SMOV Report I: Location of FOS Spectra

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Abstract

The optimal Y locations of the FOS spectra were determined for all non-polarized grating/detector combinations and the mirror using calibration maps obtained during SMOV (proposal ID 5243). The last observation obtained to determine the location of spectra in Cycle 3 showed a jump of 22 Ybase units for nearly all the grating/detector combinations. This ybase value was ~3 sigma from other values, and is likely due to filter grating wheel non-repeatablity. This is confirmed by the SMOV observations for most of the grating/detector combinations. The SMOV data show that the location of the spectrum follows the trends seen in the Cycle 1 and Cycle 2 data. The trends seen in the data cannot be easily characterized. Hence, it is recommend that the location of spectra be monitored several times per cycle and the Project Data Base (PDB) updated as required. YBASE values in the PDB were updated on December 17, 1993.

1. Introduction

The introduction of COSTAR could affect the magnetic field surrounding the FOS and the location of the spectra on the photocathode could thereby be influenced. Our ability to acquire FOS spectra depends on our knowledge of the location of the spectra on the photocathode. Hence, internal wavelength calibration lamps were observed using the 0.3" aperture to determine the location of the FOS spectra for both the red and blue detectors during SMOV. An initial test was conducted prior to COSTAR deployable optical bench (DOB) deployment which used the mirror and 4 gratings per detector (G130H, G190H, G270H, G160L on the blueside, and G190H, G270H, G400H and G650L on the redside) to determine the effect of COSTAR on the magnetic field surrounding the FOS.

Analysis of SV/OV, Cycle 1, Cycle 2, and Cycle 3 data indicated that the Y location of spectra changed with time. Observations were obtained during SMOV after the deployment of the FOS COSTAR mirror to monitor the Y location of spectra on the photocathode for all detector/disperser combinations to determine the correct Y location of the spectra for Cycle 4 observations.

Target acquisition requires an accurate knowledge of the location of the image formed by the mirror on the photocathode. Hence, observations were also conducted using the mirror for both detectors.

2. Observations and Analysis

The observations consisted of obtaining maps of the photocathode illuminated by the internal Pt-Ne lamps and TALEDs using 24 Y-steps and 1 X-step. These data were obtained on the dates given in Tables 1 and 2. As a preliminary guess for the location of the spectra on the photocathode, the pre FOS COSTAR mirror deployment observations of 15 Dec. 1993 used the YBASE values for each grating/detector combination determined from Cycle 1 and Cycle 2 observations (PDB values as of 15 Sept. 1993). The post FOS COSTAR mirror deployment observations of 27 Dec. 1993 used the YBASE values for each grating/detector combination determined from the three previous cycles and the first set of SMOV observations as a preliminary guess for the location of the spectra on the photocathode (PDB values updated on 17 Dec 1993). For each map the optimal YBASE, which represents the center of the spectrum in the direction perpendicular to the diode array (the FOS Y axis), is determined to minimize the effects of the distortions due to small imperfections of the Digicon magnetic field (for details see CAL/FOS-096). Tables 1 and 2 have the following information for each disperser detector combination: root name of the observation used in the analysis, the date of the observation, the derived optimal YBASE values, the diode range used in the determination of the optimal YBASE, the orientations of the FOS spectra on the photocathode (theta z), and the temperature of the FOS during the observation. The diode range over which a spectrum is expected to have a measurable signal was used to determine the optimal YBASE.

2. Results

Figure 1 shows the distribution of the YBASE values determined for each observation, including SV/OV, Cycle1, Cycle2, and Cycle 3 data, for each disperser/detector combination. As seen previously in CAL/FOS-96, most of the scatter (+/- 10 YBASE units) is due to the filter-grating wheel (FGW) non-repeatability discussed by Hartig *et al* (CAL/FOS-012, CAL/FOS-017 and CAL/FOS-060).

The inclusion of the SMOV results show that for all the blue detector gratings the trend with time seen in the previous cycles is still present (see Figure 1). This trend does not seem to be linear for the G190H, G270H and the G650L gratings on the blueside. For the redside detector and grating combinations (see Figure 1) there is no obvious trend. The trend which was suspected in CAL/FOS-96 for the G190H grating is not seen. The discrepant YBASE value shown by the last data point of Cycle 3 (1993.7) is ~3 sigma from the other values and is likely due to the FGW non-repeatability. The present trend on the blueside and the lack of trend on the redside cannot be easily characterized. Hence, we recommend that the location of spectra be monitored several times per cycle and the PDB updated as required.

The YBASE values which best represent the location of the spectra for each grating at the beginning of Cycle 4 were determined by computing the weighted average of all the Cycle 1, Cycle 2, Cycle 3 and the first set of SMOV observations acquired so far for each disperser/detector combination. These values are given in Table3 and were updated in the PDB on 17 Dec 1993. The post COSTAR observations of 26 Dec 1993 confirm that the PDB update was required. The photometric error due to the difference between the YBASE values detemined for the post COSTAR observations and the YBASE values in the PDB is $< 3\%$ for both the red and blue detectors.

REFERENCES

Hartig, G., Bohlin, R., Ford, H., and harms, R., 1984, CAL/FOS-012: FOS Filter-Grating Wheel Repeatability.

Hartig, G., 1985, CAL/FOS-017: Improvements in Filter/Grating Wheel Repeatability.

Hartig, G., 1989, CAL/FOS-060: FOS Filter-Grating Wheel Repeatability: Dependence on Motor Selection.

Koratkar, A., and Taylor, C., 1993, CAL/FOS-096: Location of FOS Spectra: Cycle 1 and Cycle 2 Results.

Koratkar, A., 1993, CAL/FOS-110: Location of FOS Spectra: Cycle3 Results.

FIGURE CAPTIONS

FIG--1. The optimal YBASE values as a function of time for the location of spectra for all grating/detector combinations. The solid line represents the PDB value for the Y location of the spectrum formed by the grating. Most of the scatter in the data is due to filter-grating-wheel non-repeatability. The Cycle 3 observation of 1993.7 is consistently displaced from the trend seen for most of the gratings and is most likely a 3 sigma point due to filter-grating-wheel non-repeatability. The blueside continues to show the trend seen in Cycle 1 and Cycle 2 data, while the redside does not show this trend.

Table 1: Blue side

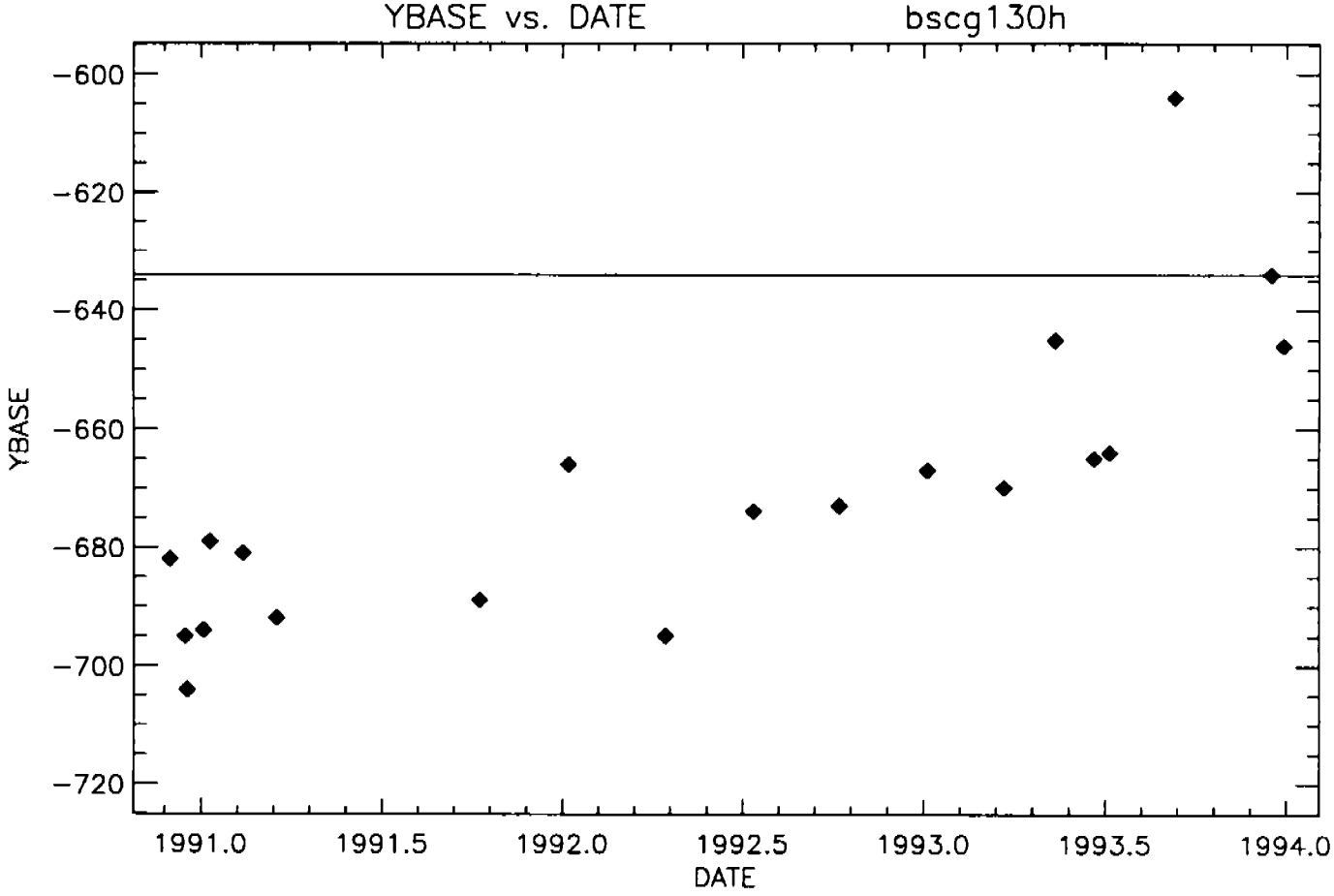
Name	Date	YBASE	Range	θ_z (degrees)	Temperature (C^0)
MIRROR Diode Range 230-250					
y2400101t	15 Dec 93	-992	0	0.0000	-7.22
y2400a01t	26 Dec 93	-1028	0	0.0000	-5.96
G130H Diode Range 100-511					
y2400102t	15 Dec 93	-634	35	-0.0569	-7.22
y2400a09t	26 Dec 93	-646	40	-0.0885	-5.96
G190H Diode Range 0-511					
y2400104t	15 Dec 93	-980	31	0.0319	-7.22
y2400a07t	26 Dec 93	-1022	27	0.0156	-5.96
G270H Diode Range 0-511					
y2400103t	15 Dec 93	-1626	24	0.0221	-7.22
y2400a06t	26 Dec 93	-1632	22	0.0119	-5.96
G400H Diode Range 0-511					
y2400a02t	26 Dec 93	293	23	-0.0173	-5.96
G570H Diode Range 100-310					
y2400a08t	26 Dec 93	257	17	-0.0162	-5.96
G160L Diode Range 300-511					
y2400105t	15 Dec 93	-880	30	0.0142	-7.22
y2400a03t	26 Dec 93	-898	41	-0.1742	-5.96
G650L Diode Range 290-511					
y2400a04t	26 Dec 93	-702	30	0.0668	-5.96
PRISM Diode Range 20-140					
y2400a05t	26 Dec 93	-761	23	-0.1721	-5.96

