COLLABORATIVE ANALYSIS OF SOLAR MAXIMUM MISSION, VENERA AND PROGNOZ SOLAR X-RAY BURSTS (NAG5-935)

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The investigators met once during the past six months, at Goddard Space Flight Center. Efforts centered on cross-calibrating the Solar Maximum Mission HXRBS detector with the Venera 13/14 cosmic gamma ray burst detectors. To be useful, such a cross-calibration should hold over a wide range of event intensities and spectral shapes. It was decided to concentrate on one solar flare (1982 February 5) which displayed such a wide range of spectral parameters.

The event was divided into six time intervals, and the best fitting SMM and Venera 13 spectra were calculated for each interval, using the individual fitting routines for the two instruments. (It is also possible to calculate a joint best fitting spectrum for the combined data of the two instruments, and this has been done for one of the six spectra on a trial basis.) The results are displayed in Figures 1–8. Figure 1 shows the time history of the event as detected by SMM, with the six spectral fitting intervals indicated. Figures 2–7 show the best fitting SMM and Venera 13 spectra for each of the six intervals. Figure 8 shows the joint best fit for the data of interval 5 only. From these figures, it can be seen that the difference between the two fits is quite small in some cases. Taking the ratio of the V13 flux to the SMM flux at 100 keV as an approximate measure, ratios as small as 1.01 are found (which are of course well within statistical errors), but also, ratios as high as 3 can be found. The reason for these differences is not completely understood, but it is suspected that they may be due in large part to the fact that the two time histories have not yet been accurately cross-correlated, and therefore the spectral fitting intervals may not correspond exactly between the two spacecraft. Figure 8 appears to support this idea, since the joint fit in this Figure (for interval 5) is clearly much better than the two individual fits for the same interval (shown in Figure 6): the difference between the two procedures involved a slightly different choice of time interval for the SMM data. (It should also be noted that this particular solar flare was not observed under ideal conditions for the SMM–V13 comparison, since the SMM/Sun/V13 angle was about 60°. While it is not felt that strongly anisotropic emission could account for the differences we see, it is still difficult to estimate the magnitude of this effect.)

In the near future, our efforts will be directed towards a careful cross-correlation of the SMM and V13 time histories. For this we will use a computer code which takes into account the position of the active region on the sun, and calculates the propagation of a spherical wave out to the spacecraft positions. We believe that the application of the correct timing will remove much of the discrepancy which we have observed.

