ASTRO-H

INSTRUMENT CALIBRATION REPORT
Telescope Effective Area Auxiliary Transmission
ASTH-SXT-CALDB-AUXTRANS

Version 0.1

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ISAS/GSFC

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DOCUMENT TITLE: Telescope Effective Area Auxiliary Transmission			
ISSUE	DATE	PAGES AFFECTED	DESCRIPTION
Version 0.1	December 2016	All	CALDB First Release

1 Introduction

1.1 Purpose

This document describes "auxiliary transmission" factors (or fudge factors) that are used to modify the effective area generated by aharfgen for the SXI and SXS. The adjustment to the effective area is intended to account for the difference between the ground-based telescope effective area measurements and the telescope effective areas generated by the raytracing code xrtraytrace. The effective area produced by the raytracing code is controlled by the data in the mirror definition files, the reflectivity files, and the scattering files. Although the data in these files were fine-tuned to reproduce the ground-based effective areas as closely as possible by adjusting physical parameters relating to the physical properties of the telescopes, residuals of up to ~7% between the ground-based measurements and the raytracing predictions remained. The CALDB files described in this document can be used optionally with aharfgen to include the correction to the effective area in the ARF.

2 Release CALDB 20161122

Filename	Valid date	Release date	CALDB Vrs	Comments
ah_sxi_auxtran_20140101v001.fits	20140101	20161122	005	For SXT-I
ah_sxs_auxtran_20140101v001.fits	20140101	20161122	005	For SXT-S

2.1 Data Description

Ground measurements of the effective area of the SXT-I and SXT-S were made at selected energies of 1.5, 4.5, 8.0, 9.4, 11.0, and 17.5 keV with the ISAS beam line, using events in a circle of 12 mm diameter. The measurements reported in this document are for on-axis illumination. The raytracing code xrtraytrace (version 1.09.2) was used to generate the theoretical effective area at each energy for the given extraction region. The code was run with the thermal shield off since the ground measurements were made with the thermal shield removed.

2.2 Data Analysis

The effective area measurements and the predicted values are shown for SXT-I in Figure 1 and for SXT-S in Figure 2. The ratio between the measured and predicted effective area as function of energy is shown in Figure 3 for SXT-I and in Figure 4 for SXT-S. The ratio of measured to simulated effective area was then fitted with a spline function for each telescope.