Table 2: Red side

Name	Date	YBASE	Range	θ_z (degrees)	Temperature (C^0)
MIRROR Diode Range 230-250					
y2400201t	15 Dec 93	-208	0	0.0000	-7.88
y2400901t	26 Dec 93	-238	0	0.0000	-5.96
G190H Diode Range 0-480					
y2400204t	15 Dec 93	-300	47	0.0808	-7.88
y2400908t	26 Dec 93	-318	46	0.0710	-5.96
G270H Diode Range 0-511					
y2400203t	15 Dec 93	355	55	0.0802	-7.88
y2400907t	26 Dec 93	348	56	0.0826	-5.96
G400H Diode Range 0-511					
y2400202t	15 Dec 93	-1384	52	0.0916	-7.88
y2400902t	26 Dec 93	-1413	45	0.0805	-5.96
G570H Diode Range 0-511					
y2400909t	26 Dec 93	-1490	30	0.0436	-5.96
G780H Diode range 250-511					
y2400906t	26 Dec 93	254	12	0.0375	-5.96
G160L Diode Range 0-120					
y2400903t	26 Dec 93	-224	32	0.2440	-5.96
G650L Diode Range 50-220					
y2400205t	15 Dec 93	-343	44	0.2337	-7.88
y2400904t	26 Dec 93	-340	47	0.2502	-5.96
PRISM Diode Range 370-500					
y2400905t	26 Dec 93	-337	8	-0.0310	-5.96