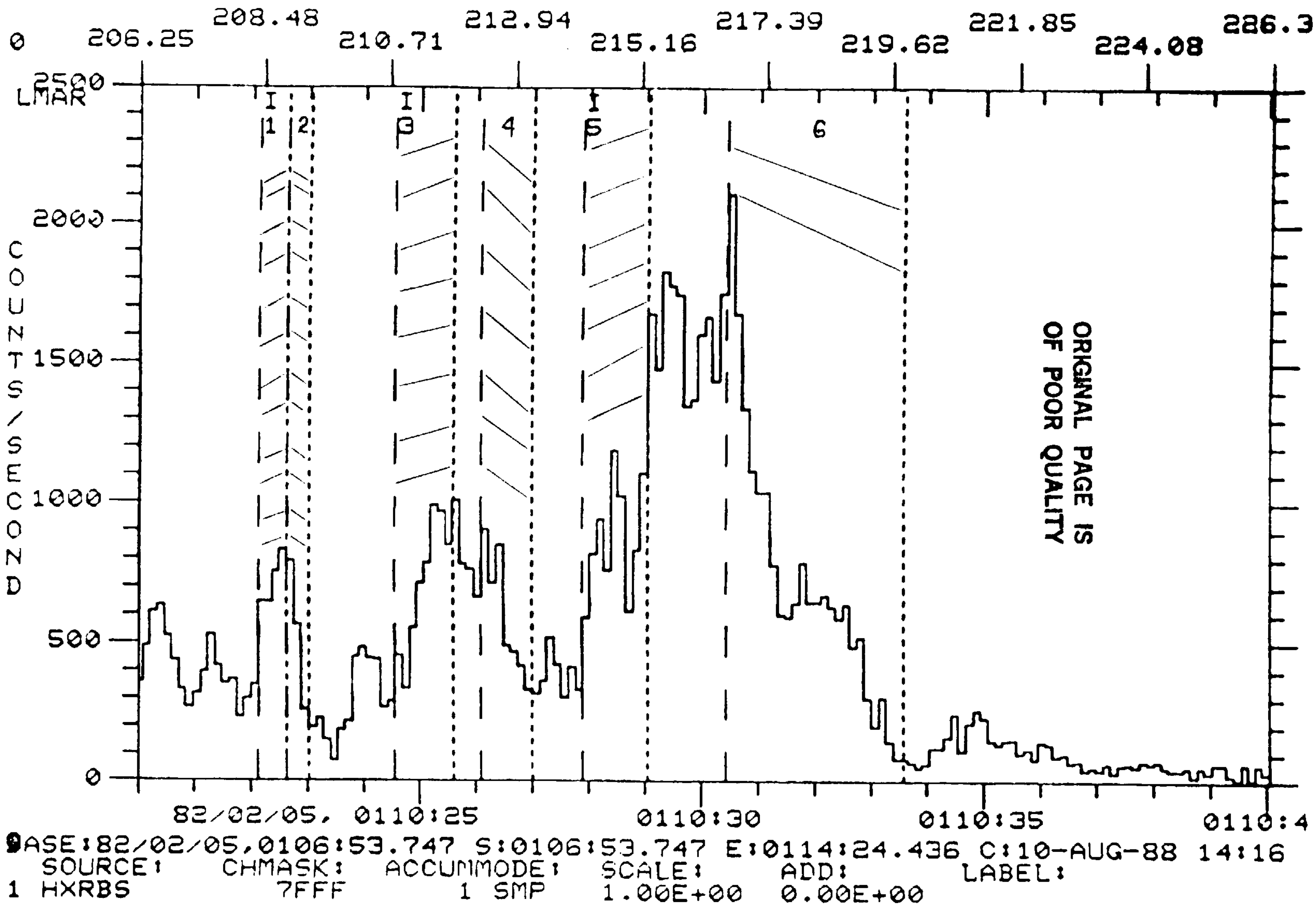

Figure 1. The time history of the February 5, 1982 flare in hard X-rays, as observed by SMM HXRBS. Six intervals are indicated; these are used for HXRBS and Venera 13 spectral fitting.

