An Automated Image Rejection System for GONG

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The current quality assurance process for the GONG image calibration and processing pipeline requires much human interaction. We have developed and are testing an Automated (bad) Image Rejection (AIR) program to automate this QA work as far as possible for several reasons:

- Reduce the level of human interaction necessary to process data
- Use objective, repeatable criteria for image selection/rejection
- May improve duty cycle

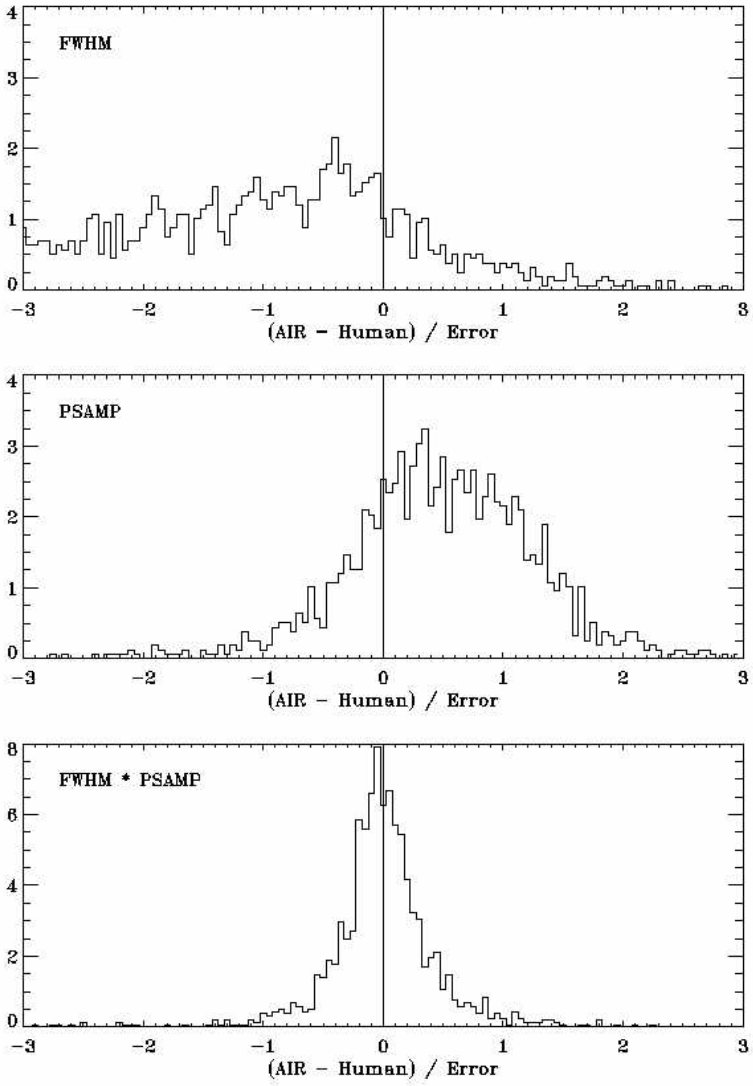
The checks that AIR performs

- Several image header parameters are checked to assure normal operating mode.
- A limb finder (radius, X and Y of the center) provides a very tight check for tracking and also a simple check of intensity image quality.
- For each image the difference between the modulator states is produced.
- Calculate statistics on the set of pixels within the solar image and test against empirically determined limits.
- The difference between successive 1-minute images is formed. This image is responsive to thin clouds and other transient features. Image statistics are compared against thresholds.

