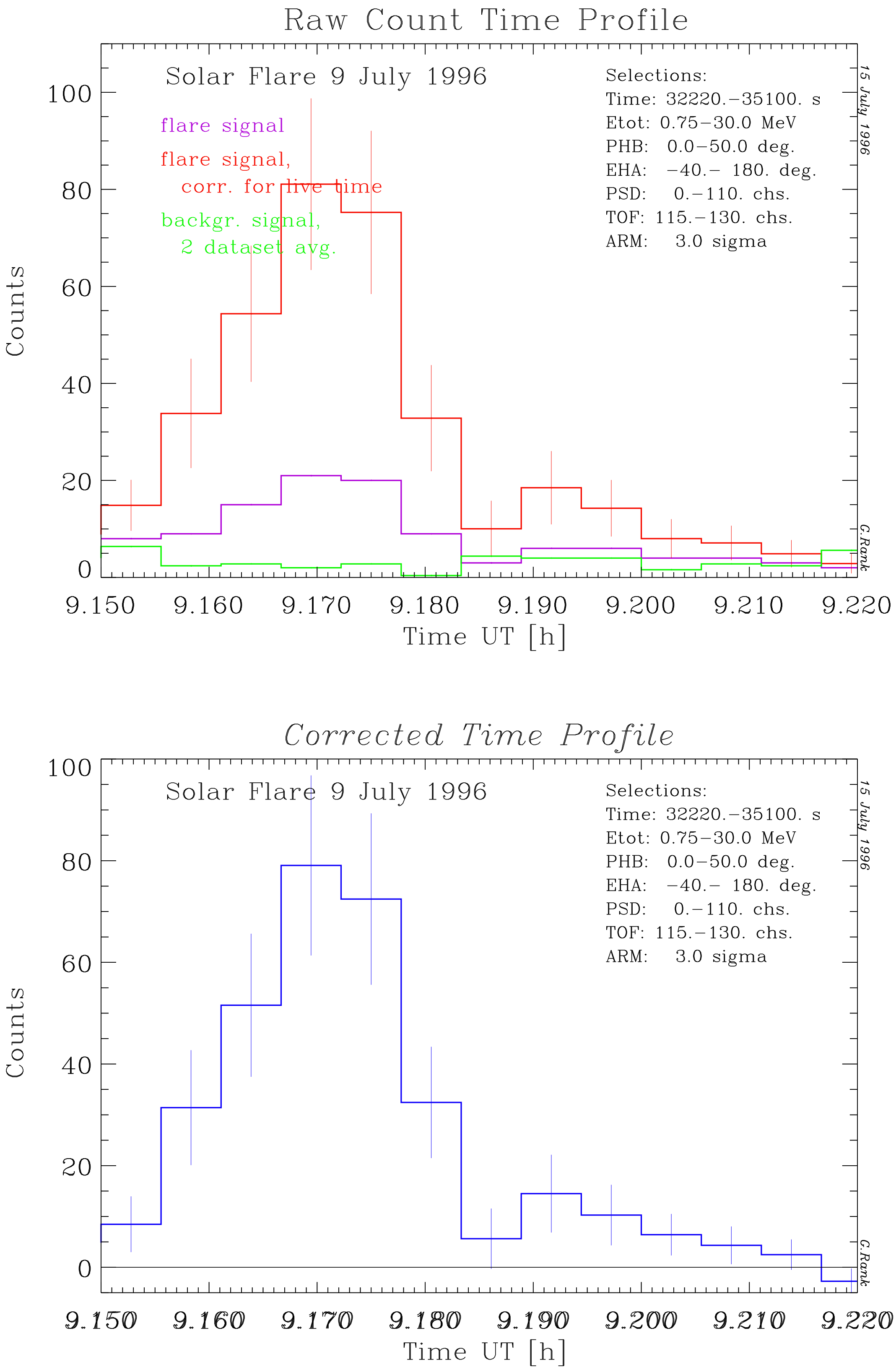

Figure 1: *Time Profiles in the Telescope Mode. Fig. (a) shows the raw data, fig (b) the livetime and background corrected counts.*

