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A Dynamic Sky Simulation for the Scanning Sky Monitor on ASTROSAT

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Abstract. We have developed a dynamic sky simulation software for the visualization of the operation of the Scanning Sky Monitor cameras. This software can be used for the background modelling of the cameras and the refinement of source location using multiple cameras with crossed fields of view.

Keywords : ASTROSAT – Scanning Sky Monitor – Sky Simulation

1. Introduction

The proposed Scanning Sky Monitor (SSM) on board ASTROSAT is an assembly of three cameras mounted on a rotating boom (Seetha et al, 2002). The objective of the SSM is to locate transient sources in the sky as well as monitor the intensity variation in known bright X-ray sources. We have developed a software for computation and dynamic display of X-ray source locations in the field of view of continuously scanning coded mask cameras of the Scanning Sky Monitor (SSM) aboard ASTROSAT. This software reads a database of known X-ray source locations and strengths (e.g. the UHURU catalog, Forman et al, 1978) and as a function of time computes the location of sources in the field of view of each of the three SSM cameras in the local camera coordinates.

2. Visualisation of the Operation of the SSM Camera

To visualise the operation of the SSM cameras one has to inter-convert from camera co-ordinates to sky co-ordinates and vice-versa. A equal area map projection of the whole sky (Aitoff projection) on an ellipse with ranges of α and δ from $-180°$ to $+180°$ and $-90°$ to $+90°$ respectively

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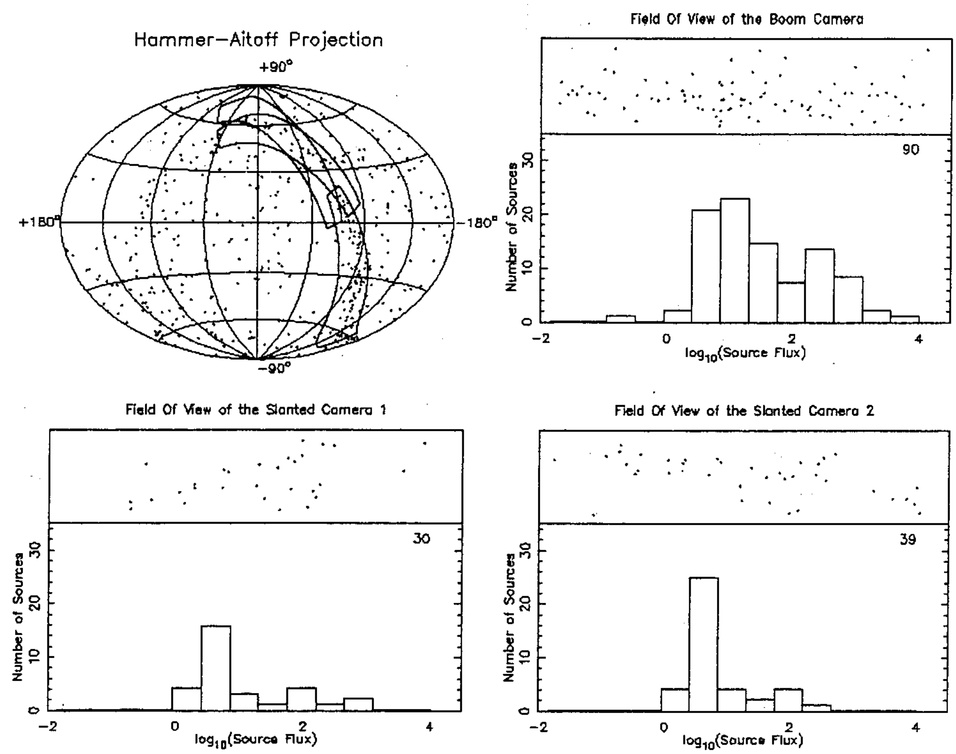

Figure 1. A snapshot of the simulation. The first panel shows the sky distribution of X-ray sources and the fields of view of the three SSM cameras. The other panels show the source distribution in the three camera FOVs, the number of such sources and their flux distribution histogram.

is generated. To facilitate the projection of the camera and the UHURU sources onto the sky, a conversion from camera co-ordinates to sky co-ordinates is performed. The transformation is carried out for all the three cameras and an inverse transformation is then performed to convert the sky co-ordinates to equivalent camera co-ordinates.

A histogram of the flux distribution of the sources in the field of view of each of the three cameras is generated. The histograms are updated as the camera rotates. This provides the total sky background in a given camera as a function of time and the spacecraft aspect. In order to recognize new transient sources, a background map consisting of previously known sources in the field of view at any given time should be subtracted. This software provides a model for this background map. Figure 1 shows a snapshot of the visualisation.

3. Estimation of Source Location in the Cross-coding Direction

The SSM cameras consist of one-dimensional coded masks and one-dimensional detectors (wires), which provide a resolution of $\sim 10'$ in the coding direction. To obtain source location in the direction orthogonal to this (cross-coding direction), we plan to employ the time difference between the passage of the source through the fields of view of two SSM cameras, slanted with respect to each other by $\sim 24°$. We have made simulated runs for such passages using the above software and have calibrated the relation between the source position in the cross-coding direction and the difference in the time of traversing the mid-planes of the fields of view in the two cameras. Consistency of this relation has been checked by repeating this procedure for several sources located in different parts of the sky. While the resolution in the cross-coding direction for a single camera is about $2.5°$, employing this method we could obtain resolution of $15'$ for high signal to noise sources. The location capability will of course degrade with reduction in signal to noise ratio.

References

Seetha, S. et al, 2002, *Bull. Astr. Soc. India*, **30**, 829 - 831.
Forman, W. et al, 1978, *ApJS*, **38**, 357 - 412.