



# Automation Methods for the Quality Assurance of VLASS Quicklook Images



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## What's the Problem!?

The Very Large Array Sky Survey (VLASS) is observing the sky at declination greater than -40 degrees. This means there are 33884.93 square degrees of area to image. VLASS has divided the observing area into 35,500 one-square-degree regions for imaging and will observe this area 3 separate times. There will be 106,500 one-square-degree quicklook (QL) images.

From the quality assurance (QA) process ~78% of these images have met the science requirements and should be able to be immediately accepted, and ~22% need to be reprocessed, at least once, with different deconvolution parameters before being accepted. In both categories there is ~2% of images that need to be remade after manual flagging. Thus a data analyst needs to look at every single image. Let's reduce that number.

**Automation allows the community to receive VLASS QL images more quickly with a reduction of manual QA by ~80%**

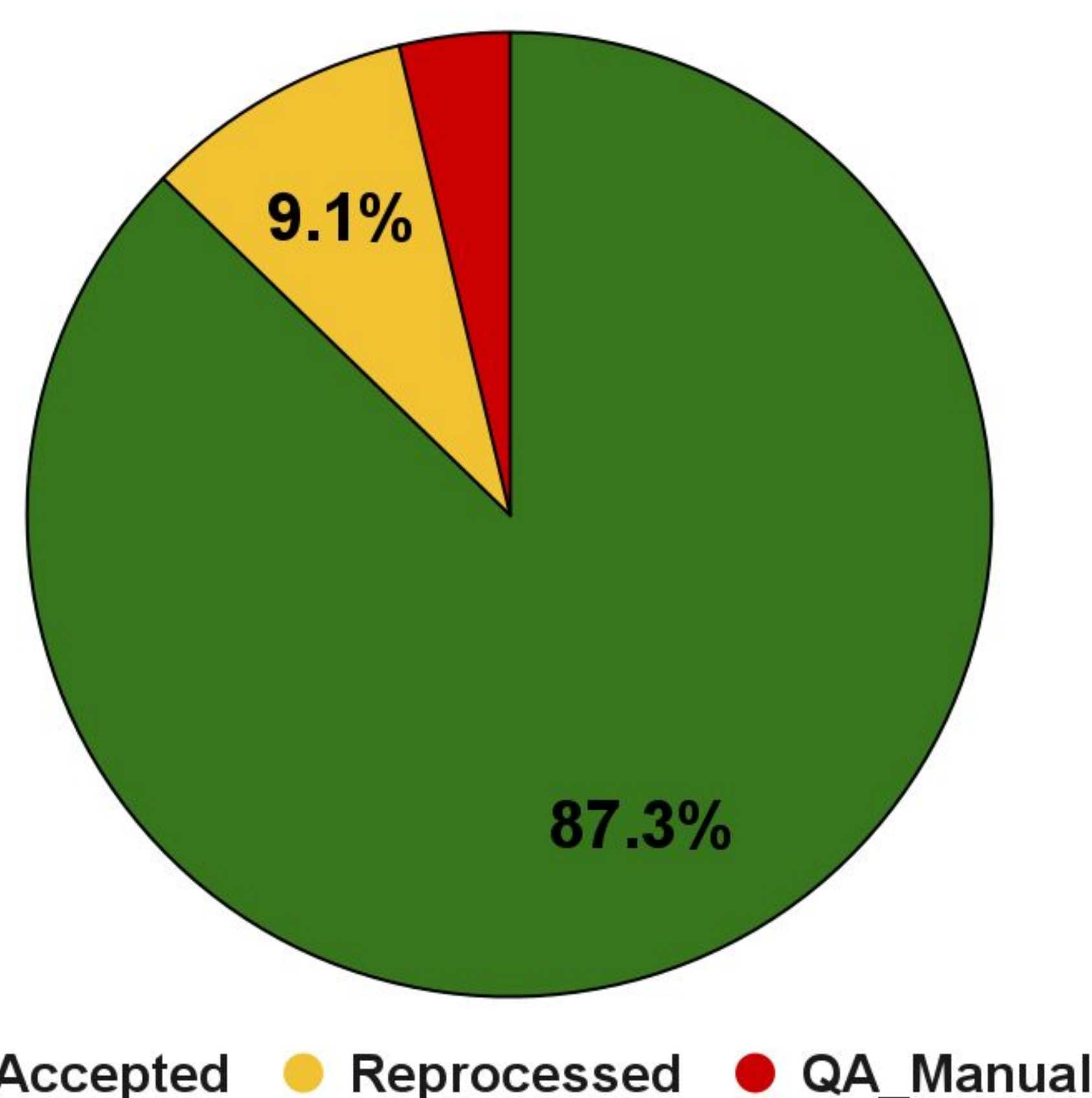
## So What Are We Doing?

To find the small number of pesky images that need manual flagging there have been different detectors made. One uses a Convolutional Neural Network (CNN) while four others use Heuristics. These search for known artifacts such as bad baselines, high weights, primary beam (PB) holes, and radio frequency interference (RFI).

