

HSP ISR #015  
 ORBITAL PERIODIC ERRORS IN HSP PHOTOMETRY  
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This is a brief description of the corrections I've applied to the 1094, 1099 and 1389 data to correct for known systematic errors in HSP photometry. The HSP is known to have a periodic effect related to the orbit of the HST. I have produced corrections based on the sidereal orbit of HST. The fit for the corrections is of the form:

$$\text{Offset} + \text{Amp} * \sin(\text{Orbphase} + \text{Phase}) - \text{Dt} * \text{Ramp}$$

Here the coefficients are Offset which represents approximately the mean of the data set about which the variations occur. Amp is the semiamplitude of the sinusoidal orbital effect. Orbphase is essentially the right ascension of the HST, and Phase is a simple phase adjustment for the sinusoid. Dt and Ramp represent the linear trend seen throughout most HSP data. Dt is just the time into the data collection in MJD and Ramp is a coefficient representing the slope of the ramp.

The fit used for the sets of data are included as plots of the data and fits to the data, and can be summarized by 4 parameters: The amplitude and phase of the sinusoid, the amplitude of the linear trend in the data, and the offset of the data.

They are:

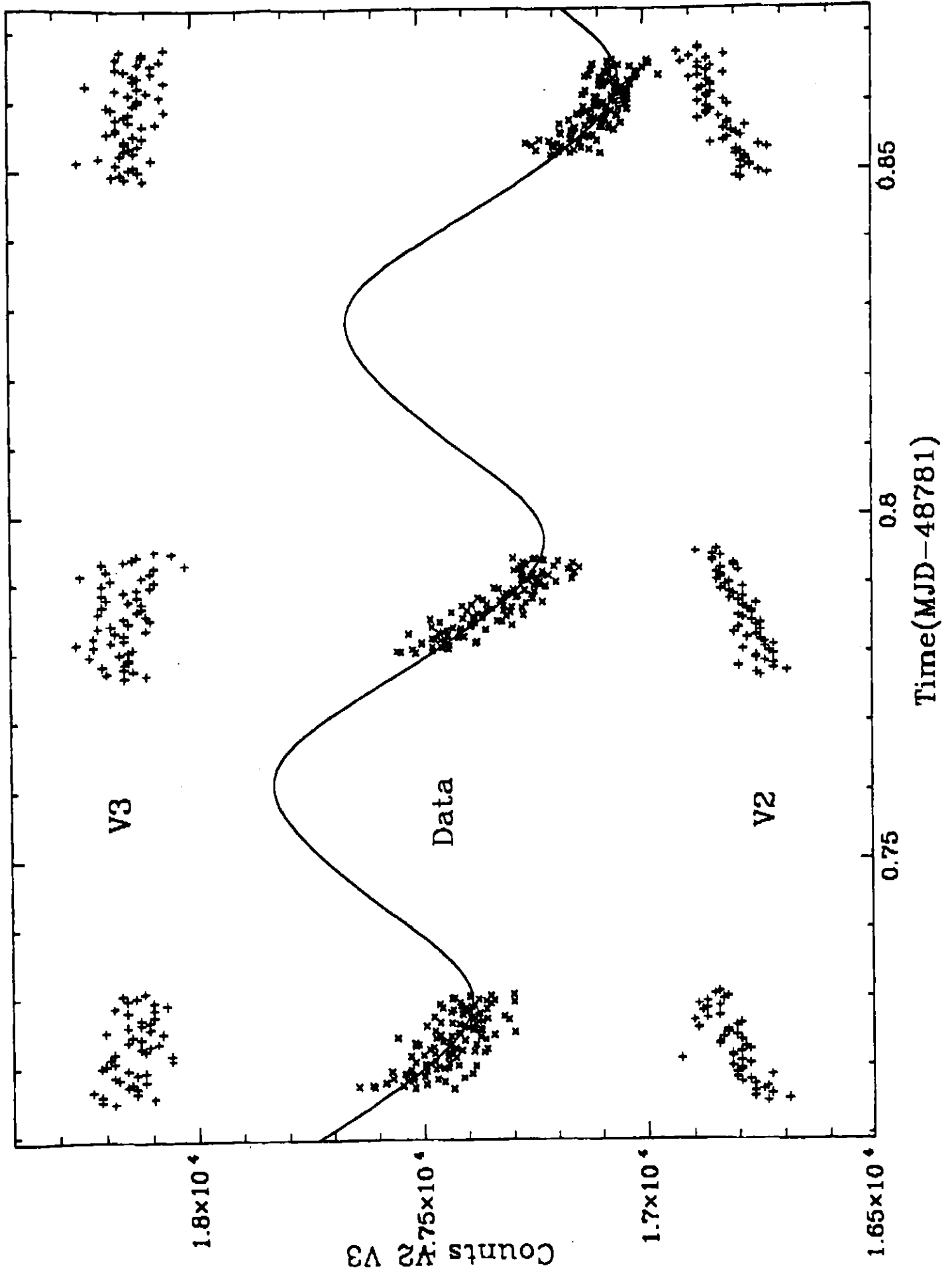
Observation	Amp	Phase	Ramp	Offset	Det/Filt	Object
1094 obs set 01:	260 C/S	4.4 radians	-2500C/day	17680	UV2/CLR_A	Cyg XR-1
1094 obs set 02:	422 C/S	4.6 radians	-1755C/day	18050	UV2/CLR_A	Cyg XR-1
1099 obs set 03:	1.4 C/S	4.3 radians	+25C/day	474	UV2/CLR_T	3C249.1
1099 obs set 04:	1.8 C/S	4.2 radians	-6C/day	79.4	UV2/CLR_A	NGC 6814
1389 obs set 01:	1800 C/S	0.7 radians	+13000C/day	177800	UV1/240_A	HD 60435

