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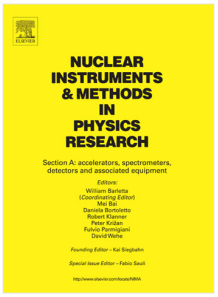

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Investigations on the thermal condition of the Alpha Magnetic Spectrometer on the International Space Station during the maneuver of locking solar arrays

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Abstract: The maneuvers of the solar arrays on the International Space Station (ISS) have significant effects on the Alpha Magnetic Spectrometer (AMS) thermal environment. In this paper, two research methods to investigate the dependence of the thermal environment on different solar β angle are given. The temperature data recorded since May 19, 2011 are used to analyze the impact of the ISS maneuver of locking solar arrays on the AMS temperatures, and the temperature variations at different AMS components are studied. We find that the extent of the temperature changes after locking solar arrays is affected by the different β intervals. We also summarize the β intervals where temperature warnings are likely after locking the solar arrays. The results can be referred to during the AMS operations.

Keywords: AMS; ISS; Locking solar arrays; Temperature warnings

1. Introduction:

The AMS (shown in Fig. 1) is a general purpose high-energy particle physics detector, aiming at the study of the origin and the nature of cosmic rays, dark matter and anti-matter in space [1]. The AMS Collaboration published the first five years' results of the long-duration experiment on the ISS on 8 December 2016. In five years, the AMS recorded more than 90 billion cosmic rays events which were beginning to unlock the secrets of the cosmos [2].

To keep the AMS detectors operating accurately in the long-term running experiment on the ISS, a reliable Thermal Control System (TCS) is essential for AMS due to the extreme and complicated environment in space. The TCS includes more than 1000 sensors to record temperatures of all the AMS components at least every few minutes, and about 300 heaters and thermostats to keep the temperatures within the allowed range [3]. Temperature warnings are likely because of the harsh environment in space.

The AMS installed on the ISS is significantly affected by the structure and layout of the ISS, in which, the ISS solar arrays, the ISS flight