Table 3: Updated YBASE values in the PDB - 17 Dec 1993

Disperser/ Mirror	Blueside	Redside
MIRROR	-1024	-228
G130H	-634	N/A
G190H	-1004	-302
G270H	-1628	363
G400H	307	-1387
G570H	246	-1490
G780H	N/A	264
G160L	-879	-218
G650L	-701	-347
PRISM	-771	-337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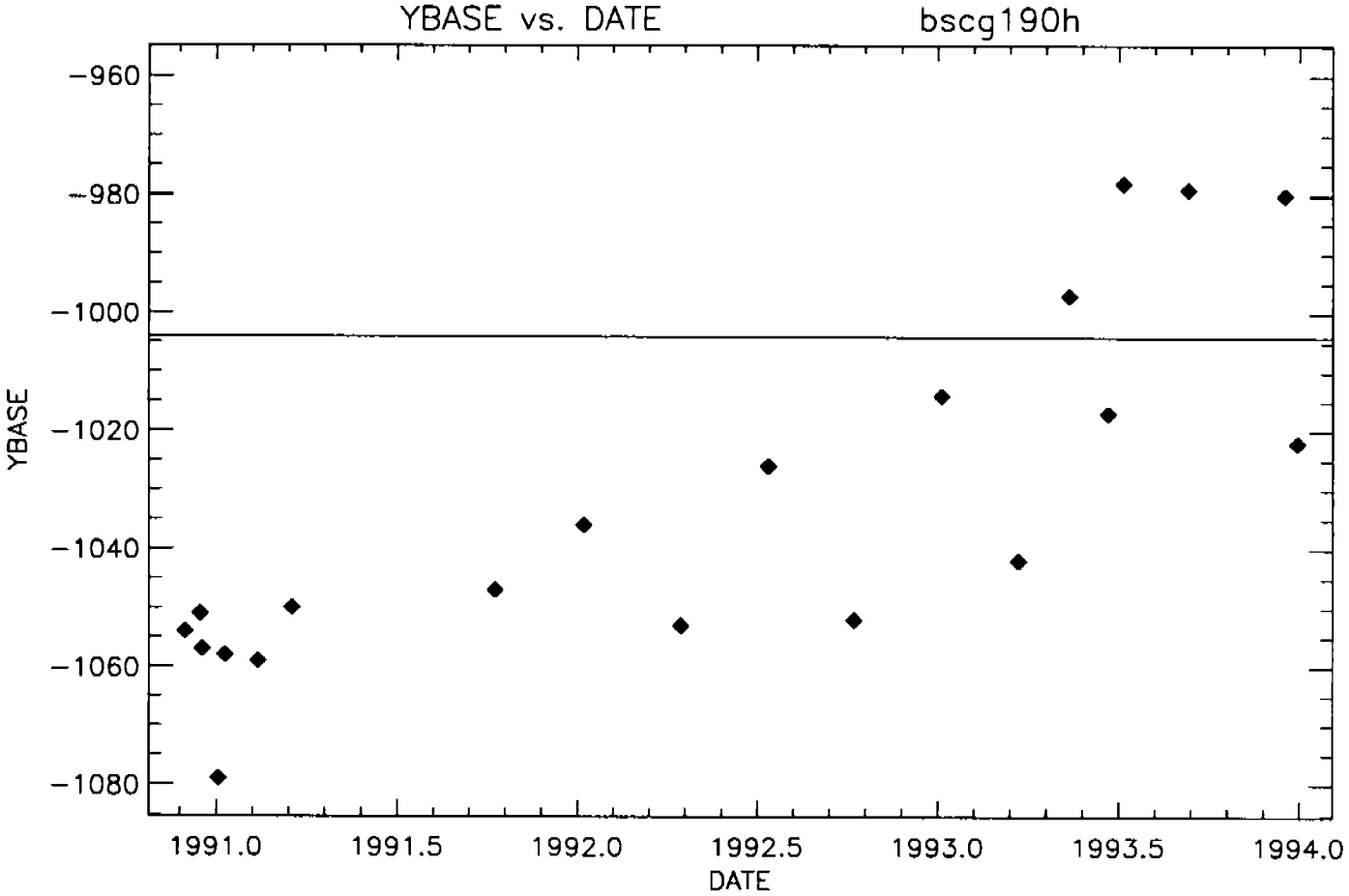