The corrected data are shown in plots along with two lines representing 1 sigma error as measured by the photon counts in the binned data. As can be seen for the 1099 and 1094 data they are corrected by the fit to within photon statistics. Also included on the plots of the raw data and fits to the data, are the PASS reported V2,V3 pointing of the telescope during the observations. In the case of the V2,V3 data, the axis is not plotted, but all pointing data are plotted with 0.2 arcseconds full scale on the plots.

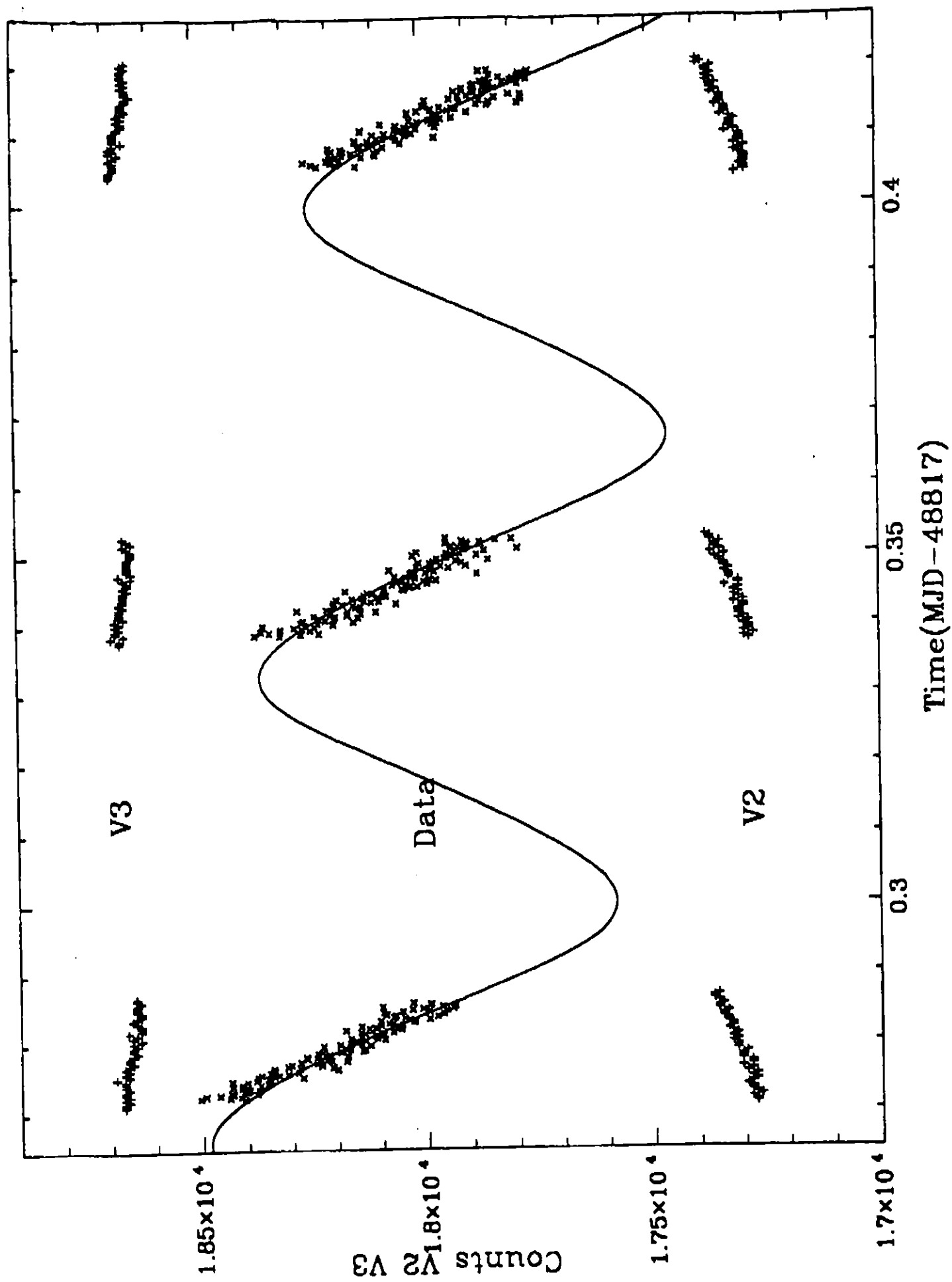
Of interest is the PASS reported V2 positions of the telescope. It can readily be seen that for the 1099 and 1094 data sets the telescope was reported to be drifting in position similarly to the recorded photometric drift seen in the data. It is not known at this time what the source of the position drift is. Also of interest is the lack of drift seen in the original 1389 PASS reported positions. The PASS report for this observation (1389) will be rerun since the original report was run almost a year before the other two tests.

