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Massachusetts Institute of Technology
Kavli Institute for Astrophysics and Space Research (MKI)

Handling Detector Wires

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Table of Contents

Preface

1.0 Scope

This document outlines the procedures used to mount and visually inspect the carbon-coated quartz wires that serve as detector anodes for the Scanning Shadow Cameras of the XTE All Sky Monitor. These procedures are largely motivated by 2 conditions: wires are very fragile (0.0007" diameter), and the quality of the carbon deposition must be guaranteed by visual inspection prior to shipment to the detector manufacturer. The supply spools for the wire are in storage at M.I.T. These procedures were influenced by the original handling instructions provided by the wire manufacturer, and also by recent laboratory tests conducted at M.I.T. References are as follows:

2.0 References

2.1 MIT Documents

- "Carbon Coated Quartz Filaments Handling Instructions", Technology for Energy Corporation, Revision O, April 1983
- "Mounting Carbon Coated Quartz Wires in the X-ray Detectors for the XTE ASM", XTE Monthly Status Report for the All Sky Monitor and Experiment Data System, March 31, 1992
- "X-ray Detector Tests for Development of the XTE All Sky Monitor", XTE Monthly Status Report for the All Sky Monitor and Experiment Data System, March 31, 1992
- "Further Analysis of the AXAF X-ray Counter", XTE Monthly Status Report for the All Sky Monitor and Experiment Data System, May 20, 1992

3.0 Procedure

3.1 Mounting the Wire Segments for Inspection, Transportation and Storage

3.1.1 Wire Support Frames

The CSR machine shop will provide wire-support frames for transportation of wire segments to the detector manufacturer. The support frames are rectangular pieces of plastic with the central area removed. The outer dimensions of a frame (8.5" x 2" x 3/16") are chosen for convenience, while the length of the hollowed-out portion (6") is chosen to be longer than the total length of the wire in the detector (4.37"), to provide excess length on each wire for handling by the manufacturer.

3.1.2 Transportation Container

In order to transport the wire, the CSR machine shop will provide a transportation container with slots designed to hold 20 support frames. One container (20 wire segments) will be provided for each detector unit (8 wires) that has been ordered, since some of the wire segments will not survive the installation process.

3.1.3 Unique Identification Tag

An MIT technician will clean each support frame and attach a unique identification tag to serialize the pieces of wire that leaves M.I.T.

3.1.4 Serialize Wire

The technician will attach masking tape to both ends of a ~7" wire segment (length includes taped section) that is removed from the supply spool. The wire shall extend 0.25 " minimum beyond the end of the masking tape to facilitate resistance measurement as described in 3.1.6.

3.1.5 Tape for Resistance Measurement

The technician will attach the masking tape for each wire segment onto a support frame. This tape may be later used to detach and control the wire after delivery. The section of each wire that spans the central hole in the support frame must not be touched, except for procedure described in 3.2.1 below.

3.1.6 Resistance Measurement

The technician or an ASM scientist will place conductive foam on the exposed ends of each wire segment and measure the resistance. After the resistance measurement, the end pieces and conductive foam will be broken off and discarded.

3.2 Optical Examination and Selection of Wire Segments

3.2.1 Prior to Visual Inspection

Prior to visual inspection, an M.I.T. scientist or QA officer (hereafter the "examiner") will clean off loose particles by blowing compressed air across the wire and gently wiping the remaining particles with a cotton swab.

3.2.2 Optical Scan

The examiner will then optically scan each wire segment along both top and bottom surfaces with a 60X bench microscope. Each wire will be evaluated according to the criteria described below for selecting or rejecting wire segments for delivery to the detector manufacturer. A numerical grade will be assigned, based on the fraction of wire surface (in mm increments) that appears to be uniformly coated with carbon (i.e. dark gray in color). The scanning grades will be recorded by the examiner. In addition, the examiner will keep a calibration wire which illustrates examples of various wire grades.

3.2.3 Rejection of a Wire Segment

The rejection of a wire segment may arise from any of the following: attached bodies, with the exception of minor particles that are no larger than 30% of the wire diameter; wire diameter non-uniformities that are more than 30% deviant from the average; a region of thickened or bubbled carbon deposits; an average coating grade < 0.99 across the entire wire; a region of 1 mm or more with a coating grade below 0.7.

3.2.4 Wire Segments that Pass

Wire segments that pass these criteria will be transported to the detector manufacturer. The rank order of the wires in the 20-wire container will be determined from the total number of wire imperfections, which is defined to be the sum of the number of attached minor particles and the total number of coating defects (in units of 10% losses per mm of wire). This rank order will be provided to the detector manufacturer as a priority list for wire usage.

3.2.5 Rejected Wires

All rejected wires will be discarded, and the support frame will be recycled per 3.1.3

3.3 Recommendations for the Detector Manufacturer

3.3.1 Instrument Manufacturer

The instrument manufacturer must insure that no new sources of contamination (e.g. dust, moisture from human breath etc.) may reach the wire surface. Installation of wires into the detector shall be performed on a clean bench by workers wearing surgical masks.

3.3.2 Prior to Attachment

Prior to attachment in the proportional counter, each wire must be gently wiped with a soft cotton swab and cleaned with a blow of clean gas (20 PSIG or less).

3.3.3 After Attachment

After attachment to the electrical feeds in the proportional counter, and before the counters are permanently sealed, an MIT QA representative will examine the wires with a microscope to insure that each wire's evaluation code remains representative of the wire's condition.