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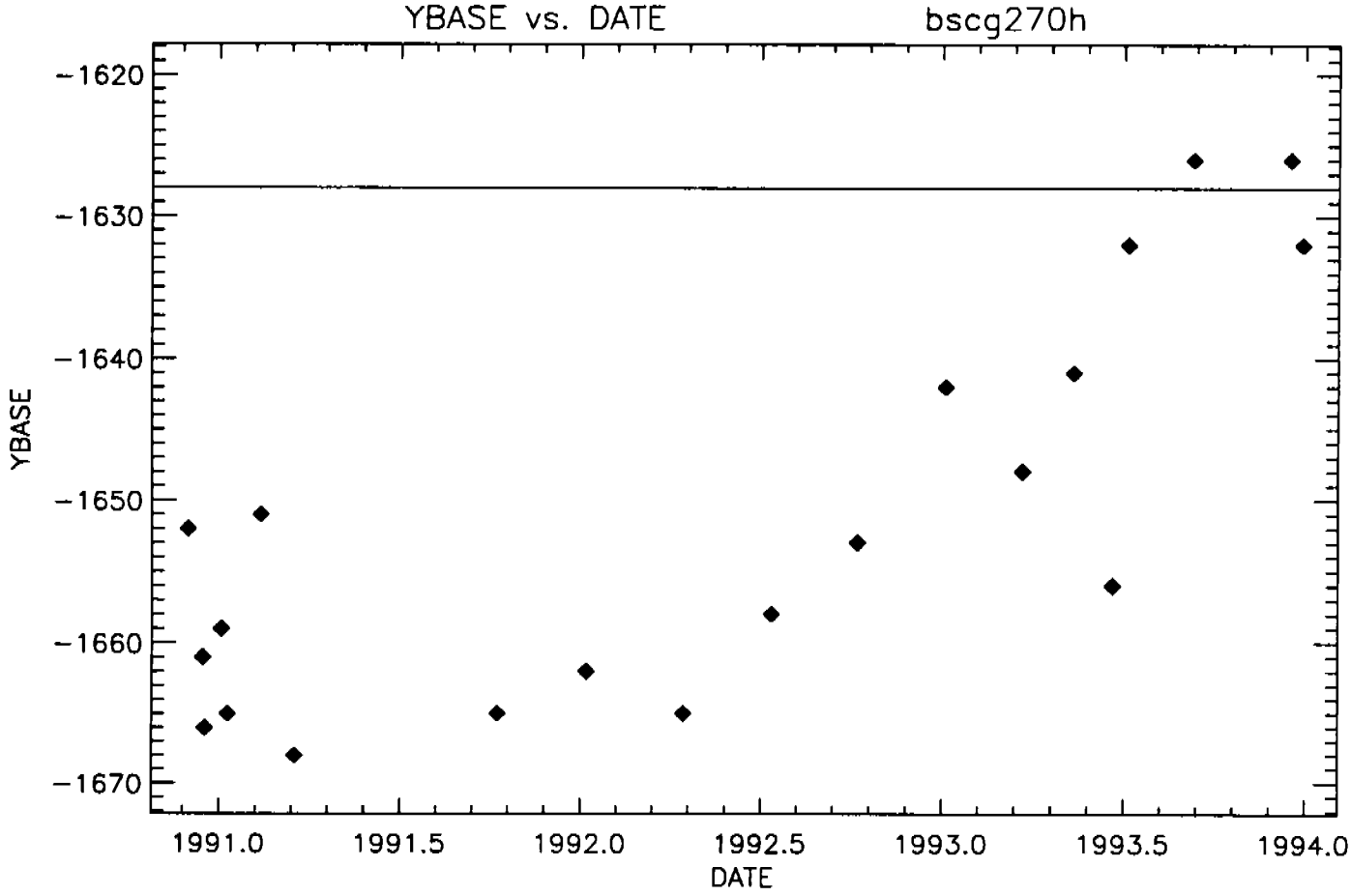
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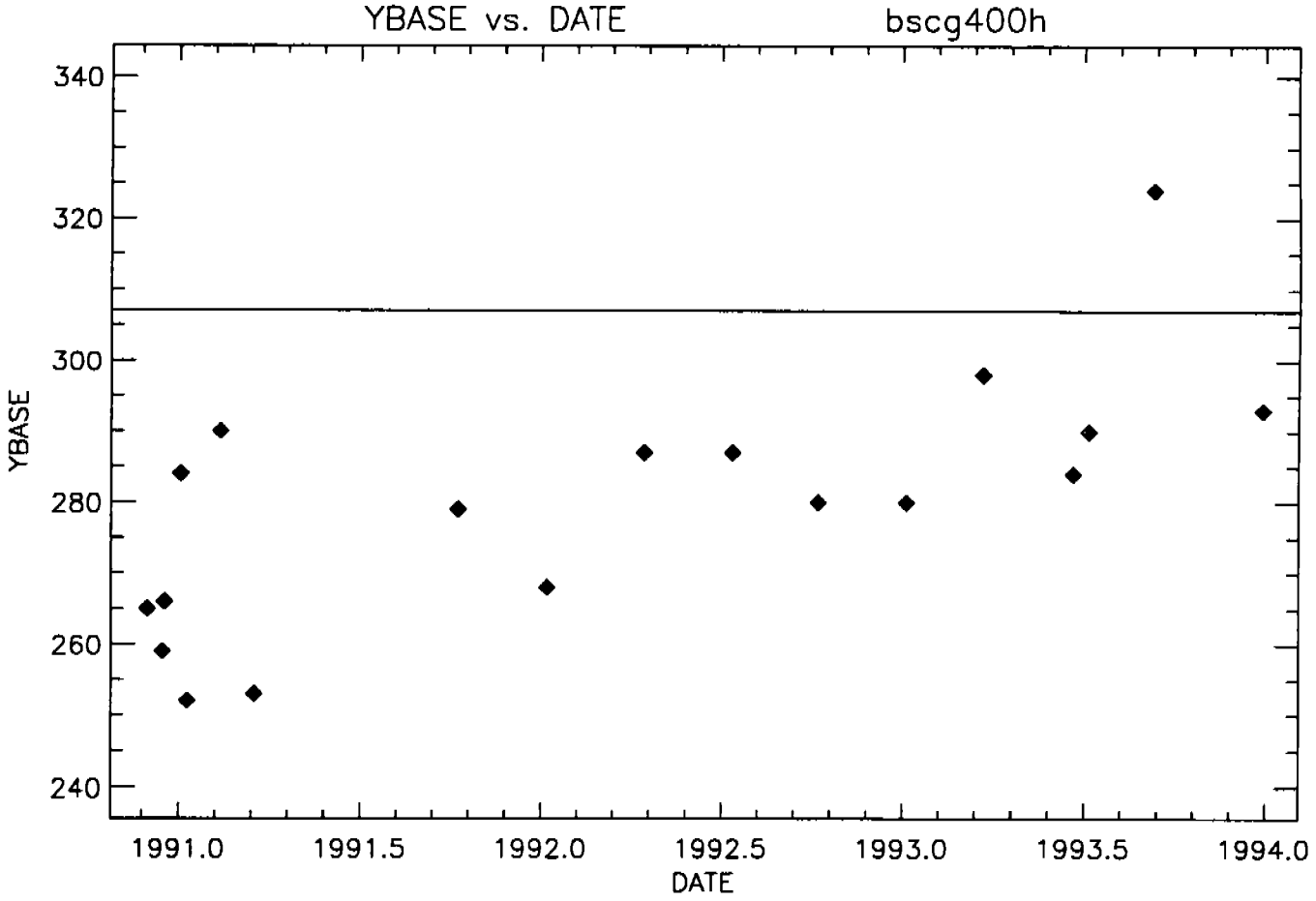
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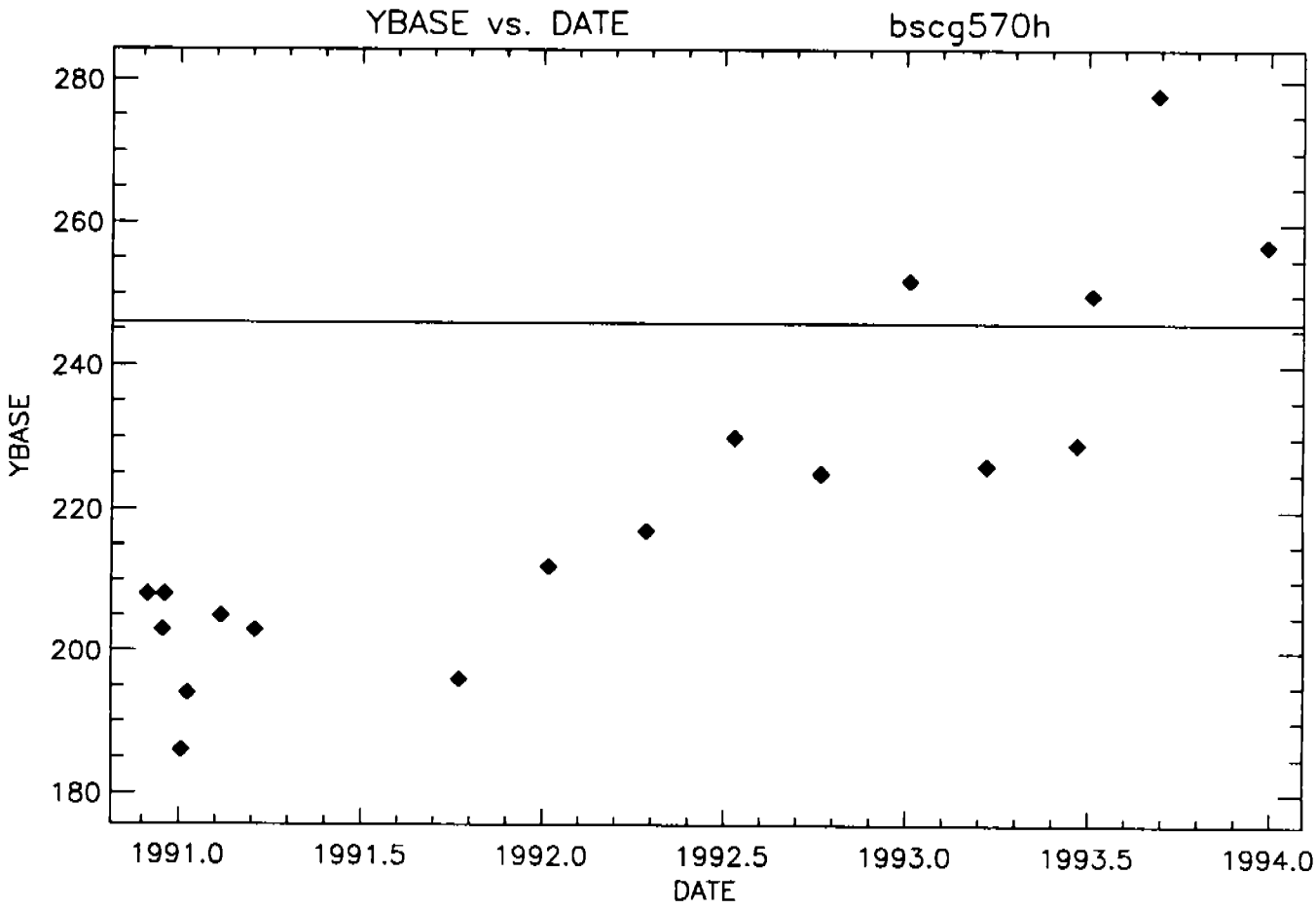
