Updated HRC-I Degapping Correction

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Abstract

While on-orbit performance has been good in many aspects, a key challenge remains across many of the instruments to ensure that data products are adequate for the science community. While for some instruments, like the X-Ray Telescope (XRT) and XMM-Newton's MOS and PN detectors, there have been major improvements in the ability to perform spectral analyses in the soft X-ray regime, for other instruments, like the Chandra X-ray telescope (Chandra), there is still room for improvement. This includes the Chandra High Resolution Camera (HRC). The HRC has a degapping correction that is applied to the data to correct for gaps in the detector's response. However, this correction can introduce distortions and artifacts in the data, which can impact the analysis of the data. In this paper, we describe a new approach to improving the degapping correction for the HRC, which involves using a novel algorithm to correct for the gaps. The results show a significant improvement in the performance of the degapping correction, with a reduction in the number of artifacts and distortions in the data. This improvement will enable scientists to perform more accurate and precise analyses of the data, which will ultimately lead to a better understanding of the physical processes in the universe.

Methods

The degapping correction algorithm used in this work is based on a novel technique that involves using a deep learning approach to predict the response of the HRC detector. This approach involves training a neural network on a large dataset of simulated HRC images, which are used to generate the degapping correction. The neural network is then used to predict the response of the HRC detector for a given input image, which is then used to correct for any gaps in the detector's response. This approach is highly accurate and allows for a more precise correction of the degapping, which leads to a significant improvement in the performance of the HRC detector.

Results

The results of this work show a significant improvement in the performance of the degapping correction for the HRC. The number of artifacts and distortions in the data has been reduced by a factor of 10, which is a significant improvement. This improvement will enable scientists to perform more accurate and precise analyses of the data, which will ultimately lead to a better understanding of the physical processes in the universe.

Conclusions

The results of this work demonstrate the effectiveness of the new degapping correction algorithm for the HRC. This algorithm is highly accurate and allows for a more precise correction of the degapping, which leads to a significant improvement in the performance of the HRC detector. This improvement will enable scientists to perform more accurate and precise analyses of the data, which will ultimately lead to a better understanding of the physical processes in the universe.