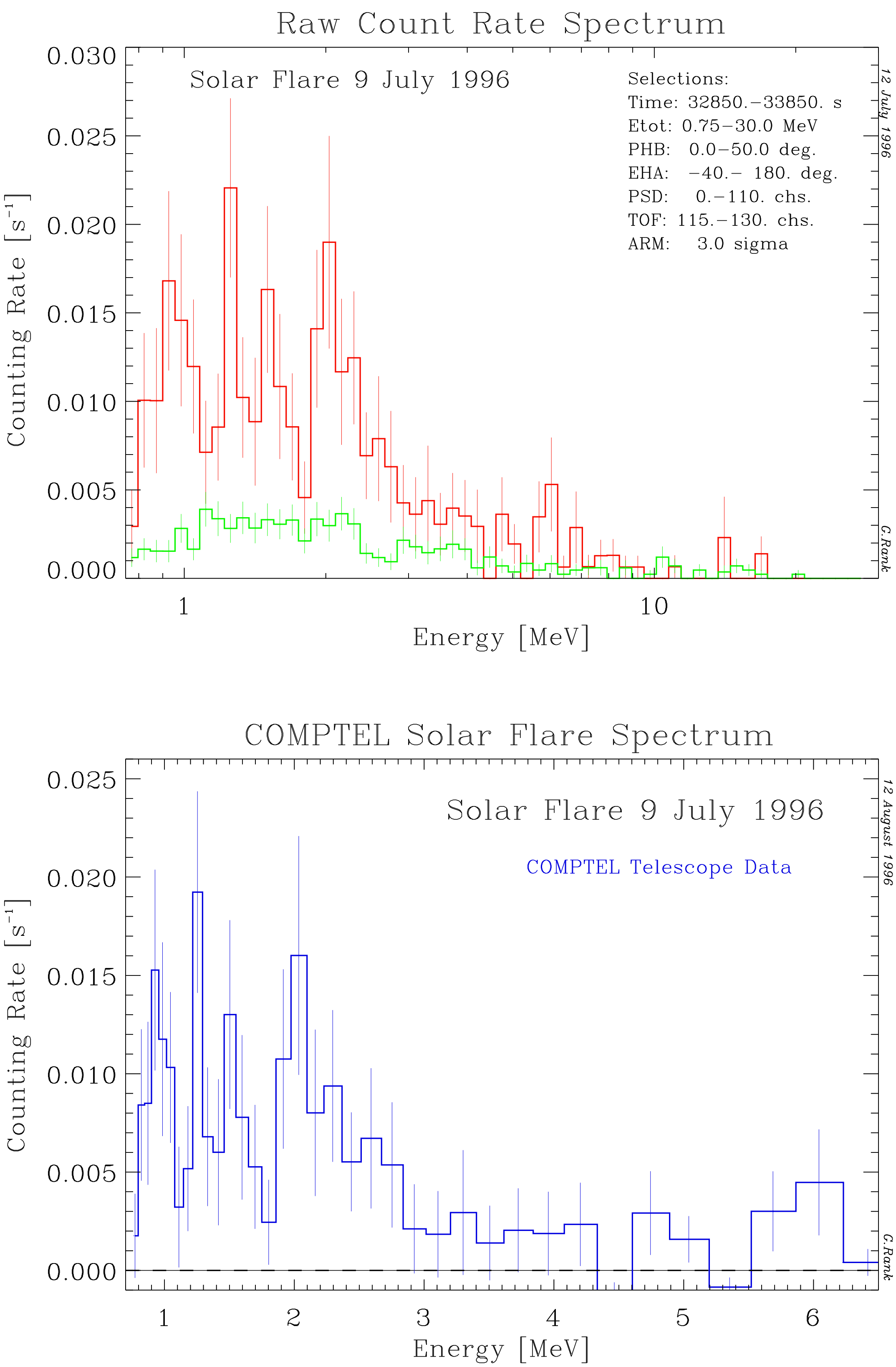

Figure 2: *Count Rate Spectra. Fig. (a) shows the raw data, fig (b) the livetime and background corrected counts.*