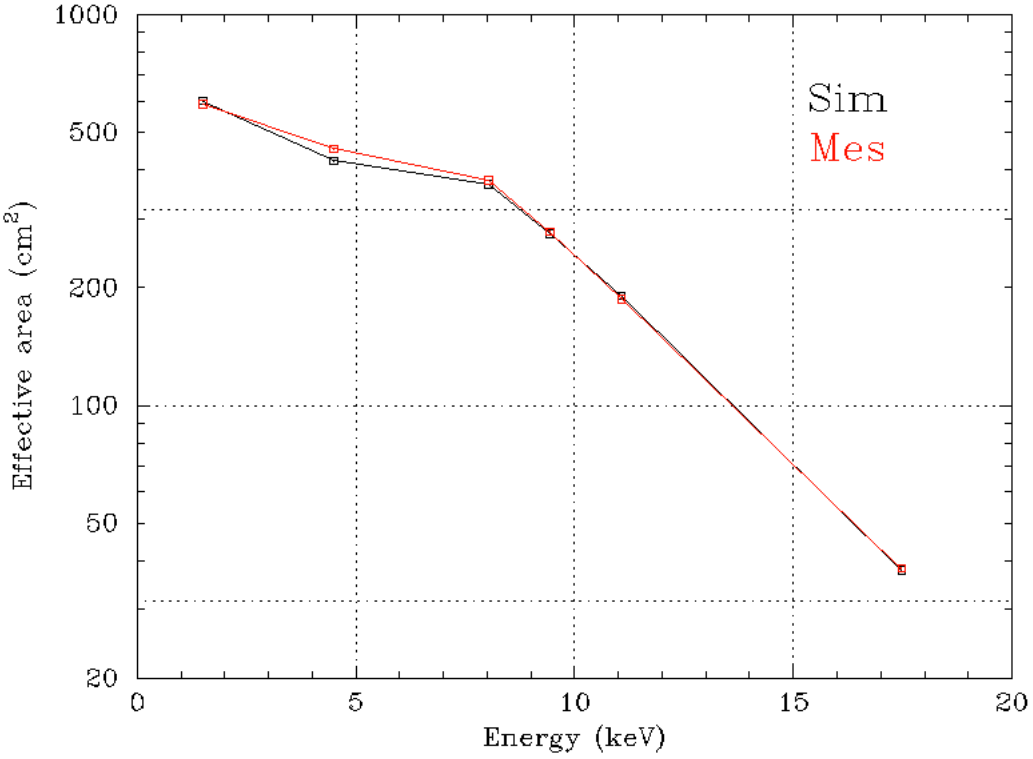

Figure 1: SXT-I effective area measurements (red) and raytracing predictions (black)

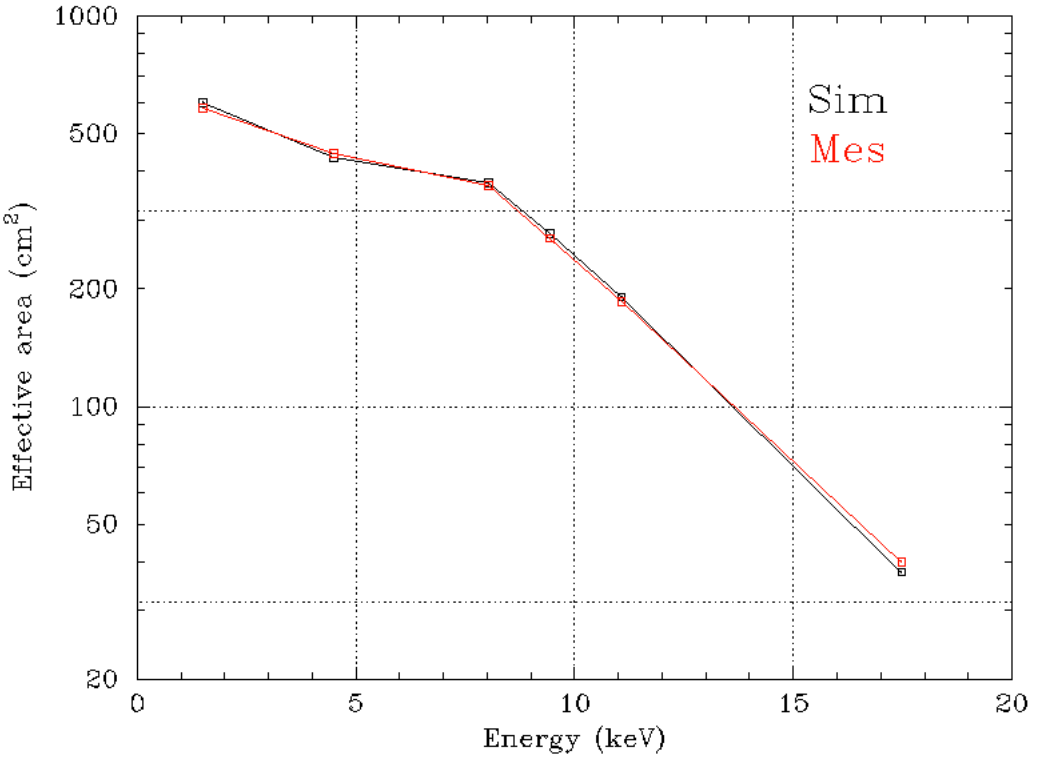

Figure 2: SXT-S effective area measurements (red) and raytracing predictions (black)

