Bull. Astr. Soc. India (2002) 30, 829–831

Scanning Sky Monitor (SSM) on ASTROSAT–A status report

S.Seetha* on behalf of the SSM team of ASTROSAT
* *ISRO Satellite Center, Airport Road, Bangalore 560 017*
Raman Research Institute, CV Raman Avenue, Bangalore 560 080

Abstract. The scanning sky monitor (SSM) on the ASTROSAT is an instrument to be used for detecting and locating new x-ray transients and to study the long term behavior of the known bright x-ray sources in the celestial sphere. The SSM is very similar in design to the ASM on RXTE. The first phase of the hardware development for this experiment is to design, fabricate and test an engineering model. This paper describes the principle of operation and the design specifications of the SSM and highlights the current status of the testing of the detector.

1. Introduction

ASTROSAT is a planned Indian multi-wavelength astronomy mission with experiments spanning the electromagnetic spectrum in optical, UV, soft and hard x-ray. One of the proposed x-ray experiments on board the ASTROSAT is a Scanning Sky Monitor (SSM). The objectives of the SSM are i) to detect and locate new x-ray transients. ii) observe bright sources over long time scales to study long term variabilities for example caused by disc precession; iii) to provide an alert on intensity level of known variable sources, which can then be observed by other instruments. Transients offer an opportunity to study physical processes giving rise to a large dynamic range of luminosities L$\approx 10^{33}$ erg/s to 10^{39} erg/s.

2. Description of the instrument

The detector system consists of a one-dimensional coded mask viewed by a position sensing gas-filled proportional counter. It operates in the energy range: 2-10 keV and has a field of view $6° \times 90°$ FWHM. The proposed sensitivity is 10 mCrab in 1 day integration. The design of the instrument is very similar to the ASM on RXTE (Levine et al., 1996 [1]). The x-rays from a source pass through the open regions of the coded mask and cast a shadow on the detector plane. The detector being position sensitive can be used to determine the energy, number and position of the impinging x-rays. The coded mask is designed using Hadamard transform. It is made in 6 parts, each of dimension 6 x 11 sqcm, consisting of 63 elements. The detector consists of a gas-filled proportional counter. The counter is filled with P-10 gas at 800 torr. There are 8 anodes which are resistive. The position of the x-ray interaction is determined by measuring the charge o/p on both ends of an anode and finding the ratio (Figure 1). Figure 2 shows the schematic of an assembled detector system.

Most of the other instruments on board the ASTROSAT are pointed to a particular region of the sky. In order that SSM can scan the sky independent of the other instruments, two monitors are to be mounted such that their FOVs form an 'X' in the sky. These are then mounted on a rotatable boom in order to scan a belt in the sky which is 90° in width. A third detector will be mounted with its view axis parallel to the rotation axis such that the regions along the rotation axis can also be scanned.

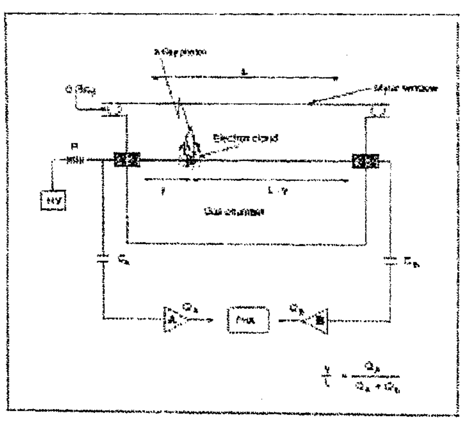

Figure 1. Principle of charge division

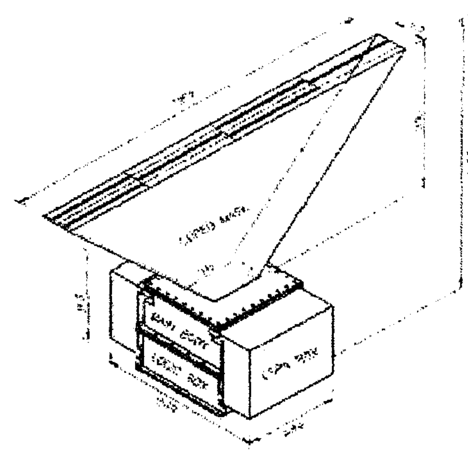

Figure 2. Schematic of SSM

[1]Levine, A., Bradt, H., Cui, W., et. al., 1996, ApJ lett. 469,L33

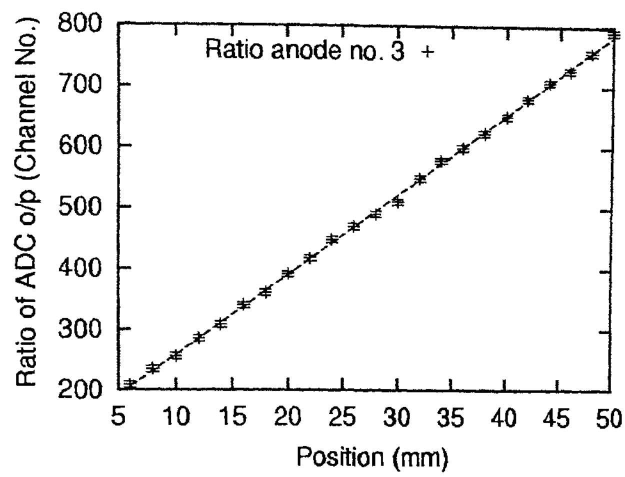

Figure 3. Plot of the ratio of signal on either ends of anode no.3 versus positon

Development status of the experiment

A proto flight model of the detector system has been fabricated and is being tested. The 16 charge sensitive preamplifiers followed by linear amplifiers (LA) were mounted for the 8 resistive anodes. Testing of the detector was done using a Fe 55 radioactive source(6 keV). The o/ps of LA on both ends of wire is found to be linear. The residuals are of the order of 0.4 mm. The LA o/ps are then connected to a front end logic card, which does the following functions:i) Logic to veto simultaneous signals from any two wires, or which cross ULD; ii)Conversion of amplitude of each pulse to digital form (ADC) and tag it with the respective wire ID, left/right identification; iii) Threshold levels for all the wires. The testing of all above with a pulser is completed and satisfactory. The ADC o/p of the logic card is connected to a PC and used for characterisation. Figure 3 shows a plot of the ratio of signal with variation in position of the source along the wire. The FWHM of the o/p peak is of the order of 1.5mm. It may be noted that the beam width of the source is 1.2mm. Detailed characterisation with further collimation of the beam width is being conducted.

3. Conclusions

Initial tests of the detector show that it is linear and position sensing capability is around 1 mm. The counter has remained stable for over a year. Noise reduction methods have to be adopted and position resolution is to be measured with improved collimation. Detailed characterisation of the detector is to be completed. Complete tests of the detector after mounting the coded mask is to be done.