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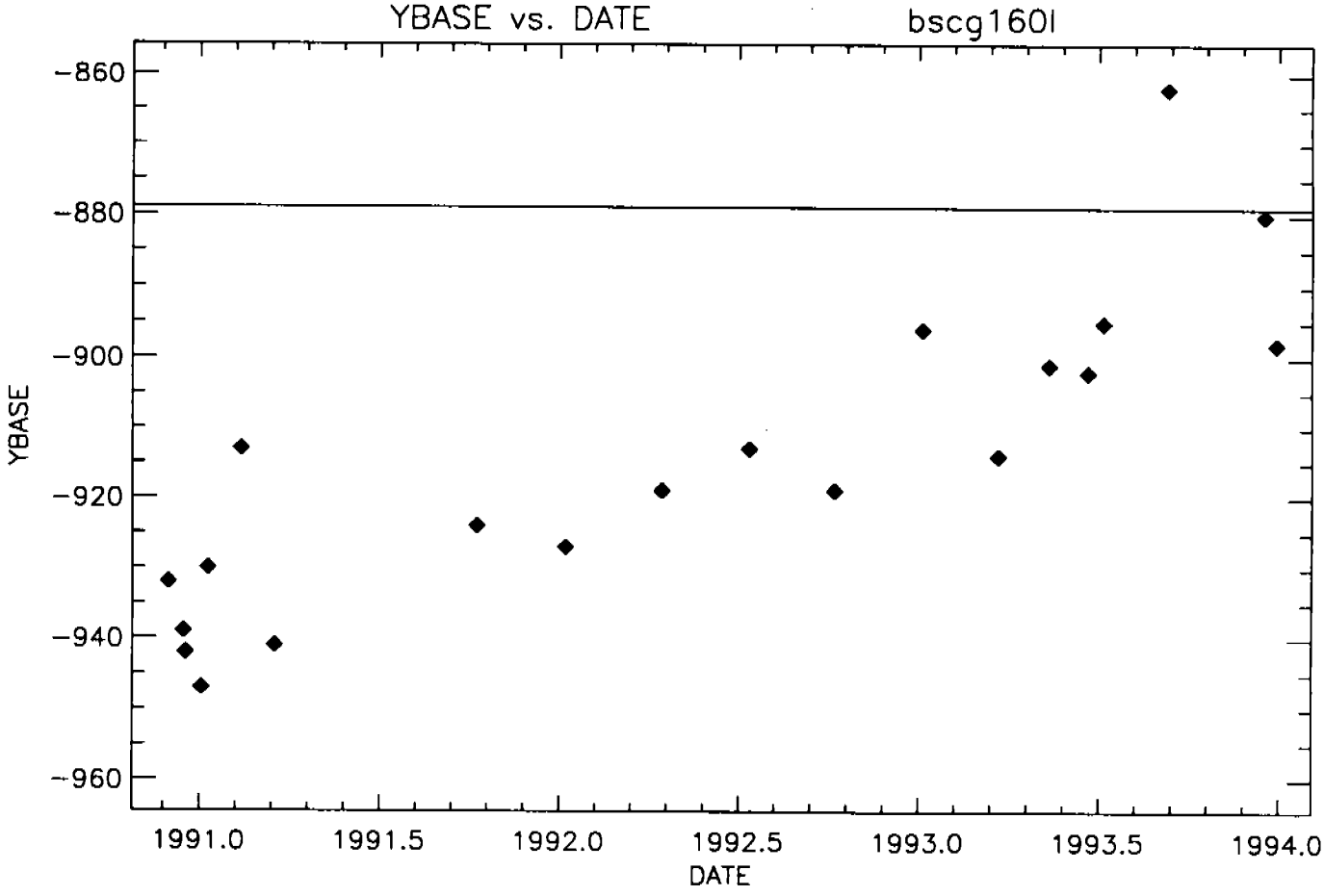
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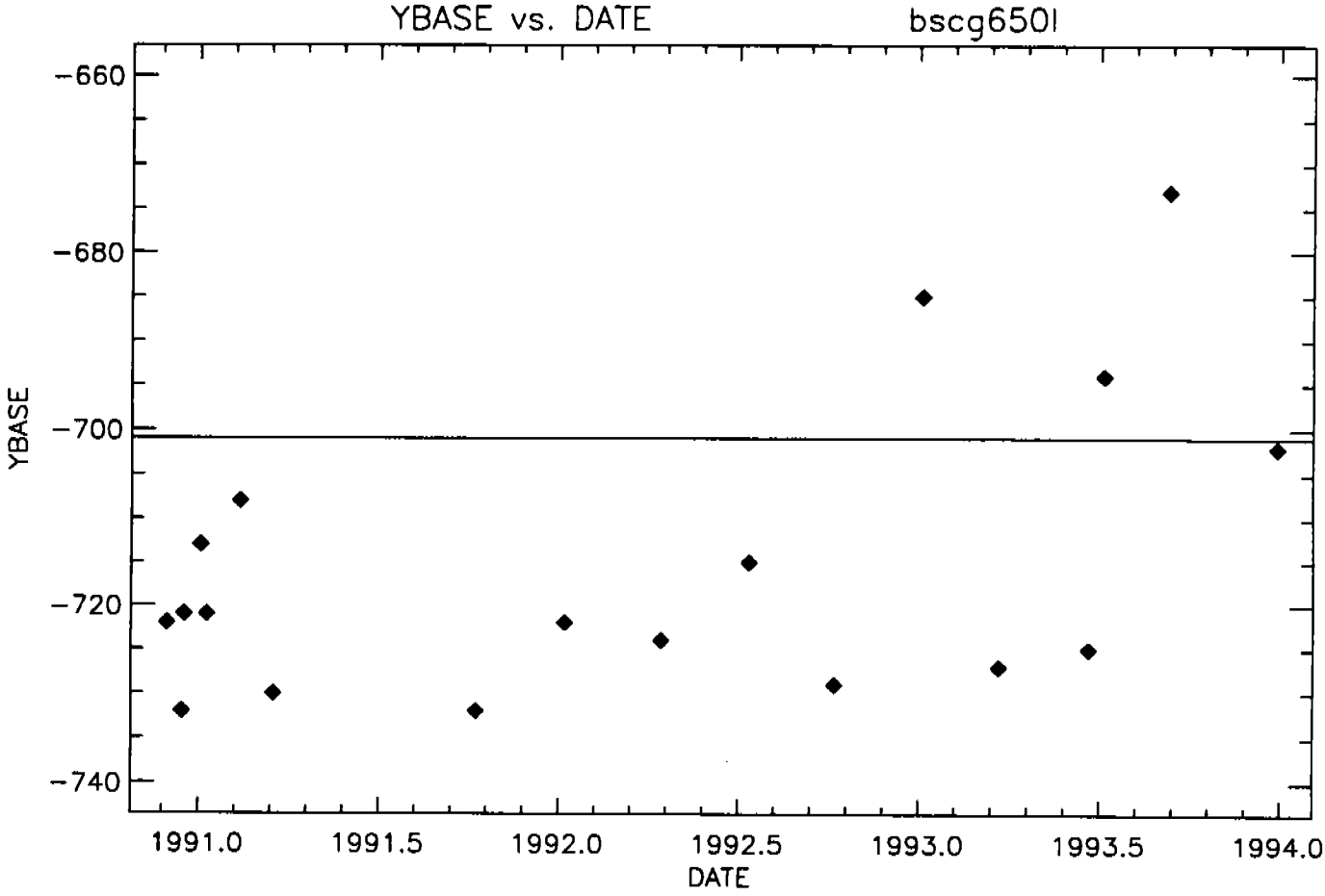
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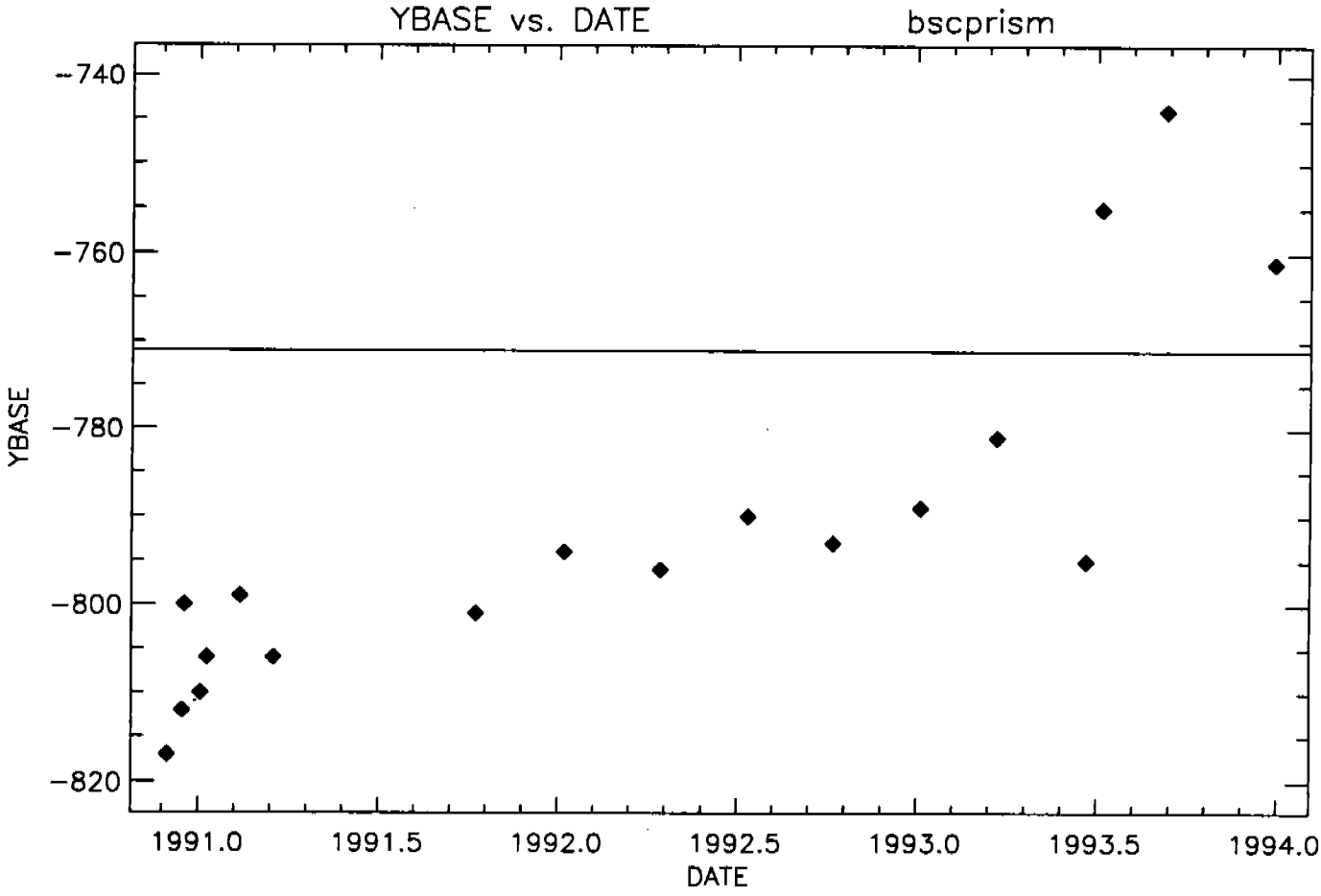