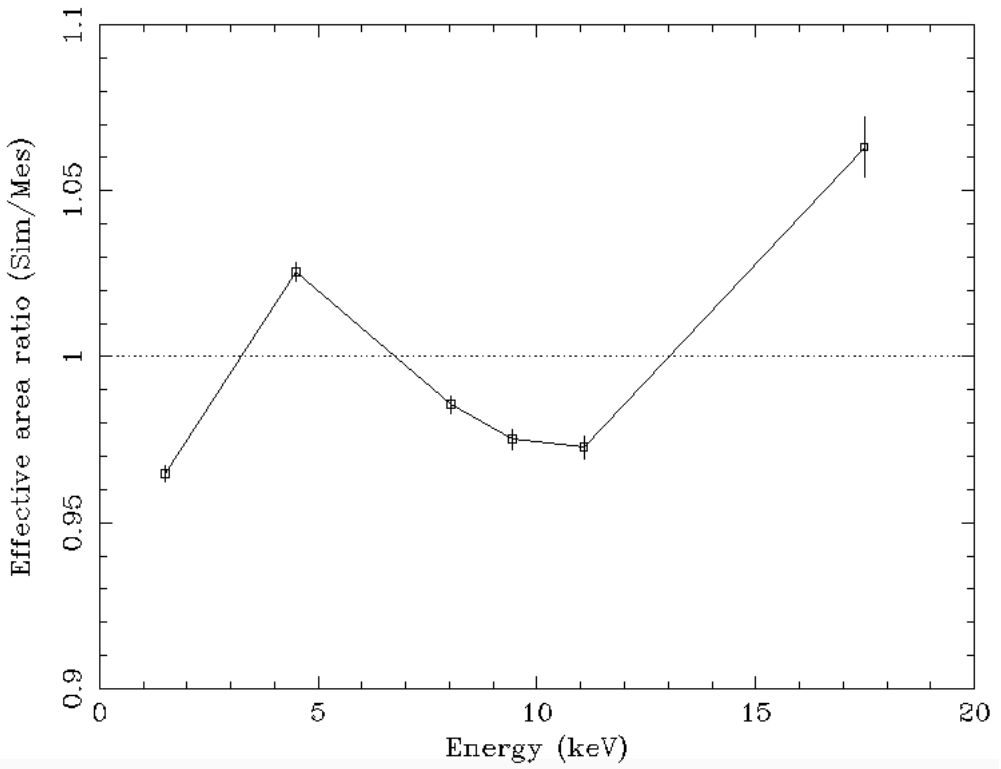

Figure 3: SXT-I ratio of measured to predicted effective area
s

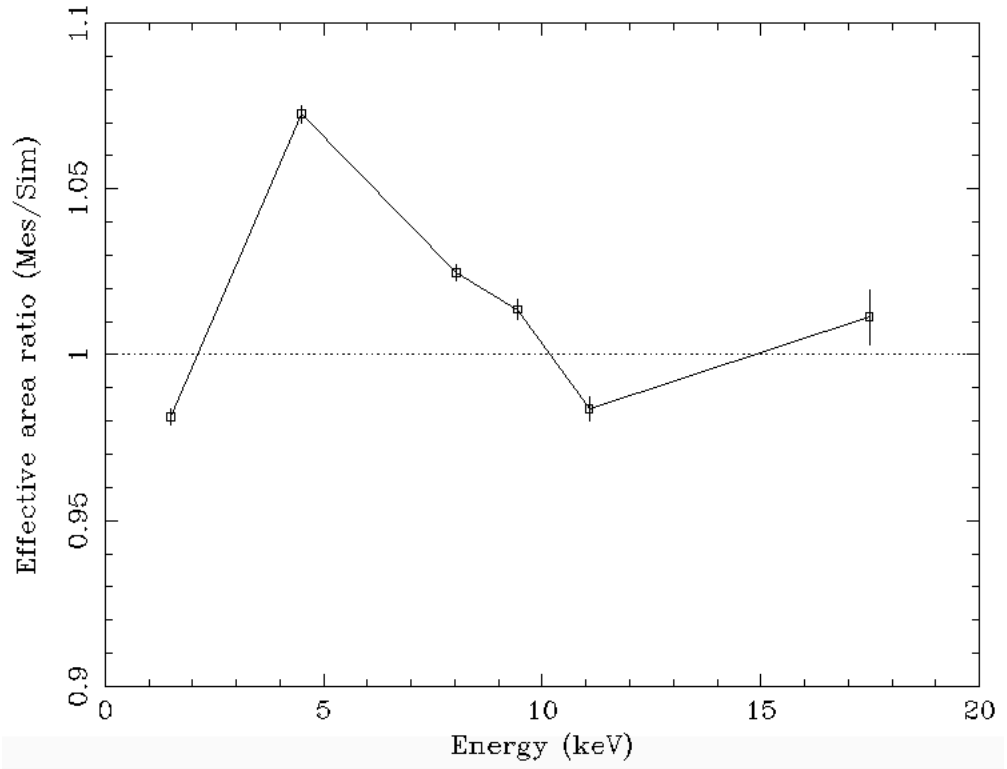

Figure 4: SXT-S ratio of measured to predicted effective area

3 Results

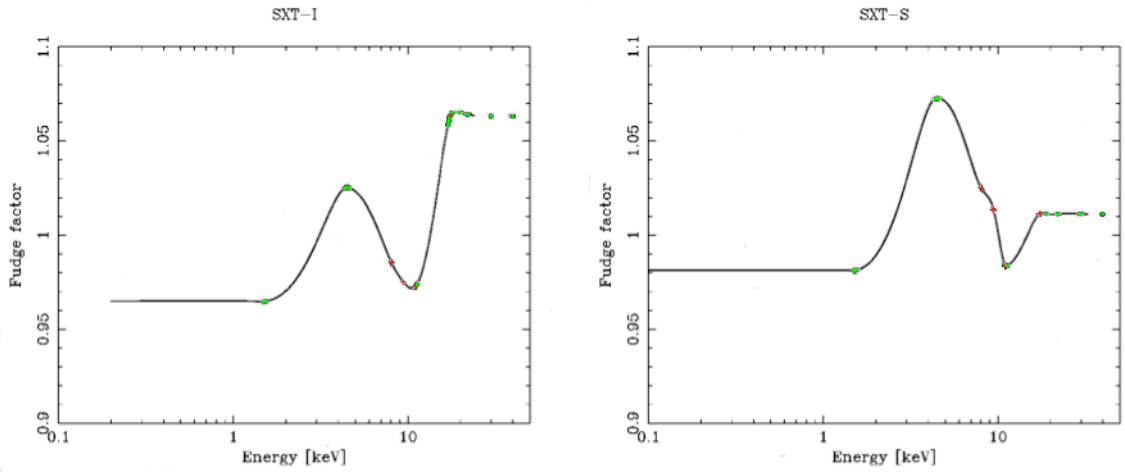

Figure 5: The ratio (red mark) between the effective area of the ray-tracing output and of the ground measurements. The white line corresponds to the fudge model. The light green data correspond to the knots for the spline interpolation.

Figure 5 which was made by T. Hayashi, shows the ratio between the effective area of the ray-tracing output and of the ground measurements. The ground measurements were made at the energies of 1.5, 4.5, 8.0, 9.4, 11.0, and 17.5 keV, respectively. Between the lowest (1.5 keV) and highest ends (17.5 keV) of the energies, we interpolate the ratio using a spline function. For extrapolation below 1.5 keV and above 17.5 keV, we simply extend the fudge factors with flat functions.

The CALDB file for each telescope has one extension called TRANSMISSION and two columns called ENERGY and TRANSMISSION, which store the appropriate function shown in Figure 5.

3.1 Final remarks

This is the first release of the auxiliary transmission CALDB files.