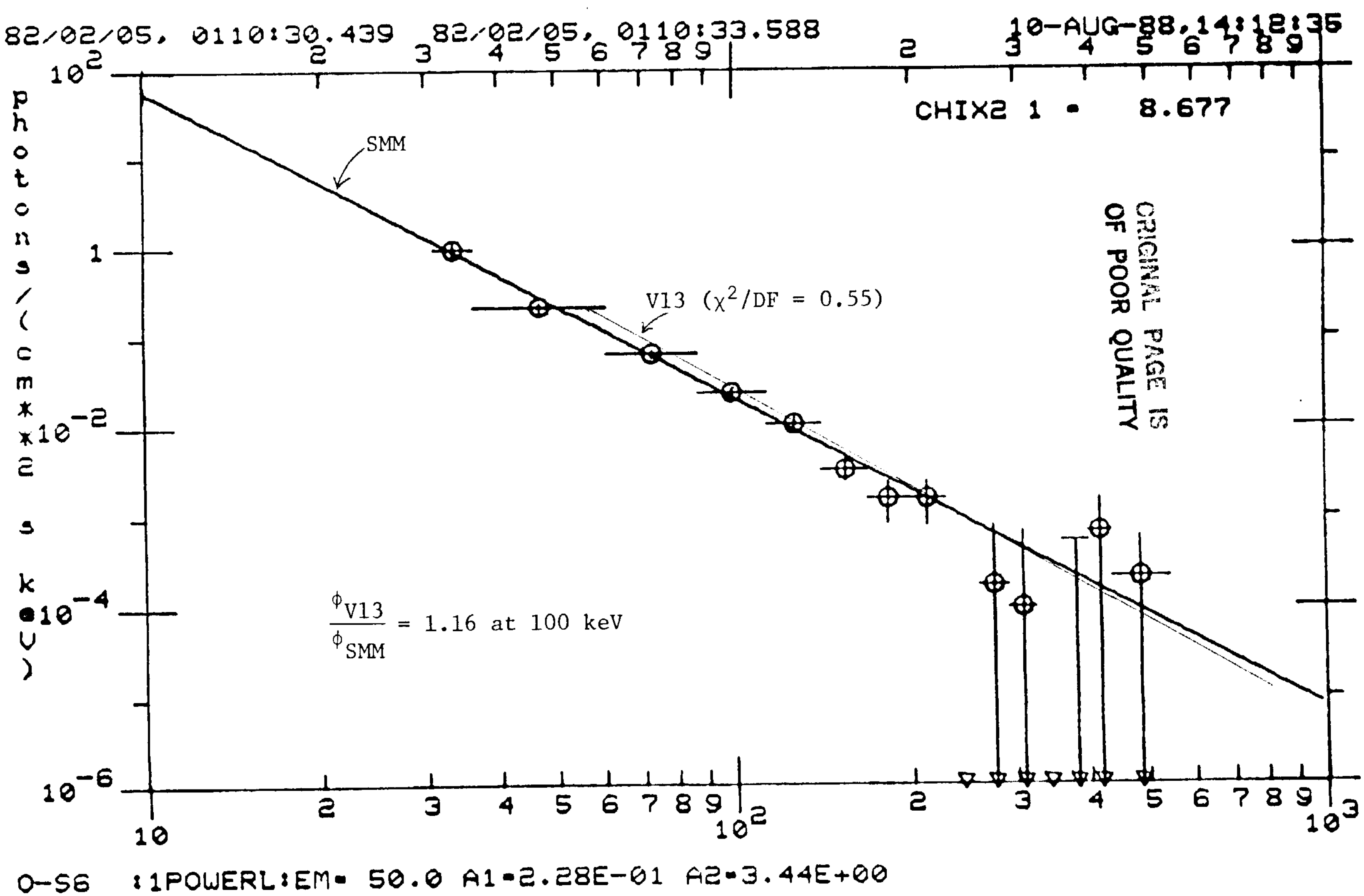

Figure 2. Best fitting energy spectra for interval 1, from SMM HXRBS and Venera 13. The agreement between the two is well within statistical errors.

