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Scanning Sky Monitor (SSM) on ASTROSAT- A Status Report

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1. Introduction

One of the proposed x-ray experiments onboard ASTROSAT is the Scanning Sky Monitor (SSM). The objectives of the SSM are :

- To detect and locate new x-ray transients.
- Transients offer an opportunity to study physical processes giving rise to a large dynamic range of luminosities L 10^{33} to 10^{39} erg/s.
- Alert on intensity level of known variable sources.
- Study bright sources over long time scales (disc precession, long term periods etc).

2. Specifications of the Instrument

The detector system consists of a one dimensional coded mask viewed by a position sensing gas filled proportional counter. There are 8 resistive wires of carbon coated quartz connected to charge sensitive preamplifiers which in turn are connected to the front end logic electronics. Details of the detector and principle of operation is given in an earlier reference (Seetha, BASI, 2002, 30, 829). We give here the salient parameters and the developmental status of the experiment.

Energy range: 2-10 keV; Field of view $6° \times 90°$
Source location capability $5 - 10'$ depending on intensity of the transient.
Sensitivity 10 mCrab in 1 day integration Coded mask : minimum slit size 0.95mm, No. of patterns 6; each of 63 elements
Best time resolution 1 ms.
No. of sky monitors: 3 , Payload weight: 48 kg (excluding boom arrangement)
Event rate: nominal 200c/s; max 5000c/s; Electronics designed to work upto 15,000c/s
Position resolution 0.5 mm along the wire
Onboard memory: 180 to 280 Mbyte for R/O done every 12 hours.
Attitude - pointing : better than $3'$, preferred $1'$
Knowledge better than $1'$(at the end of boom, inclusive of tilt/resolver errors).

3. Development Status of the Engineering Model

An engineering model of the detector system has been fabricated and is being tested. The detector outputs are connected to the preamplifiers, and their outputs in turn are connected to the front end logic. Detailed characterisation of all the wires has been completed. All the wires (except one) have position peaks with FWHM of 1 to 1.5 mm. The total energy resolution is better than 20% at 6 keV and is invariant of position in the central portion of the wire. At either ends of the wire (1 cm), the plot is non-linear. However, even in this portion the ratio and therefore position information can be determined. The detector has been subjected to thermovac cycling for a period of 7 days. The o/p after thermovac is comparable (within 1.5 σ) and the linearity is maintained..

4. Test Counter for R&D

An alternate counter with graphite wires was made ready because carbon coated quartz wire is known to have problems in space. The graphite wires have a resistance of 100 Ω/mm and have diameters of less than 10μ(compared to 8kΩ/mm for the 25μ diameter for the carbon coated quartz). One of the graphite wires was obtained from Japan and another from VSSC. Along with these wires one wire of carbon coated quartz (the same as in the engineering model) was also used for comparison. The o/p level from graphite wire was lower, but similar preamplifiers can be used with adjustment in HV. The position resolution obtained with these wires was poorer 2.5 to 3 mm for the Japanese graphite wire, and 4 mm for the VSSC graphite wire. But the linearity of the ratio peak was comparable. Further tests with fine tuning of preamplifier and HV will be necessary for these wires.

5. Challenges and Critical Areas

A calibration setup for testing with the coded mask is to be setup.
The test setup is to be automated for the test of the counter for a parallel beam.
The position resolution obtainable from graphite wires is to be improved. (Test selecting of wires is to be looked into).
The design and implementation of the boom is to be undertaken with respect to the design requirements of the detector system.