- Primary Beam Hole CNN Detector
  - Categorizes images based on the PB hole features that the CNN was trained on
- Bad Baselines Heuristic Detector
  - Looks at the fast fourier transform of the image for pixel values outside a known tolerance
- High Weights Heuristic Detector
  - Finds the mean of the pixel values of the PB image and reports if that mean is not similar to a typical image
- Primary Beam Hole Heuristic Detector
  - Searches for masked regions of the RMS image and checks if the surrounding pixels have higher noise than the mean of the whole image
- RFI Heuristic Detector
  - Searches the modified model image to find fluffy regions that is indicative of RFI for a VLASS image

Each detector is included in a larger script that looks at each image to determine its acceptability. This driver script determines if there are artifacts in an image and then decides whether to accept an image, reprocess an image, or send an image for manual QA.

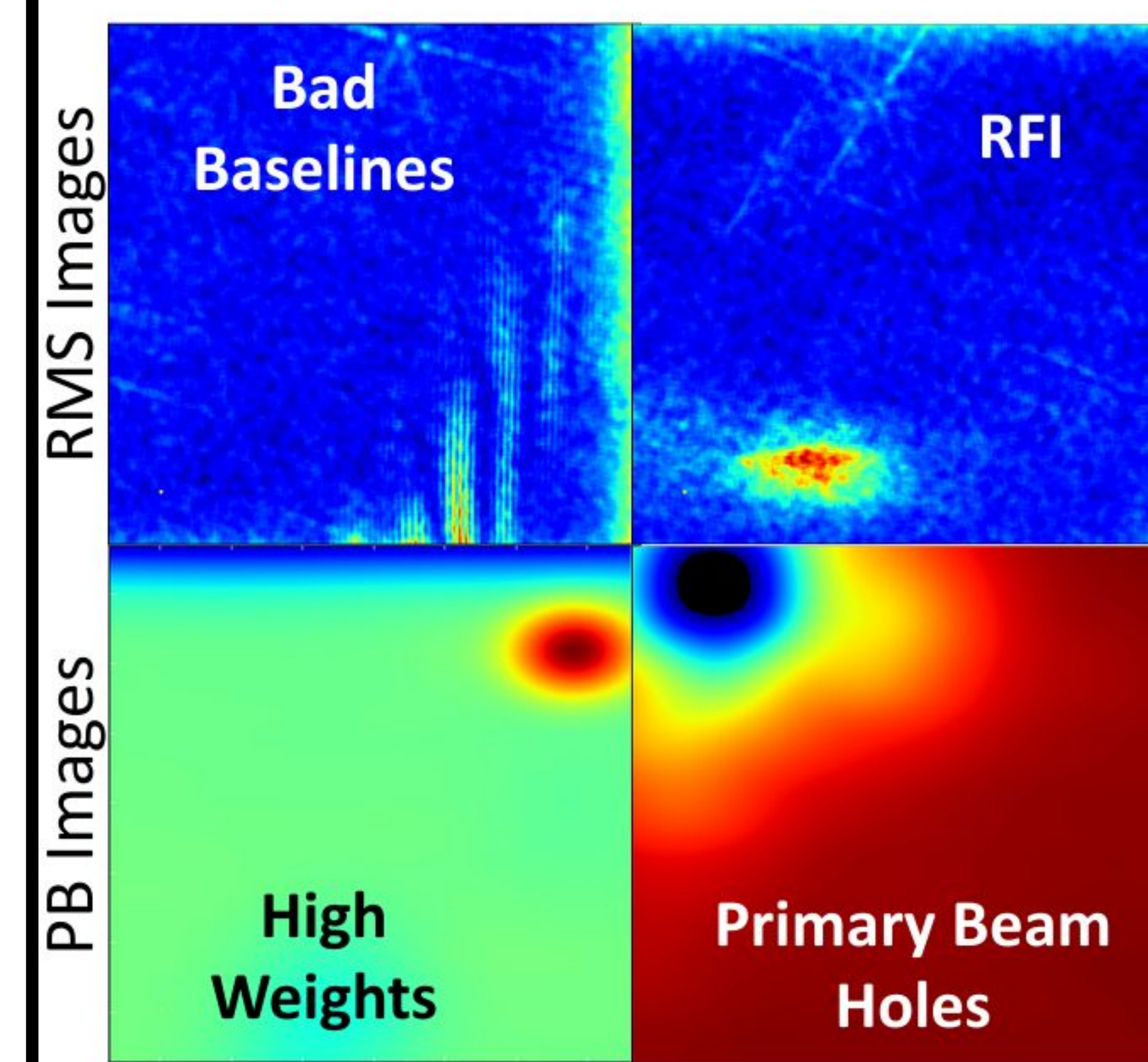
## Automatic QA of Images



Automation Category	Number (percentage)
Accepted	568 (87.3%)
Reprocessed	59 (9.1%)
QA_manual Total	24 (3.7%)
<b>QA_manual with Artifact</b>	<b>3 (0.46%)</b>

~2% of Images Have Artifacts

## ARTIFACTS



## Outcomes and Future

Running the driver script regularly will reduce the number of images a data analyst has to check. It also allows for images to be accepted and rerun outside of normal business hours which will produce more images to the community quicker and allows the data analysts to focus more on images that need manual intervention.

Future versions of this automation will have a more elegant reprocessing scheme and be applied to other VLASS products.