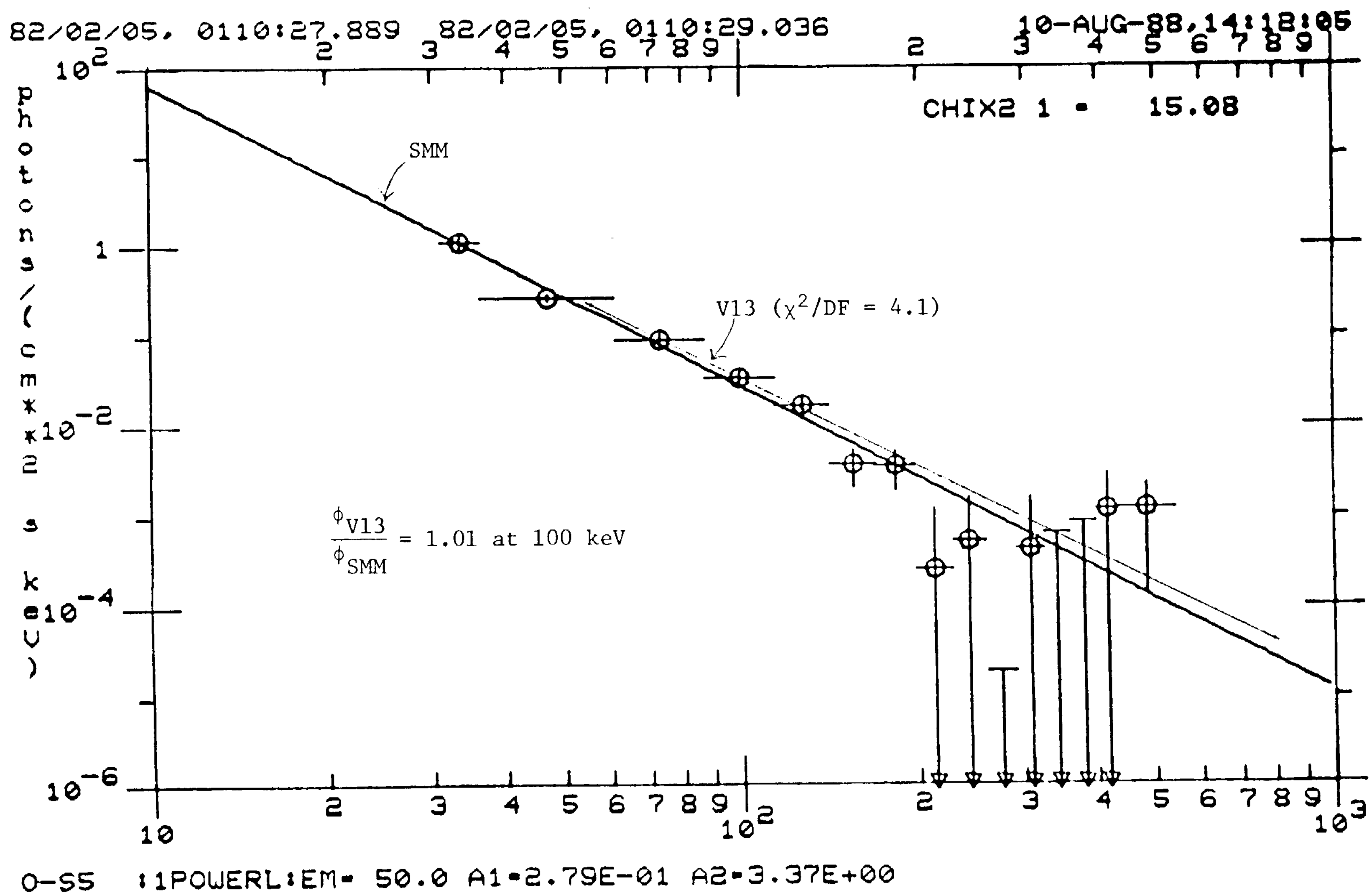

Figure 3. Best fitting energy spectra for interval 2, from SMM HXRBS and Venera 13. The agreement between the two is well within statistical errors, even though the Venera 13 fit has poor statistical confidence.