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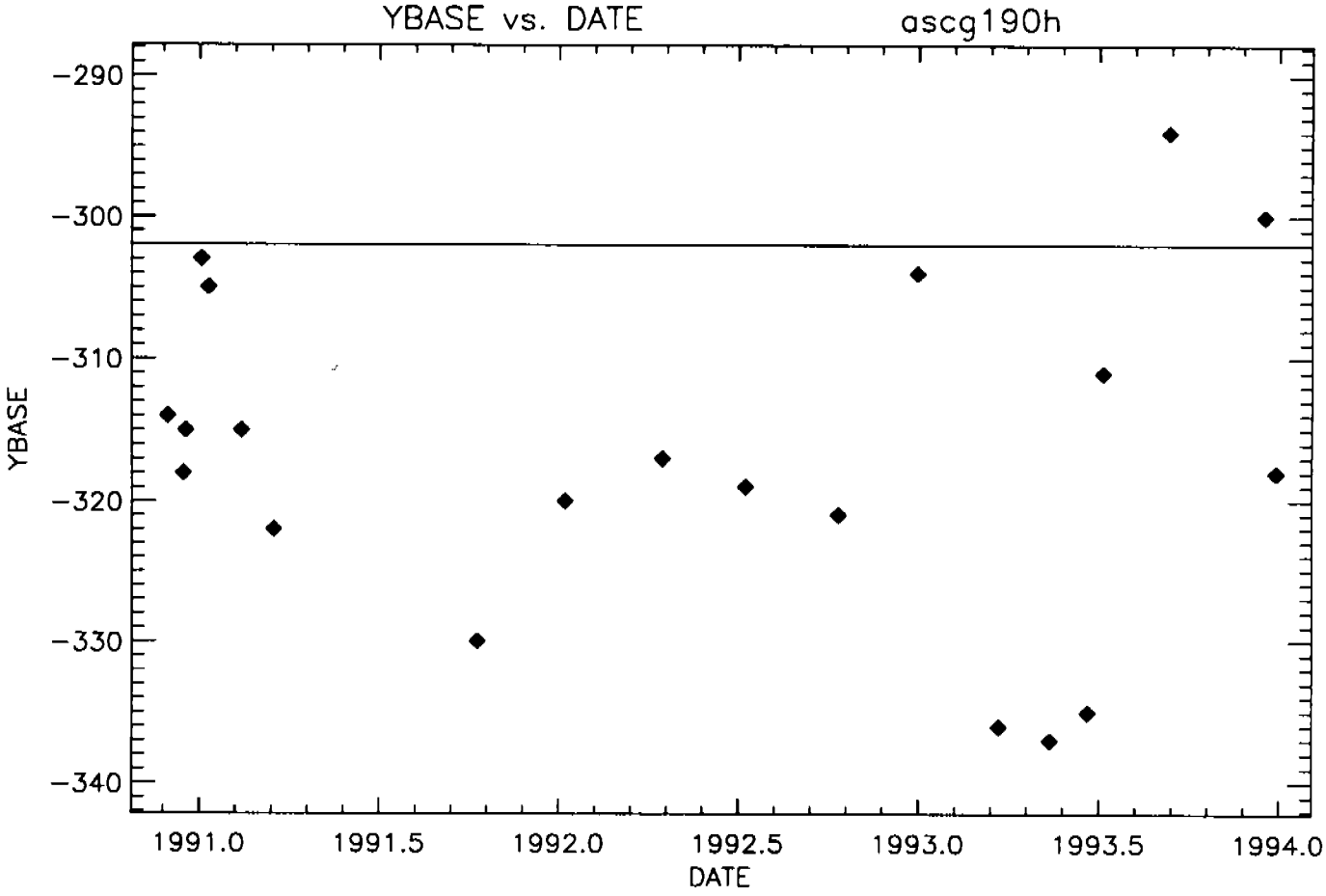
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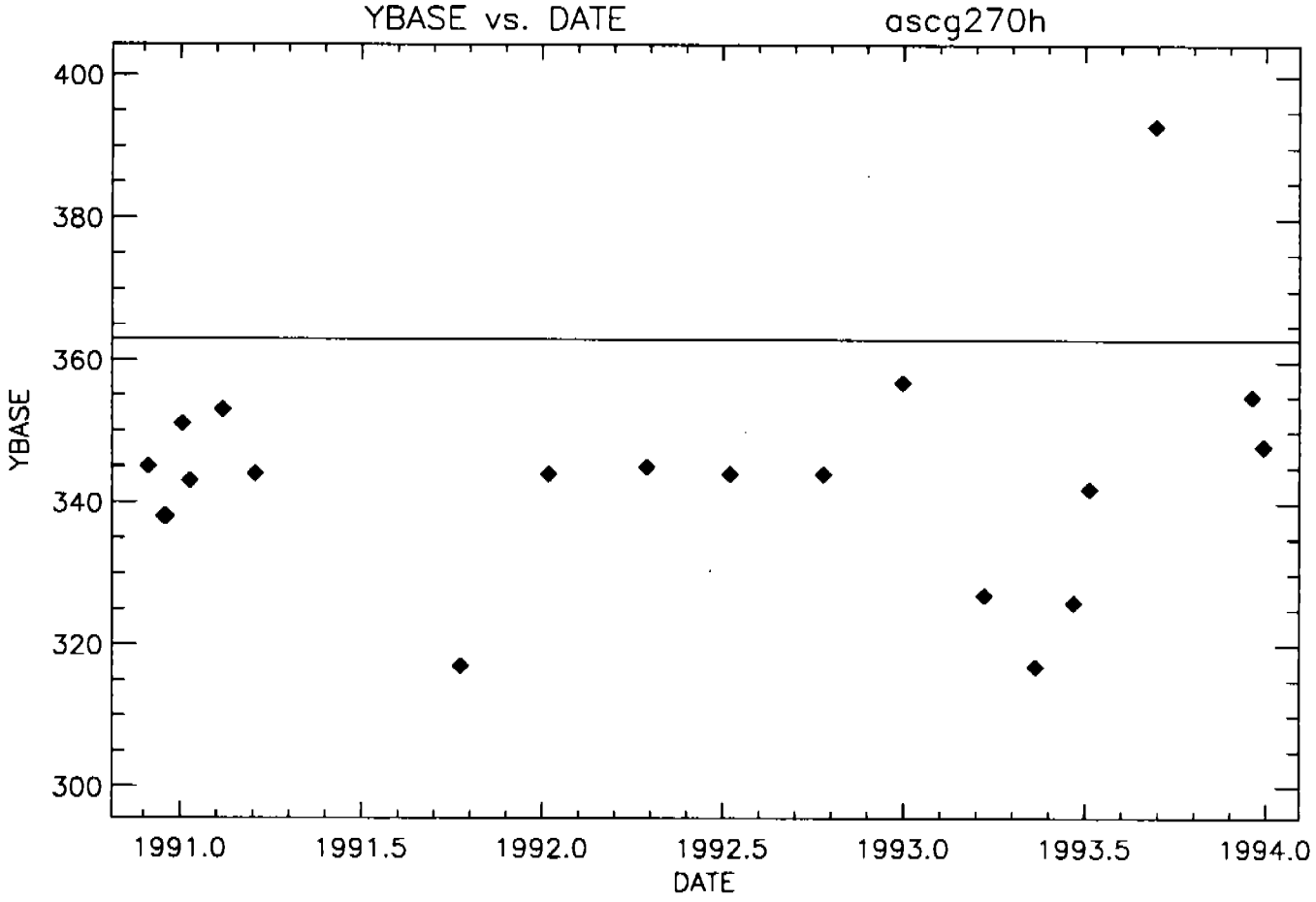
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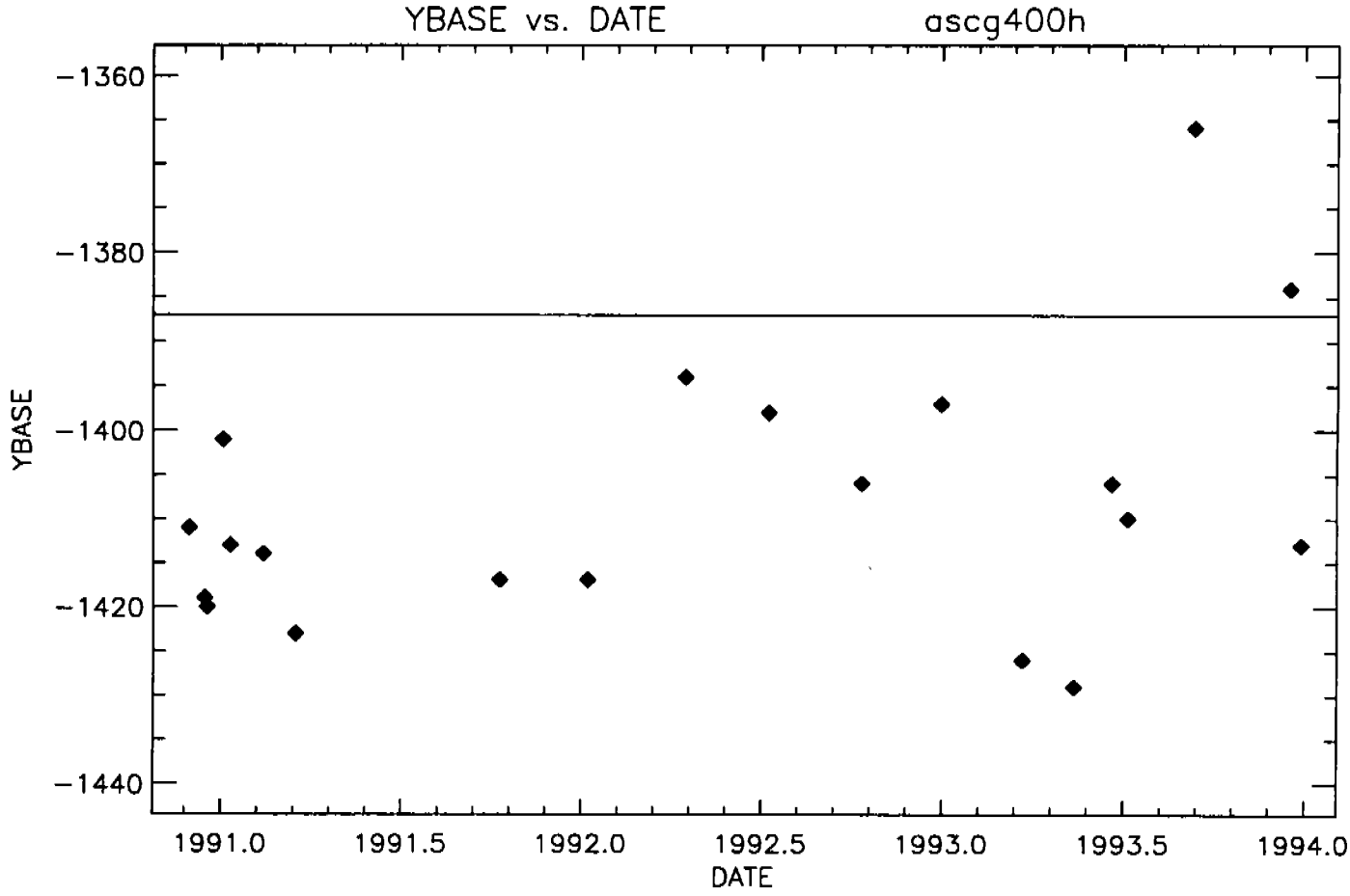
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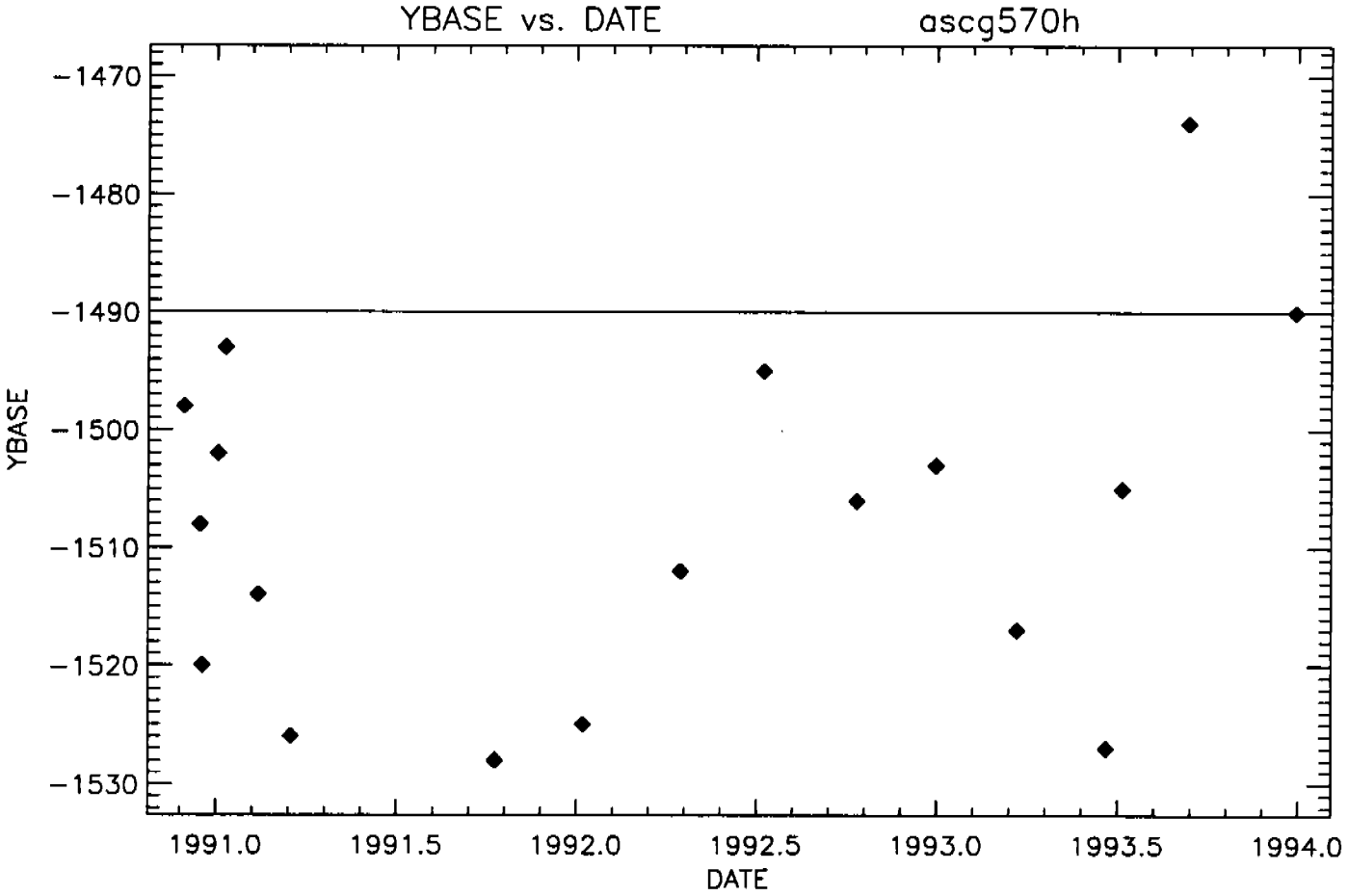