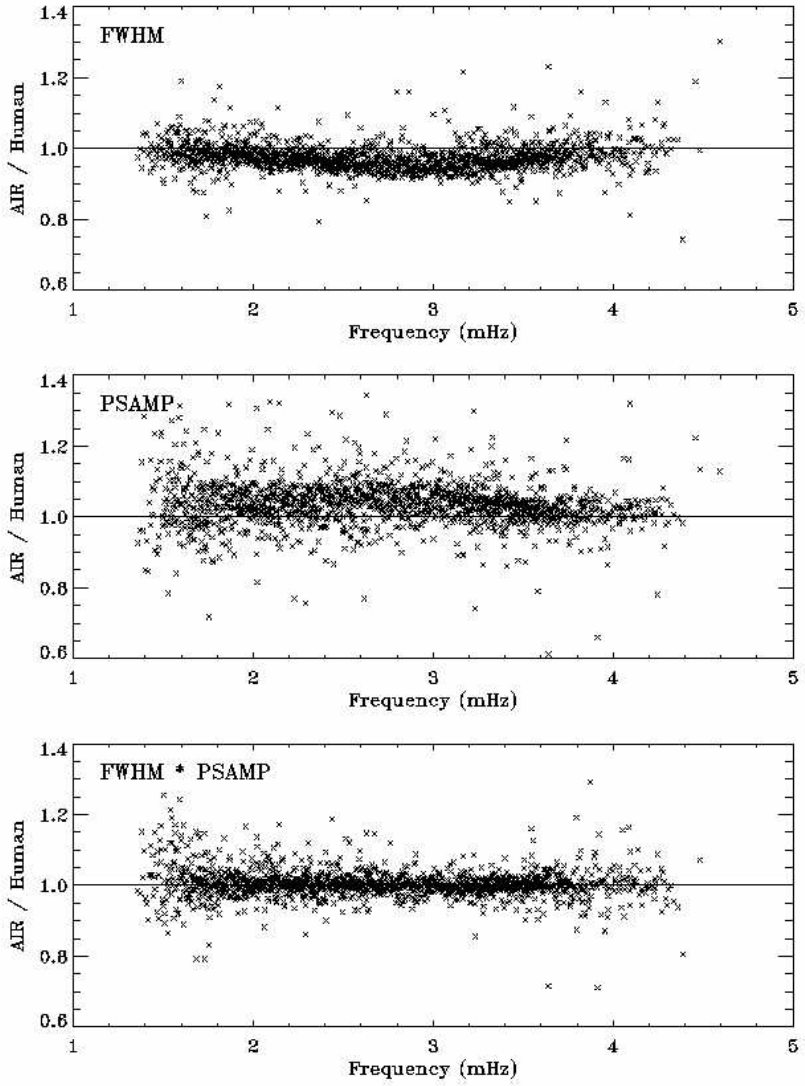
Tests

GONG data from a 108 day period were processed using AIR to select images for inclusion. Helioseismic products generated from this dataset were compared with products from the normally processed dataset

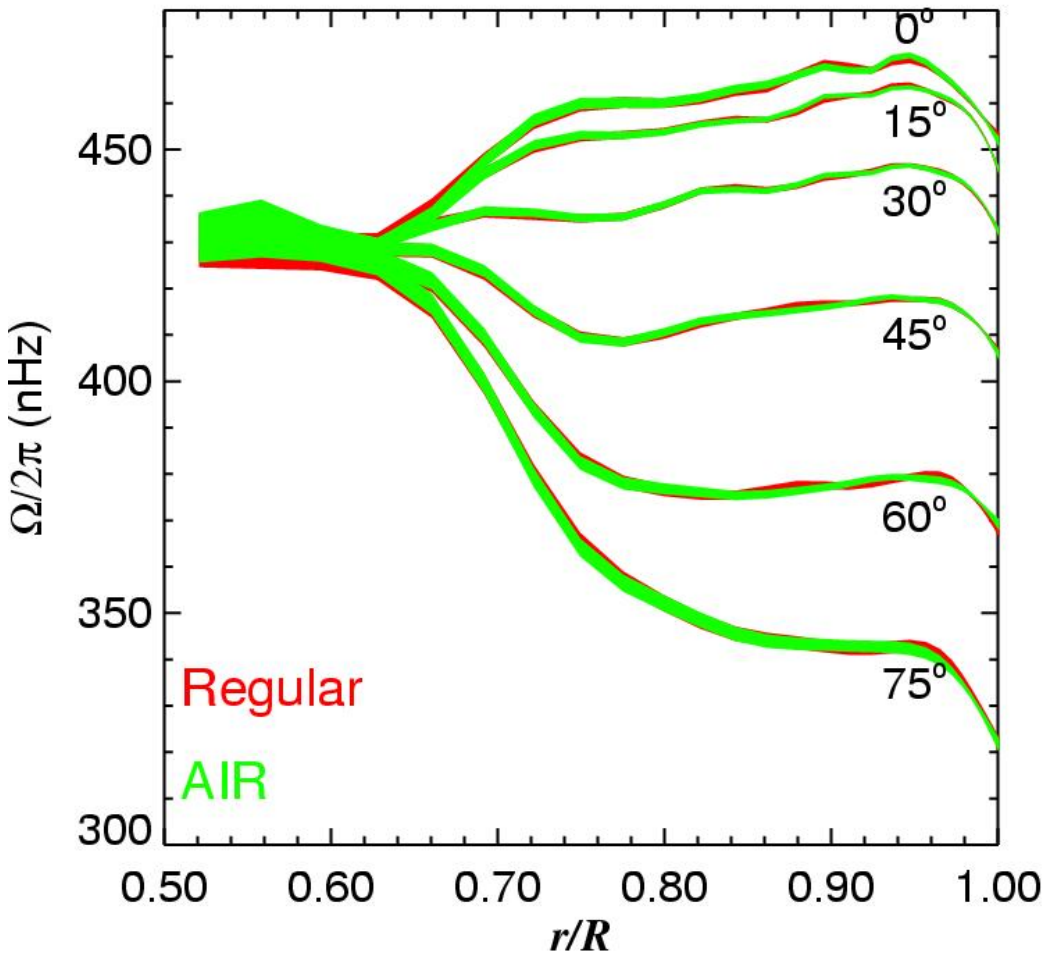
- The duty cycle during this period increased from ~85% to ~88%
- Mode frequency peaks, *l-nu* diagrams, and the results of a Regularized Least Squares inversion were very similar for the two datasets.



Histograms of mode strengths found by PEAKFIND from the original human QAed dataset and the AIR dataset. The bottom plot shows the distribution of normalized mode strengths corrected for the difference in duty cycle.



Same as above but showing the ratios of individual p-mode strengths.



The results of a RLS inversion. The line width is proportional to the uncertainty in the inversion.

Status

- Preliminary tests with local helioseismology products also give results very similar to those obtained from the original Human QAed dataset.
- Including short sequences of data from marginal days adds high temporal frequency structure to the window function. This does not appear to have any negative impact on the quality of products but is still being investigated.
- The interface between AIR and the existing image calibration/processing pipeline needs to be streamlined for routine use.
- Tests for additional instrument anomalies have been devised and will be added.

This work utilizes data obtained by the Global Oscillation Network Group (GONG) Program, managed by the National Solar Observatory, which is operated by AURA, Inc. under a cooperative agreement with the National Science Foundation. The data were acquired by instruments operated by the Big Bear Solar Observatory, High Altitude Observatory, Learmonth Solar Observatory, Udaipur Solar Observatory, Instituto de Astrofísica de Canarias, and Cerro Tololo Interamerican Observatory