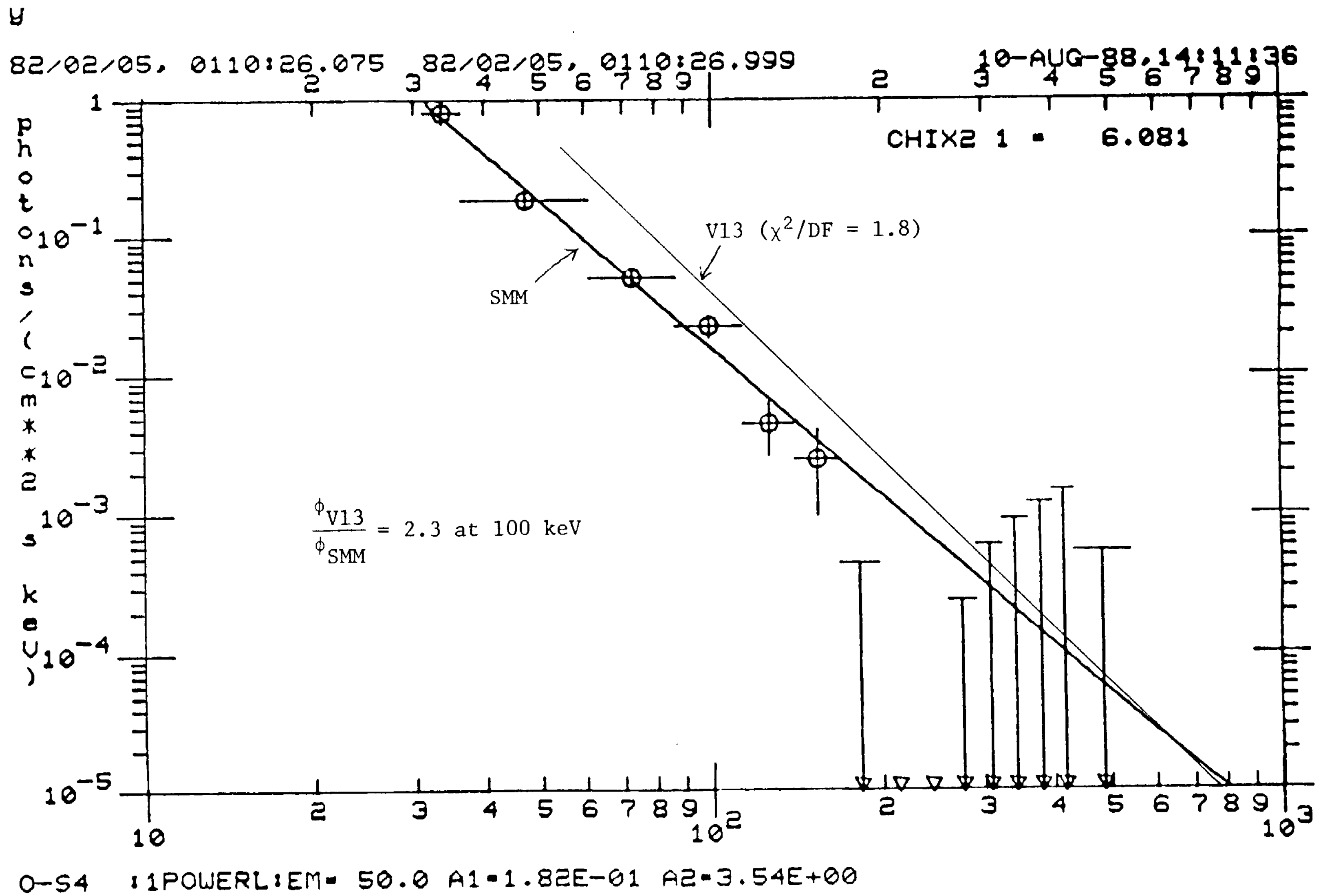

Figure 4. Best fitting energy spectra for interval 3, from SMM HXRBS and Venera 13. The agreement between the two is poor, even though the Venera 13 fit has good statistical confidence.