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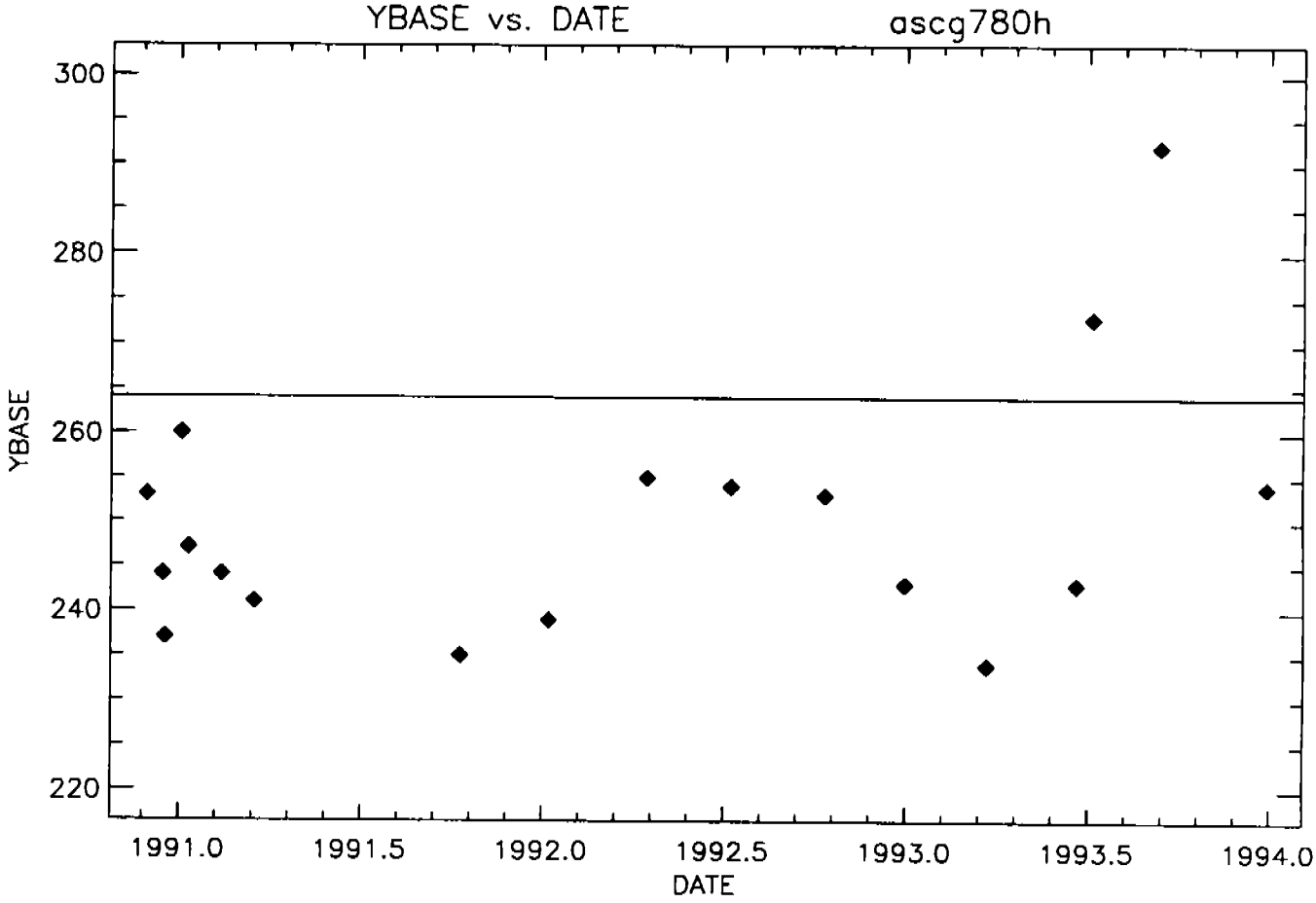
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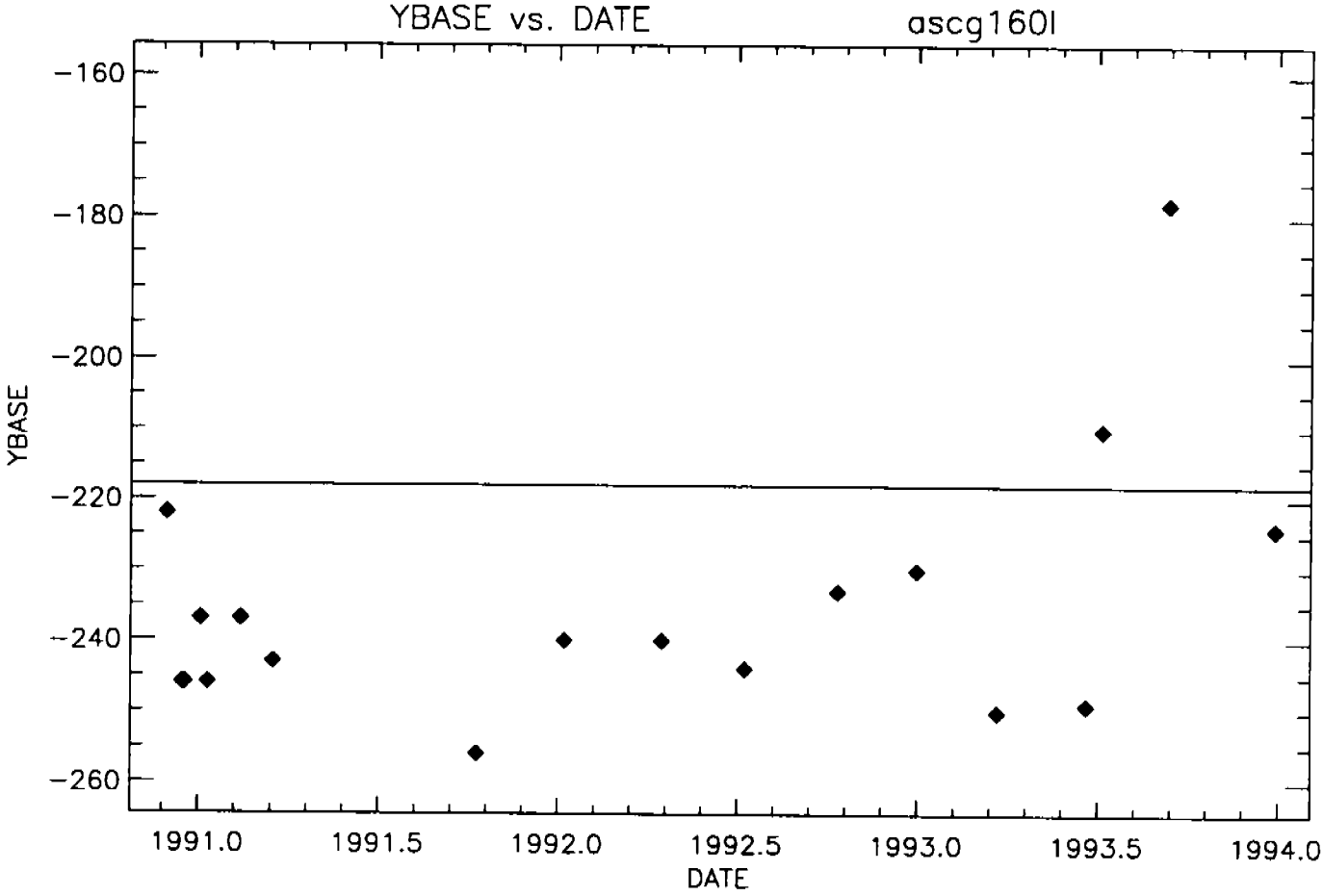
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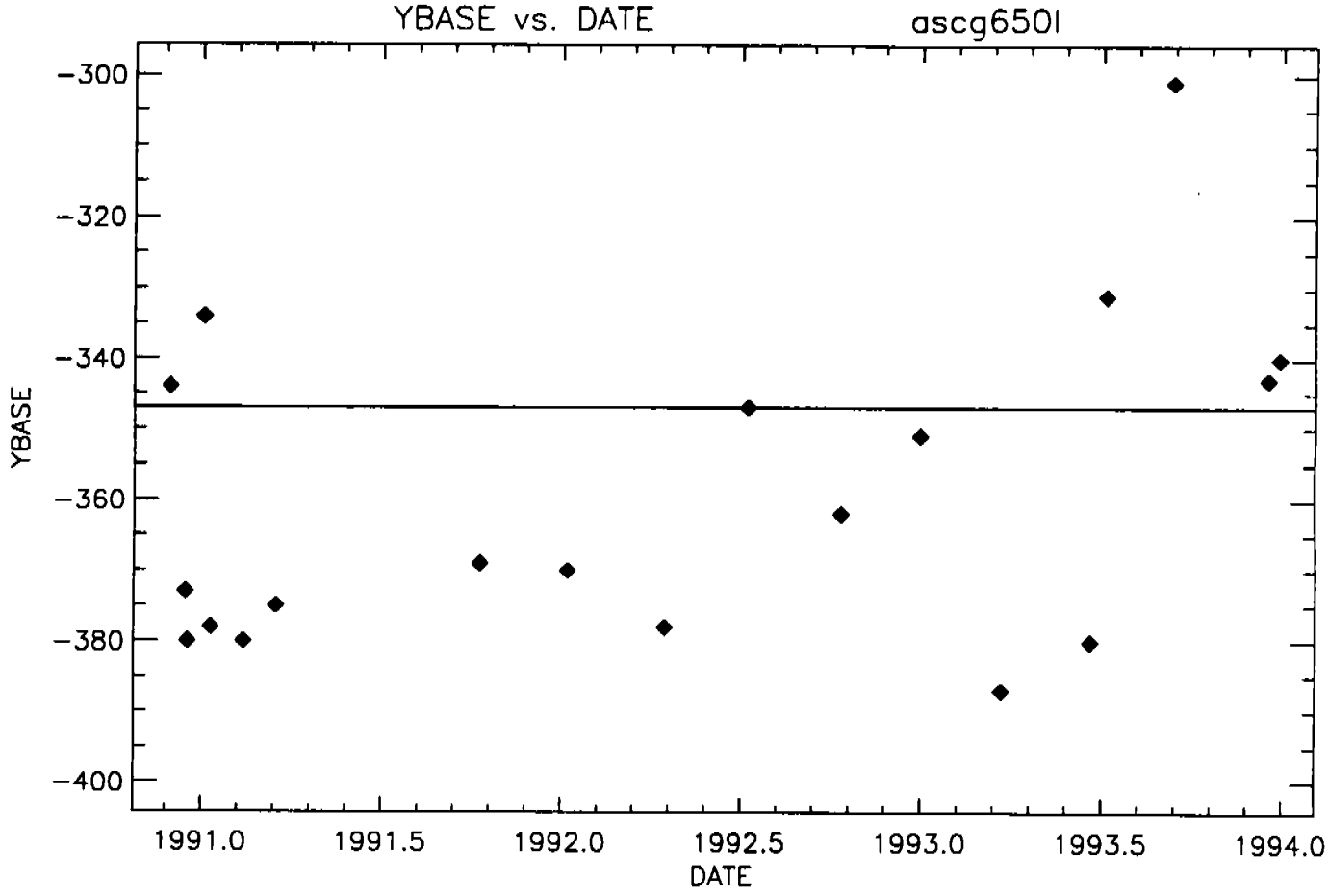