When this problem was first explored the orbital effect was most likely thought to be due to thermal or power (Bus Voltage) effects related to the sunlit orbit of the HST. If this was the case then the period of the effect should be the synodic period of the HST's orbit. This is slightly different from the sidereal period used for these corrections. However, the 1099 and 1094 data span 140 days on the same detector and aperture. The difference in the sidereal and synodic periods should have shown up as a drift in the measured Phase for the four observations. Instead the phase was essentially the same for all four data sets, indicating that the effect is linked to the sidereal orbit of the spacecraft. Very few effects which could cause this problem are linked to the sidereal period of the HST.

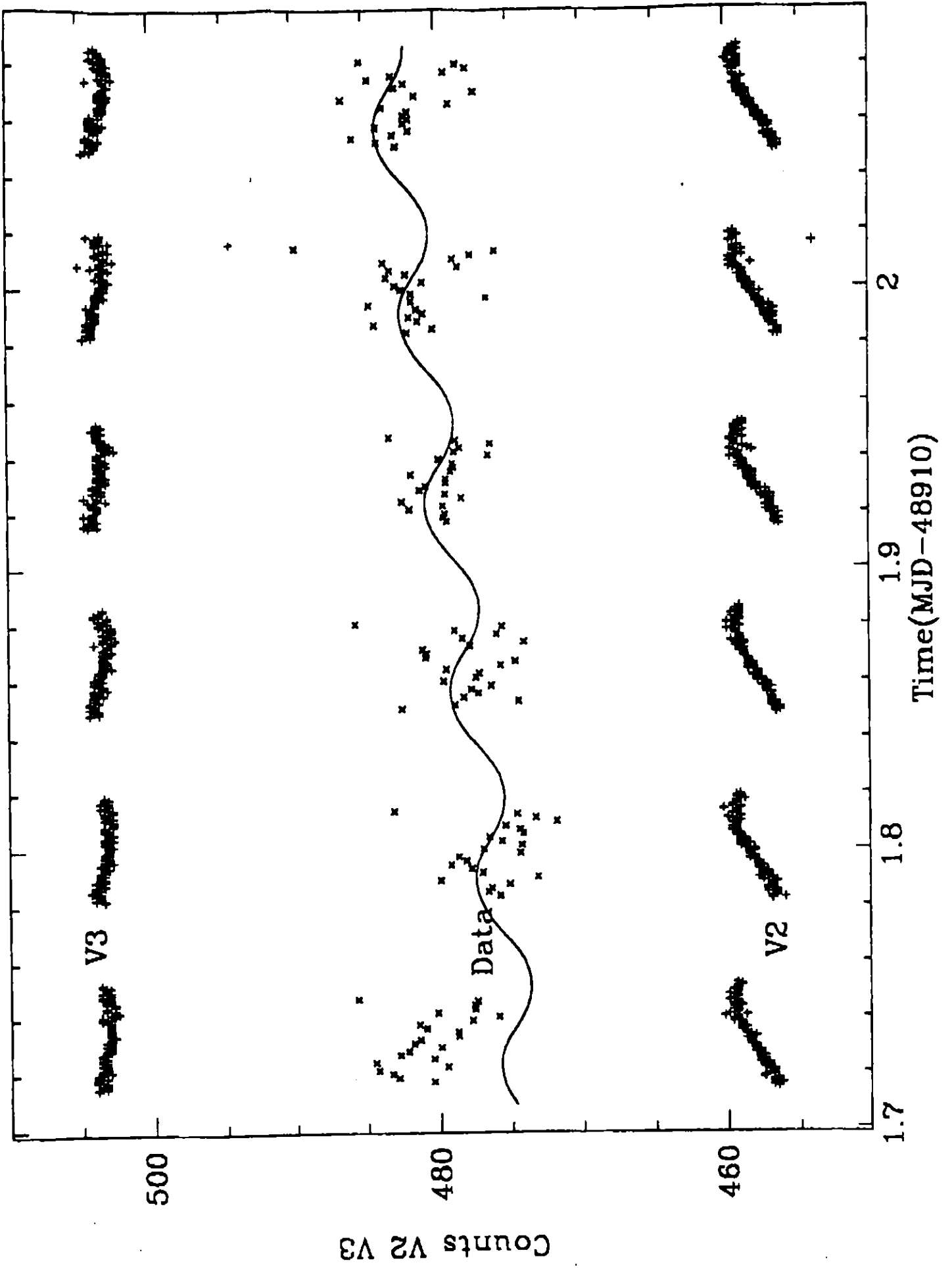
1094 Cyg XR-1 Data/V2/V3 Obs Set 01



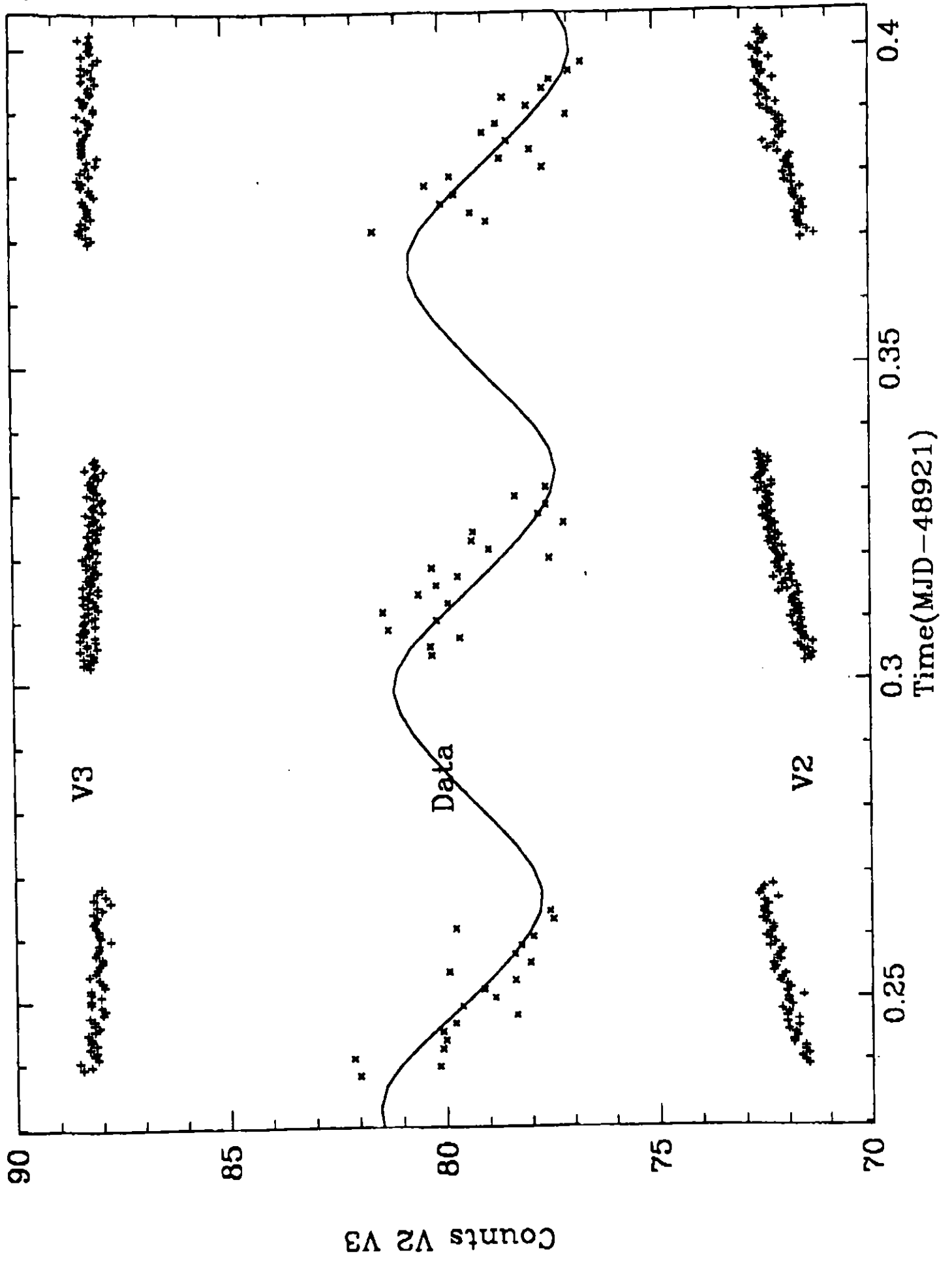
1094 Cyg XR-1 Data/V2/V3 Obs Set 02