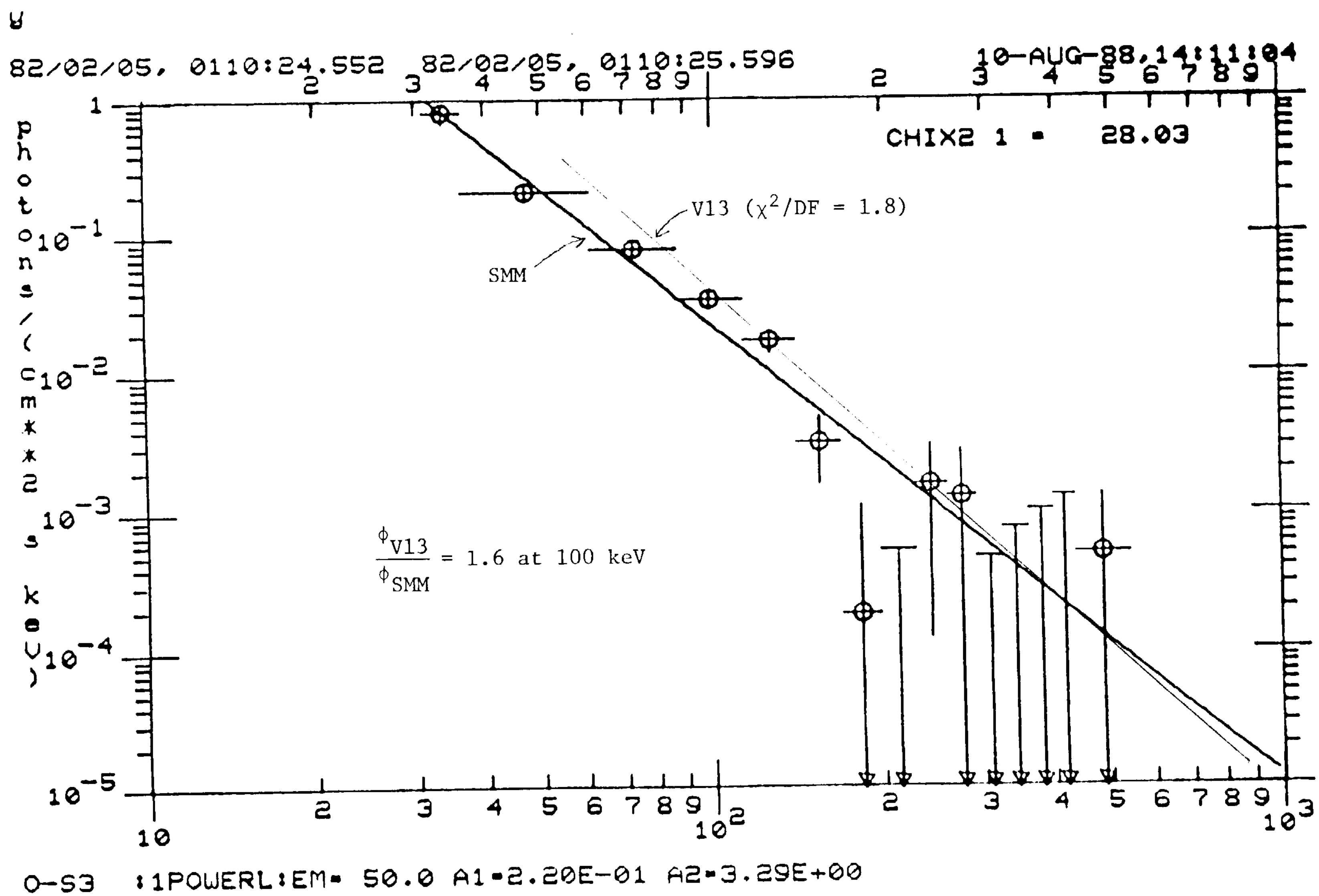

Figure 5. Best fitting energy spectra for interval 4, from SMM HXRBS and Venera 13. The agreement between the two is poor, although the best fitting Venera 13 spectrum agrees well with the SMM data points; the statistical confidence of the SMM fit is not good.

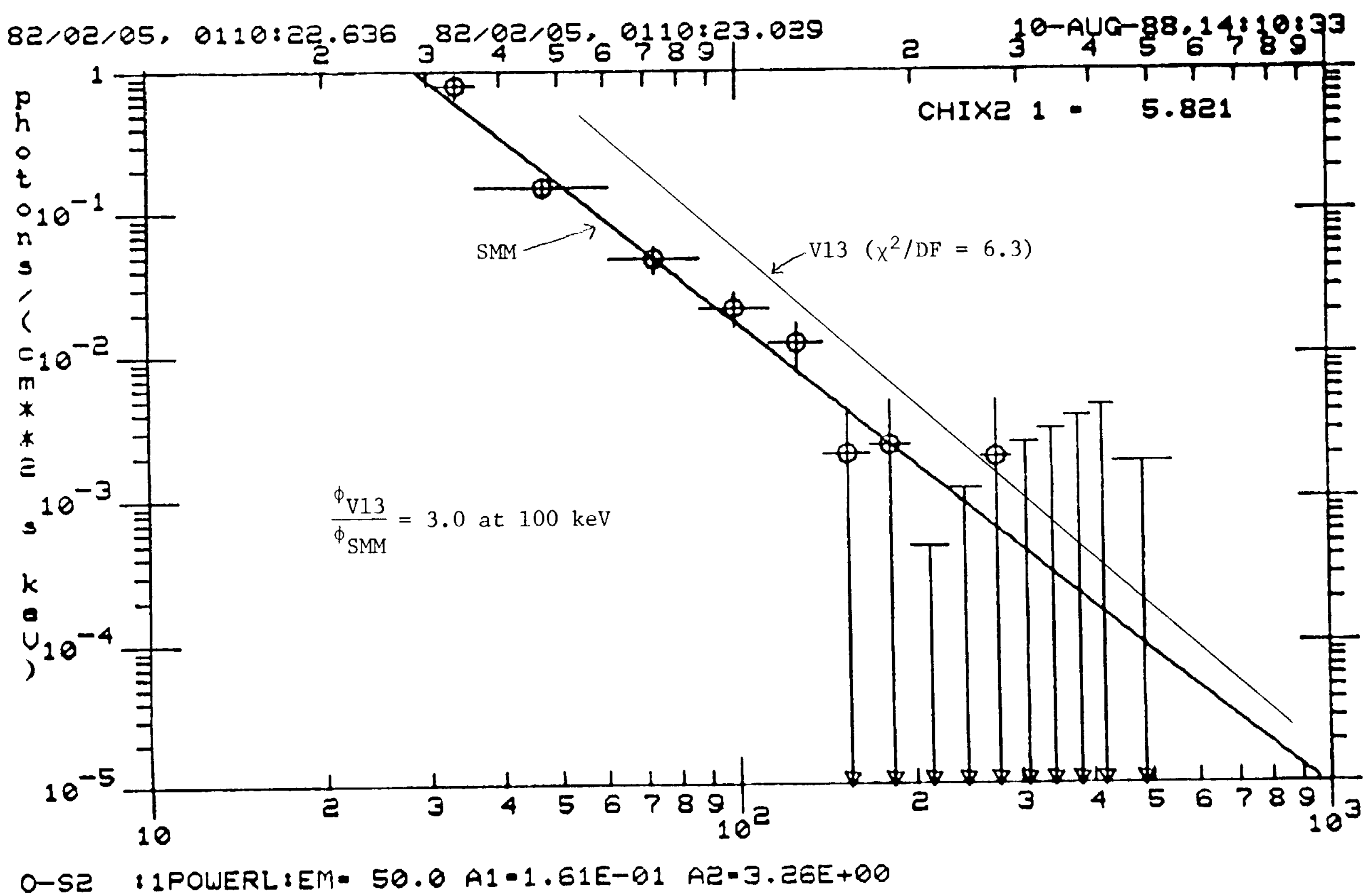

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Figure 6. Best fitting energy spectra for interval 5, from SMM HXRBS and Venera 13. The agreement between the two is poor.

