USING IMAGE PRO PLUS SOFTWARE TO DEVELOP PARTICLE MAPPING ON GENESIS SOLAR WIND COLLECTOR SURFACES M.C. Rodriguez[1], J.H. Allton[2], and P.J. Burkett[3] . [1] Geocontrol Systems-ESCG at NASA/Johnson Space Center, Houston, TX 77058; melissa.rodriguez-1@nasa.gov, [2] NASA/Johnson Space Center, Houston, TX 77058, [3] Jacobs- ESCG at NASA /Johnson Space Center, Houston, TX 77058.

Introduction: The continued success of the Genesis mission science team in analyzing solar wind collector array samples is partially based on close collaboration of the JSC curation team with science team members who develop cleaning techniques and those who assess elemental cleanliness at the levels of detection. The goal of this collaboration is to develop a reservoir of solar wind collectors of known cleanliness to be available to investigators. The heart and driving force behind this effort is Genesis mission PI Don Burnett. While JSC contributes characterization, safe clean storage, and benign collector cleaning with ultrapure water (UPW) and UV ozone, Burnett has coordinated more exotic and rigorous cleaning which is contributed by science team members. He also coordinates cleanliness assessment requiring expertise and instruments not available in curation, such as XPS, TRXRF [1,2] and synchrotron TRXRF. JSC participates by optically documenting the particle distributions as cleaning steps progress. Thus, optical document supplements SEM imaging and analysis, and elemental assessment by TRXRF.

JSC Involvement: The JSC contribution to the cleaning plan is to provide optical analysis of the collector array surfaces using a Leica DM6000M microscope. The scope has a 50X objective with an automated stage that provides capability of scanning high resolution images from the fragment surfaces. The instrument can capture features as small as one micron in size in a single frame (222 x 160 um). JSC is using Image Pro Plus software [3] to compare particle counts on scanned areas. The microscope is being used to capture images of three locations on the collector fragments in this effort. The three mosaic scanned locations are each about 1mm^2 in area.

The Cleaning Process: All sample handling at JSC is done within the Genesis lab. Samples are cleaned on a Laurell Wafer Spin Processor with megasonically charged UPW (ultra-pure water) at 3000RPM with a water flow of 1.5 l/min. at 40C. Sample UPW cleaning time is dependent on collector material [4]. After UPW cleaning, the fragments are exposed to ultraviolet light using a Jelight UV/O3 cleaner for 30 minutes [5]. Samples are then taken for optical imaging. Three areas are chosen for survey using a 50X objective. The areas must have a permanent feature (gouge, smear etc) to represent a fiducial mark for accurate repeat analysis and orientation. The final image is saved as a bitmap, and can be converted to a smaller JPEG file for processing.

Image Processing: In the Image Pro software, the dark pixels (presumed contamination) can be identified and displayed to reflect measurements per feature. For images with great differences in pixel intensity (compared to the background), a thresholding method can be used to collect the data. Outlines of the features can be saved and displayed as screenshots for publication purposes. This process is repeated for each of the three mosaic scanned areas. Care is taken to capture the exact same orientation of the fragment on the microspore stage for better comparison of data. Avoiding fragment edges yields better results. Background flattening often aids in the background correction due to uneven illumination. The features can be displayed into classes separated by color for an added visual effect.

Sample 60440. Using comparison data for scanned areas at 50X is new for the Genesis lab. Sample 60440 (Czochralski silicon , bulk array, Fig. 1) has been the most documented sample in this effort. The sample was cleaned with UPW at JSC, and has also been cleaned by acid etch (Caltech) and has since been returned to JSC. The sample was scanned in three areas at 50X, each about 0.8 mm^2 in area (Fig. 2). Particle distribution data has been collected for each position to illustrate the effects of UPW cleaning and the addition of acid-etch cleaning (Fig. 3). As part of the cleaning verification trail, JSC can perform this repeat imaging on the same areas on each fragment as it is returned to the facility.

Fig. 1. Sample 60440, after UPW and acid-etch.

Fig. 2. Position three on sample 60440, after UPW + acid- etch.

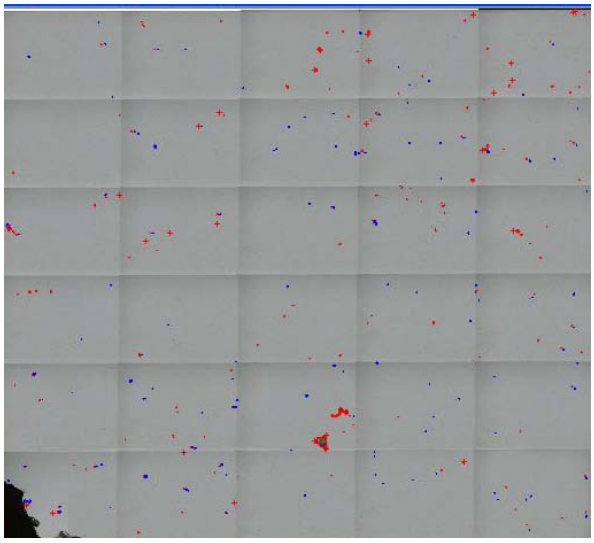

Fig. 3. Position three on sample 60440. The red objects are present now, after UPW + acid etch. Blue objects were observed after UPW cleaning.

References: [1] Schmeling M. et al (2011) LPSC XLII, Abstract # 2041. [2] Schmeling M. et al (2010) LPSC XLI, Abstract #1682. [3] Allton J.H. et al. (2007) LPSC XXVIII, Abstract # 2138. [4] Calaway M.C. et al (2009) LPSC XL, Abstract # 1183. [5] Calaway M.C. et al (2007) LPSC XXVIII, Abstract # 1627.