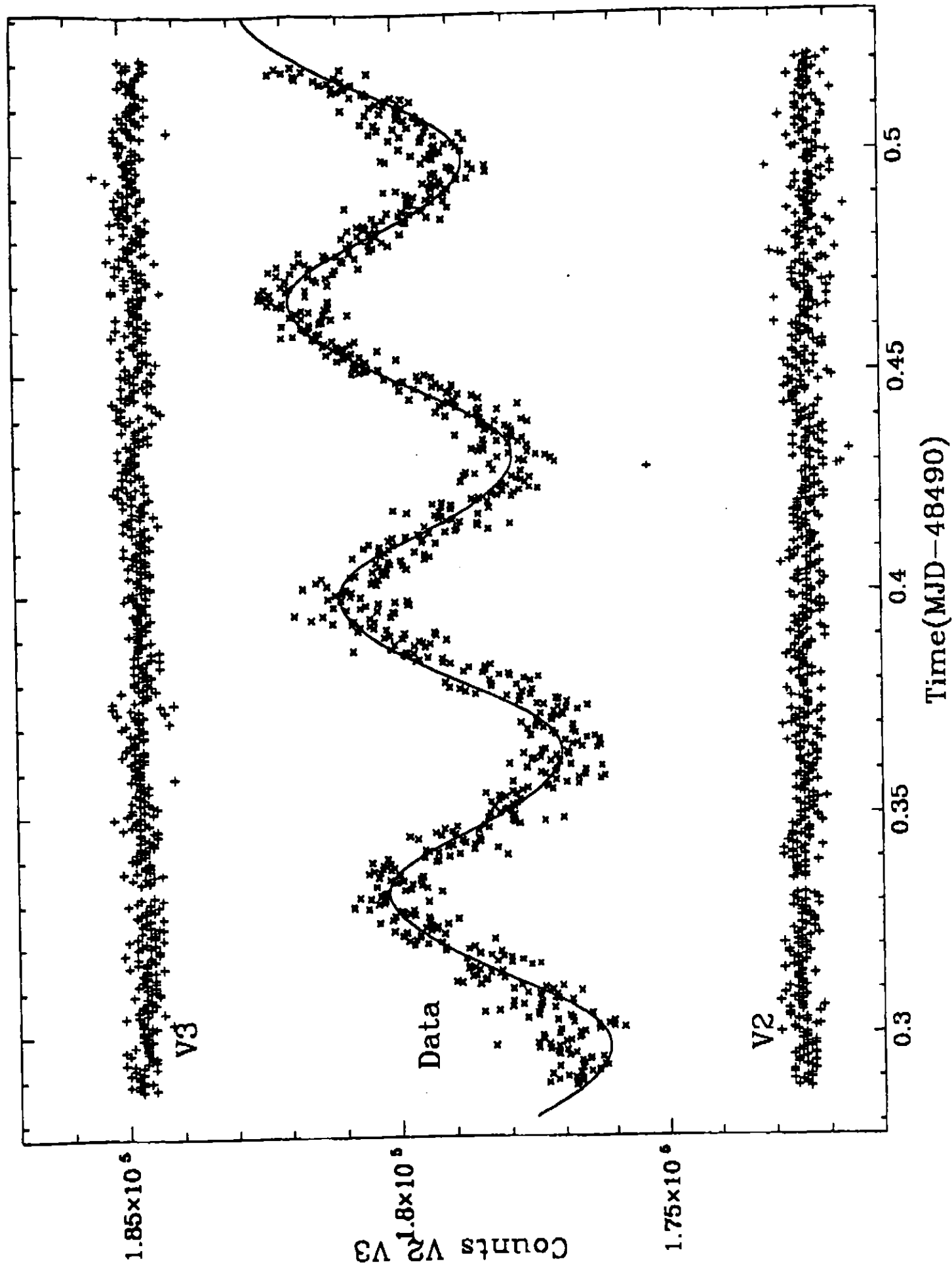
1099 3C249.1 Data/V2/V3



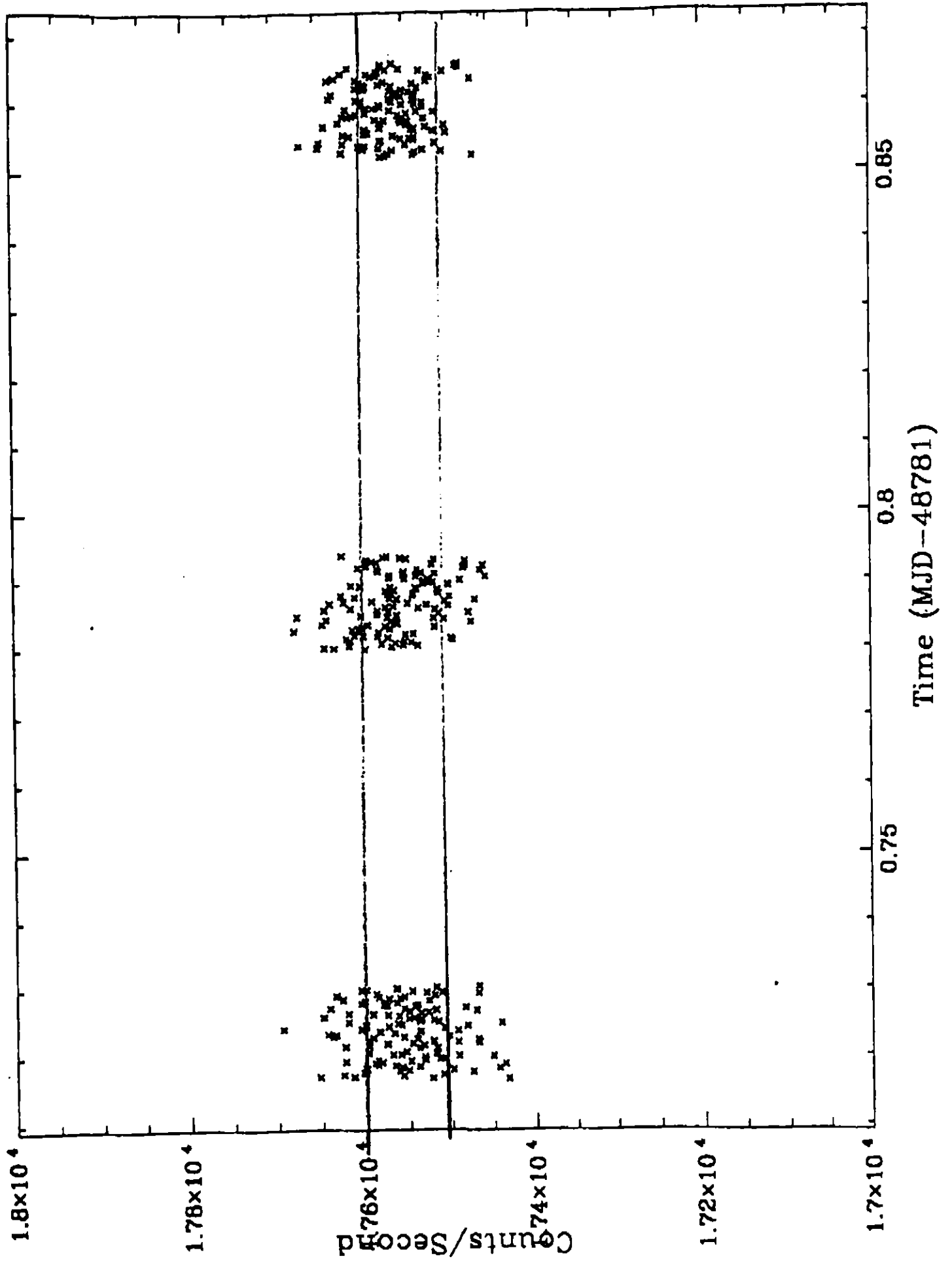
1099 NGC 6814 Data/V2/V3



1389 HD60435 Data/V2/V3

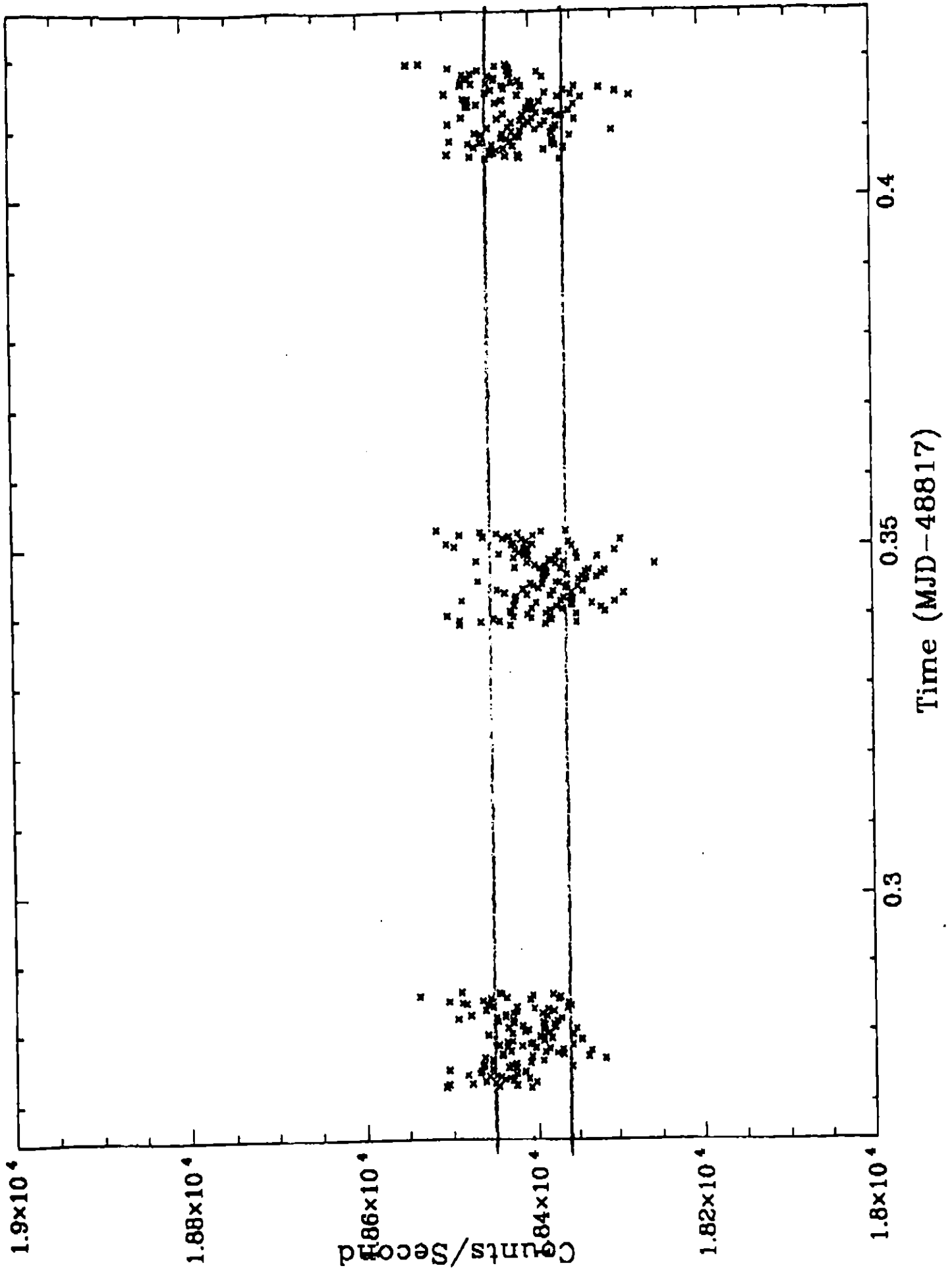


1094 Data Set 01 Corrected