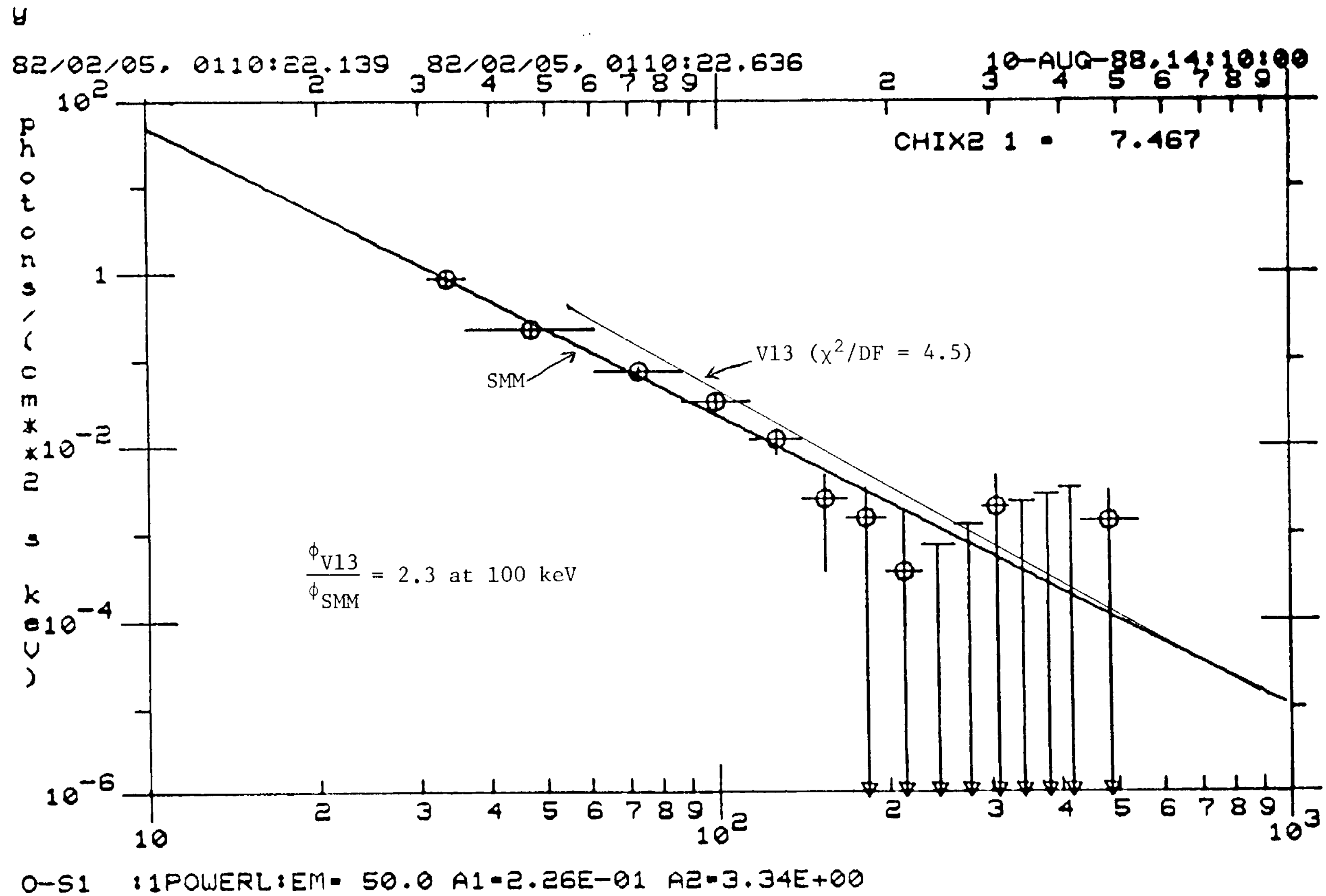

Figure 7. Best fitting energy spectra for interval 6, from SMM HXRBS and Venera 13. The agreement between the two is poor.