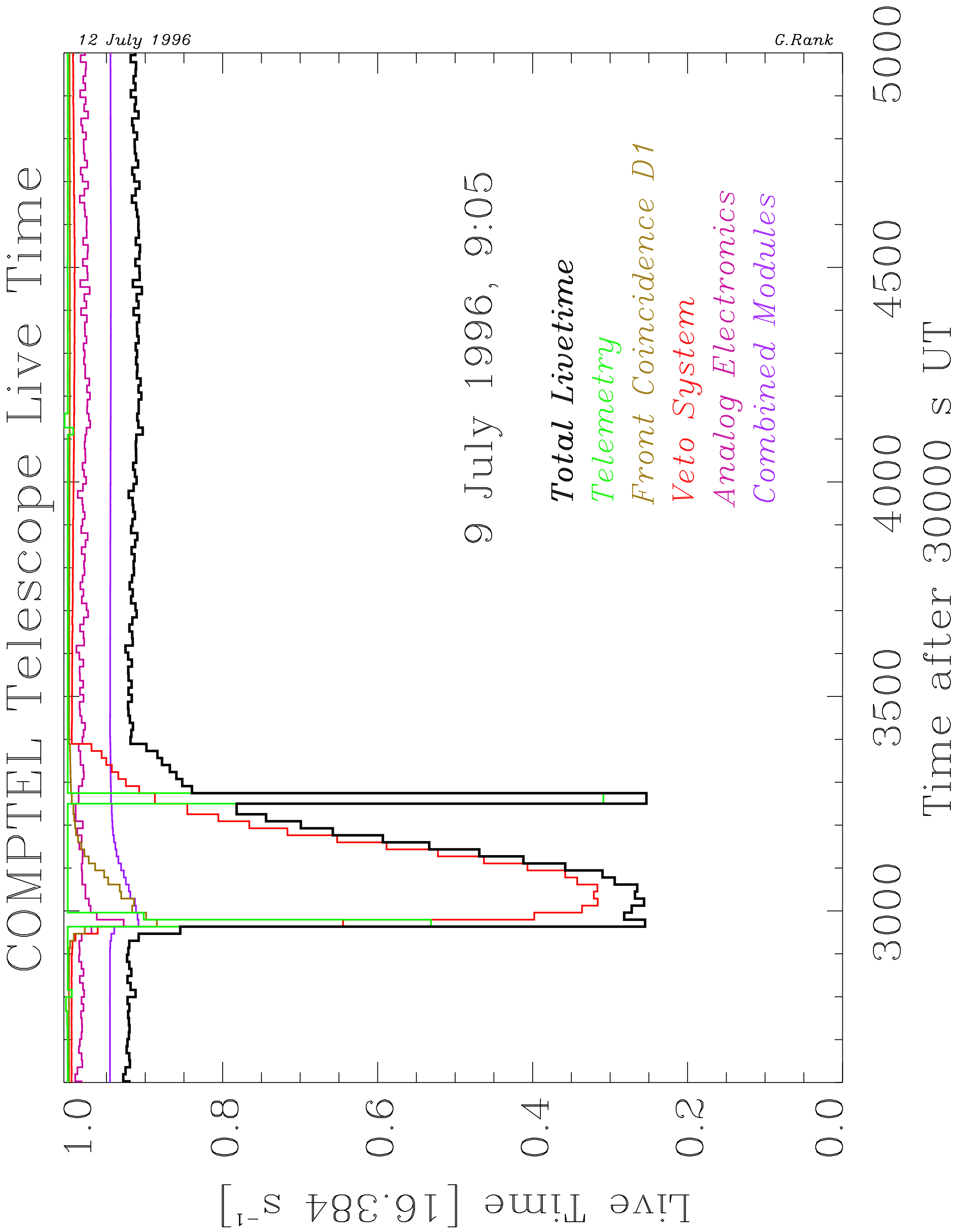

Figure 3: *Composite Telescope Livetime and the major contributors.*

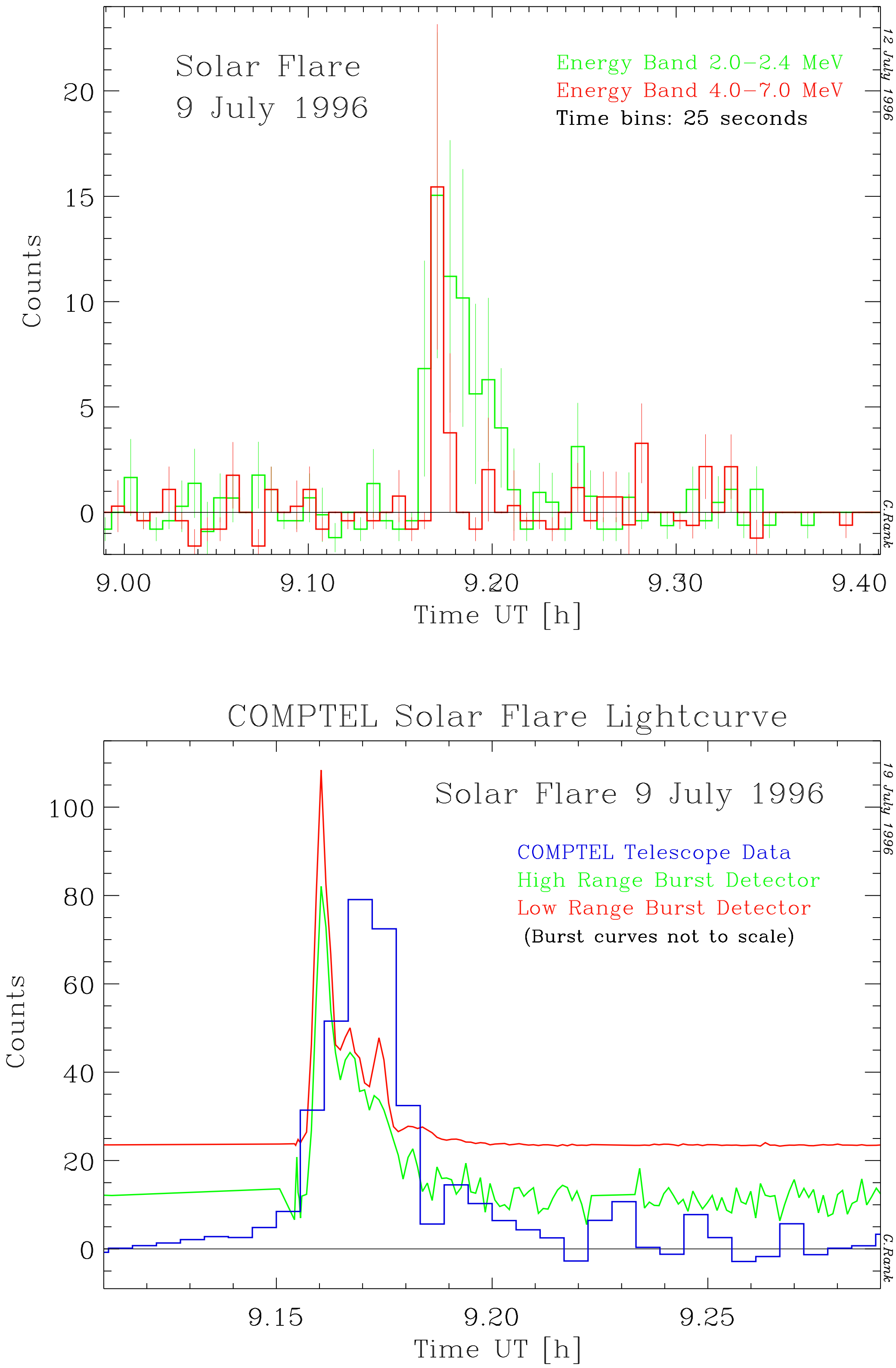

Figure 4: *Different Time Profiles of the Flare: Fig (a) shows the profiles in the 2.0-2.5 MeV and 4-7 MeV regions. Fig (b) compares the telescope time profile with the High and Low Range Burst Mode.*