Study of the stability of the time assignment of the XTE clock using the sharp pulse of PSR 1821−24

Yoshitaka Saito[1]
Institute of Space and Astronautical Science,
Sagamihara, Kanagawa, 229-8510, JAPAN

1 Introduction

It has been said that the stability of the XTE clock is 1∼2 μsec based on the clock calibrations. It also has been estimated to be better than 30 μsec using observations of the Crab pulsar, while more accurate study has not yet done using celestial object. To obtain the reliable pulse width of the sharp pulse of 3-msec pulsar PSR 1821-24, it is necessary to study the stability using the data itself.

In this report, we report the study of the stability using the 100 ksec observation data of PSR 1821-24 obtained from Feb. 10 to 13 on 1997.

2 Analysis

Data we used is the one obtained for proposal ID P20159 (PI : Y. Saito). The one of the purpose of the observation was to determine the pulse width of the sharp pulse, which cannot be obtained by the *ASCA* data since the stability of the *ASCA* clock was not enough. We used *GoodXenon* data for this analysis. **FTOOLS** we used was version 4.0 on SunOS 4.1.3.

First, we extracted data using **make_se v0.20** and obtained many science fits files. We choose the good time region using **maketime** setting the data selection criteria to be "ELV > 10.0 && OFFSET < 0.2 && NUM_PCU_ON == 5". From the headers of the gti files, we knew **XTEDERIVE v2.3**, **FCOLLECT v4.0**, and **XTEDERIVE v2.3** were used. For each science fits, we made two dimensional histograms of pulse height and pulse phase using **faseBin v1.0.0** and the ephemeris supplied by Green Bank as listed in the table 1. Then, we obtained pulse profiles at different time epoch using **fbssum** collapsing the pulse height channel from 5 to 54 which roughly correspond to 1.7 and 20 keV.

Table 1: PSR 1821−24 ephemeris.

PSR B	RA(J2000)	DEC(J2000)	MJD1	MJD2	MJD(t0)	f0(s^{-1})	f1(s^{-2})	f2(s^{-3})	RMS
1821-24	18 24 32.008	-24 52 10.70	47826	50660	49243.000000025	327.4056743697863	-1.73521D-13	0.00581D-24	6.8

The pulse profiles were fitted with the flat background with two gaussian model. We set all parameters free and the number of parameters were 7. We used minimum χ^2 method to obtain the best fit values and their errors.

[1] saito@balloon.isas.ac.jp

3 Results

We plotted the phase of the sharp pulse with the error against the XTE day in the figure 1. We fitted the value with flat line using minimum χ^2 method and obtained the best fit value of 0.2098 ± 0.0005 (1σ) with χ^2 of 21.63 and DOF of 28. We projected toward the Y axis and studied the distribution as shown in the figure 2. We fitted the histogram with gaussian using the maximum likelihood method and obtained the best fit σ value of 0.0032 in phase which corresponds to 9.7 μsec.

4 Conclusion

We study the stability of the XTE clock using the 100 ksec observation of PSR 1821−24 and found that the fluctuation of the clock is less than 10 μsec for hour scale. Thank you very much for developing and managing excellent detector !!

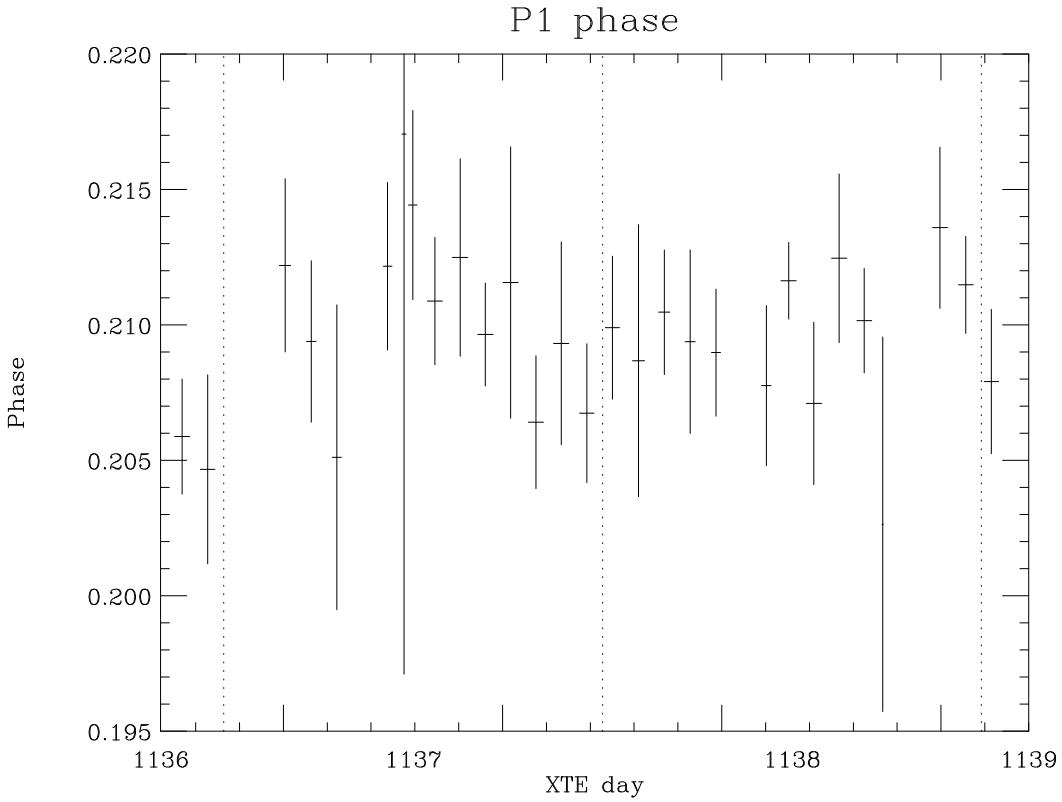

Figure 1: Phase of the sharp pulse of PSR 1821−24. One tick on X axis corresponds to 10^4 sec.

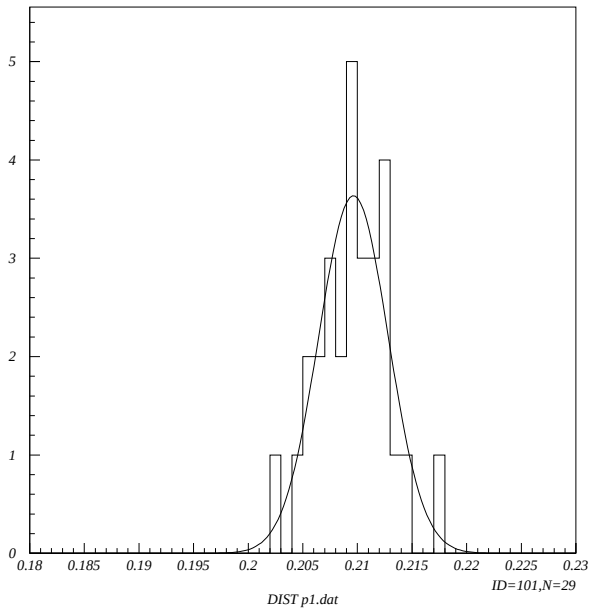

Figure 2: Distribution of the phase.