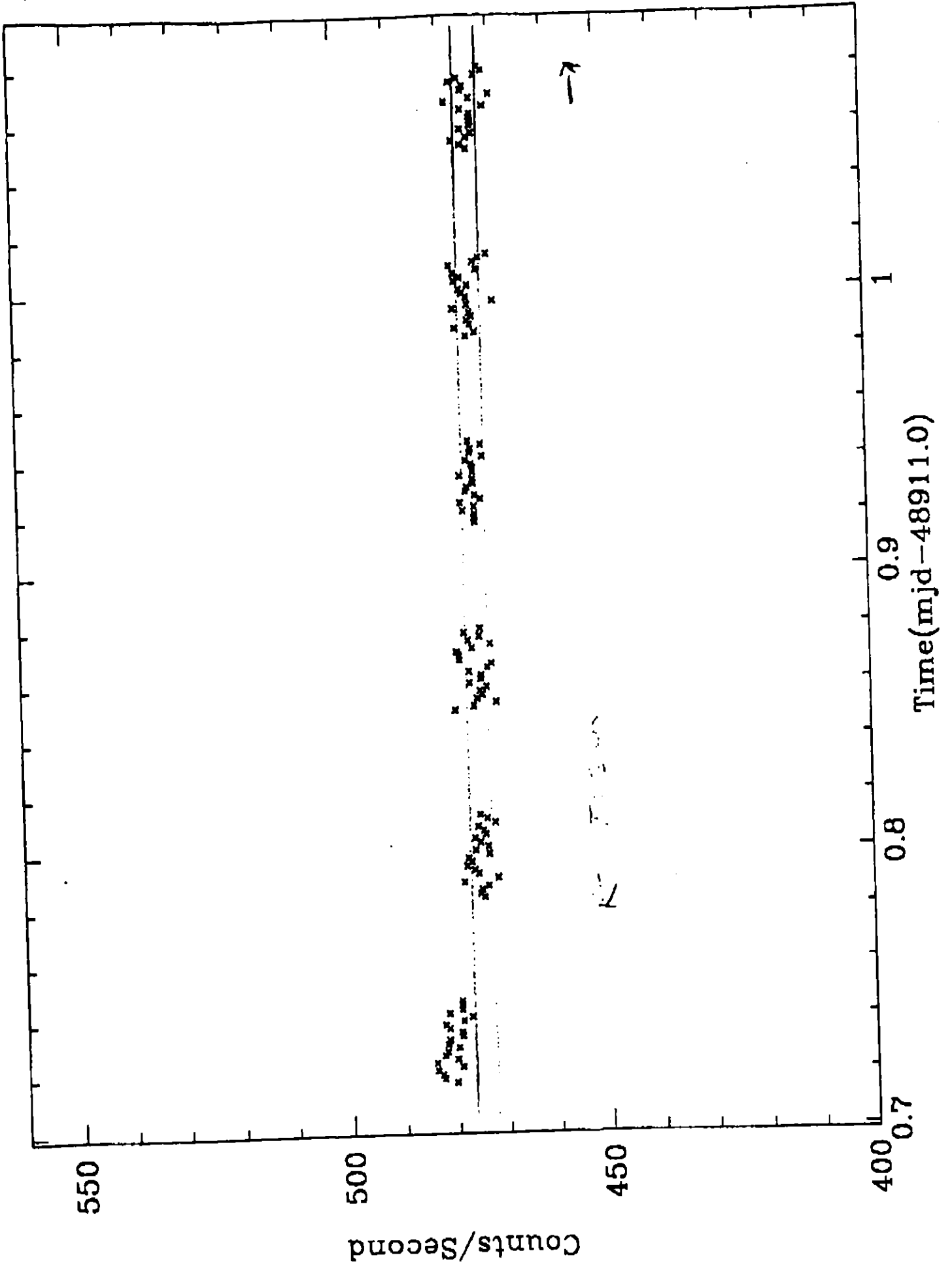




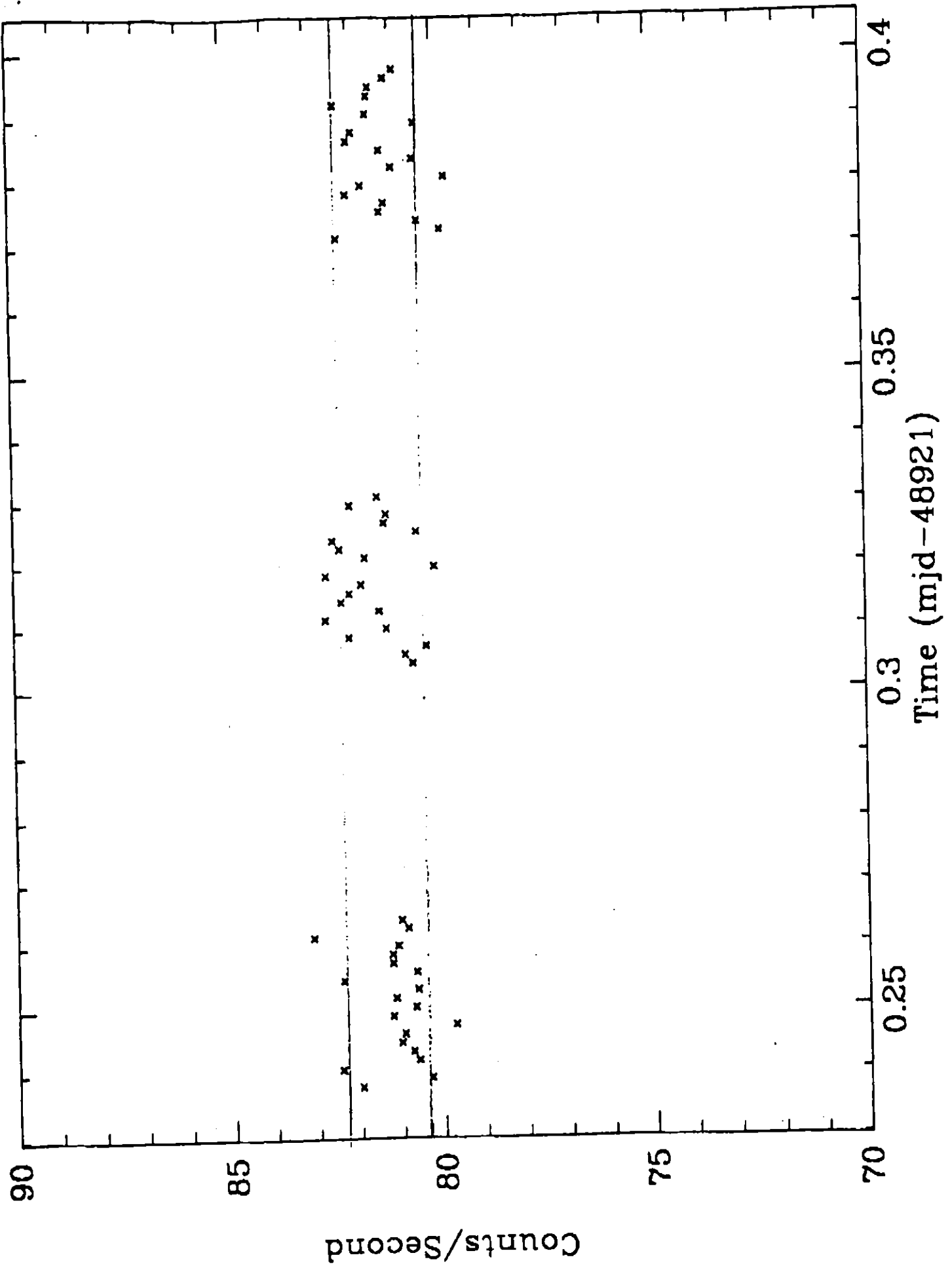
1094 Data Set 02 Corrected



1099 Target 3C249.1 120 S bins Corrected



1099 data set 12x04 04.05.06 NGC 6814 Corrected



# 1389 Data Set 01 Corrected