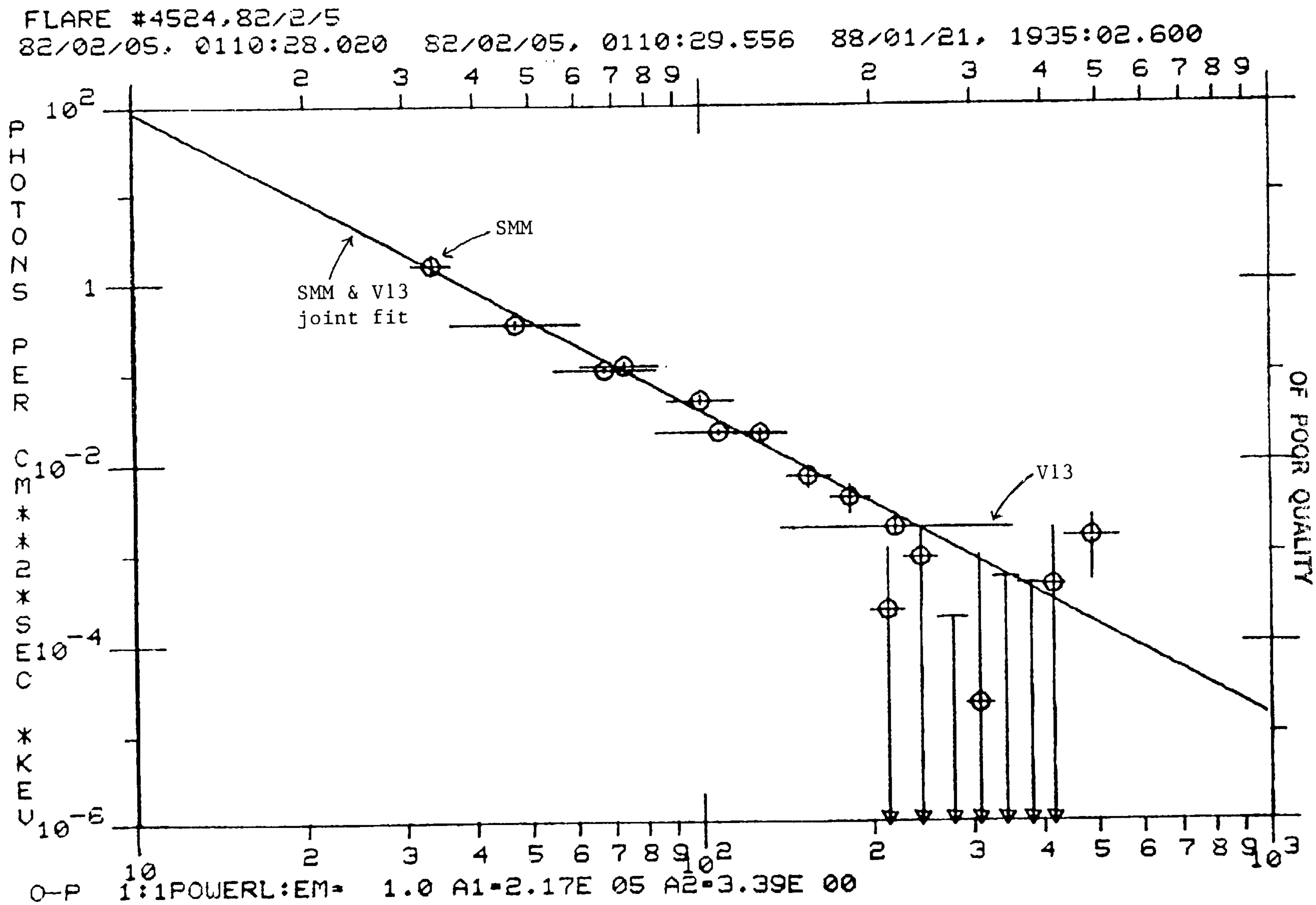

Figure 8. A joint best fit for interval 5, using both SMM HXRBS and Venera 13 data. This joint fit, which is excellent, should be compared to Figure 6, which shows the individual best fits, and displays poor agreement. The difference between the two is probably explained by the fact that slightly different SMM time intervals were used in these cases.