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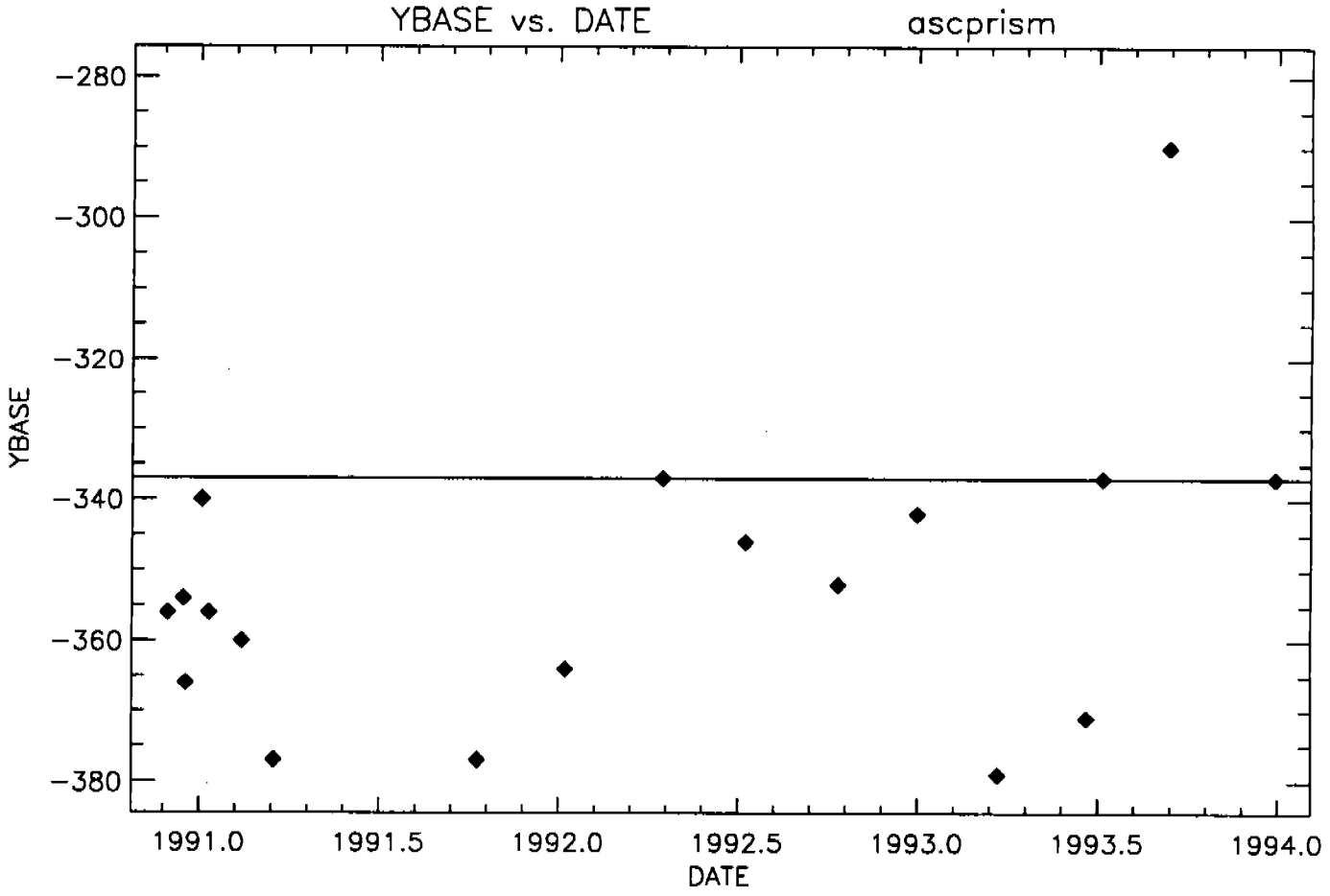
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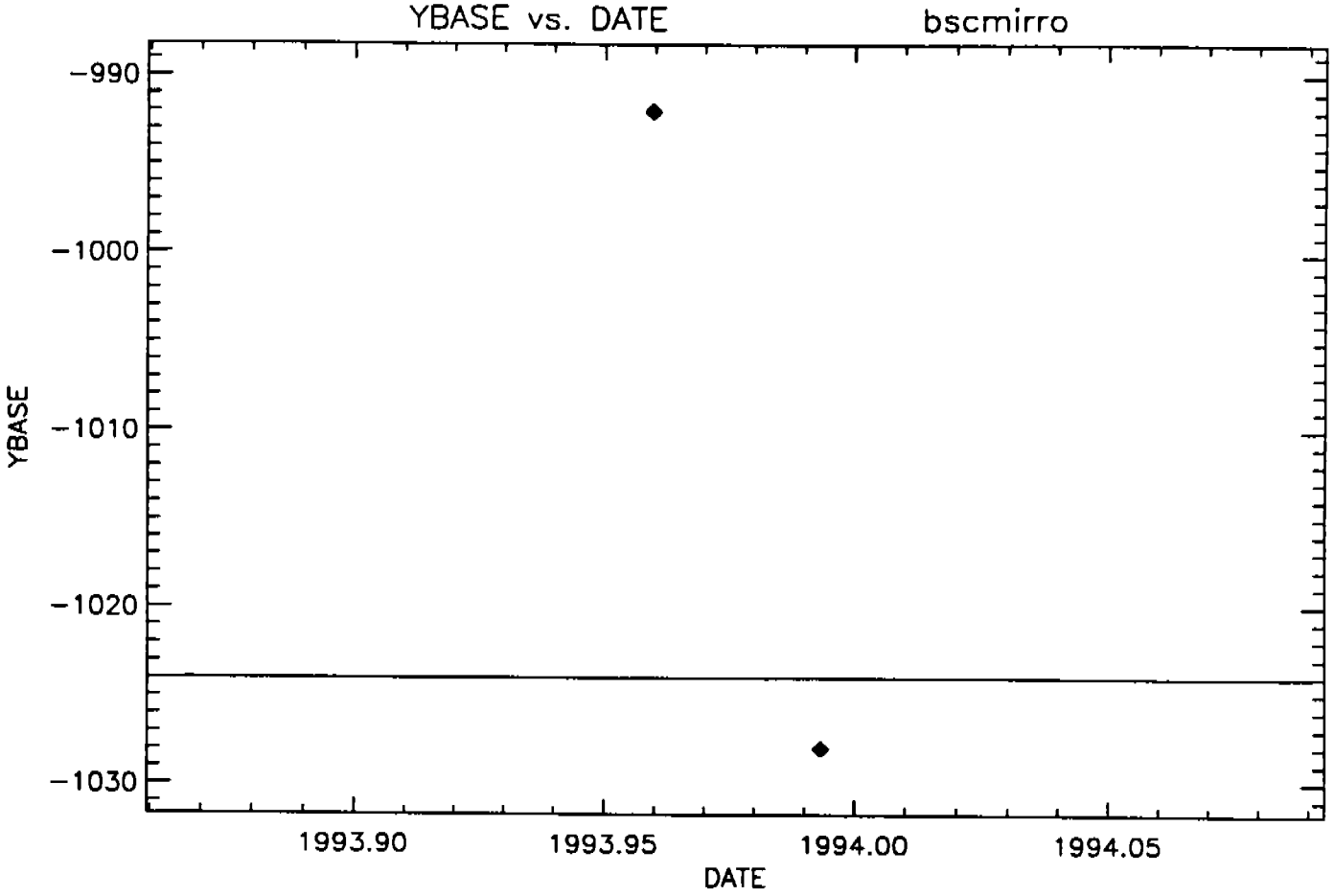
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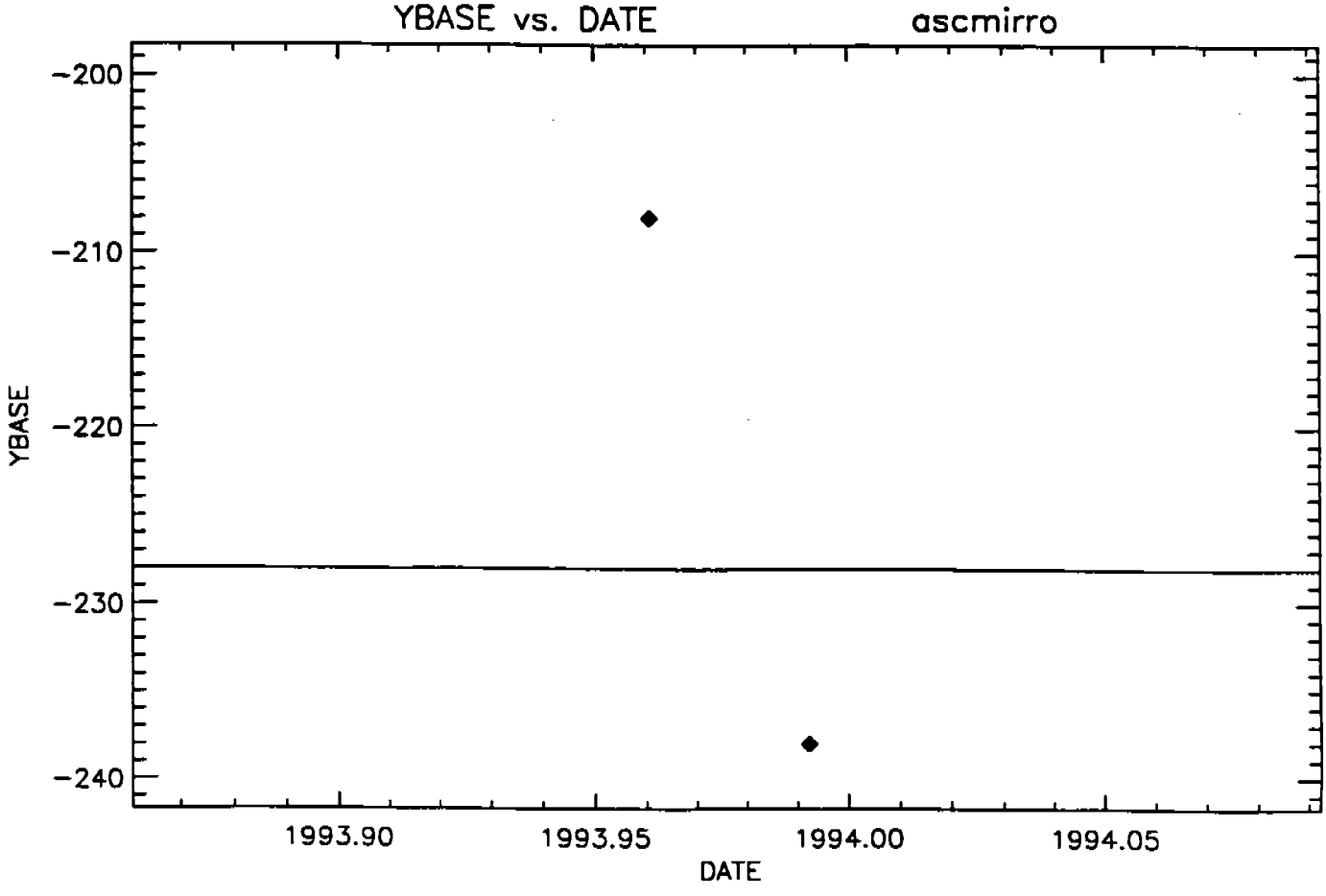
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