

Source Detection and Extraction of Point Sources (ALG-AP-001/002)

Authors:

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History:

- o 2013-Jul-30 - Draft
- o 2013-Nov-05 - Baseline
- o 2015-Mar-23 - Merged Source Detection and Source Extraction into one algorithm since they are effectively the same, made significant changes to algorithm description due to change in software being used (Astrometrica rather than SExtractor)

Description:

Source detection of point sources in OCAMS images for natural satellite detection, asteroid/natural satellite photometry and natural satellite astrometry. Source detection involves identifying all sources contained on a single OCAMS image above a specified signal-to-noise ratio. Source detection can be conducted on raw OCAMS data though it will be more efficient on data that has been bias subtracted, flat fielded and cosmic ray corrected. At present, the Astrometrica asteroid astrometry and photometry code will be used for this task. The SExtractor algorithm contains a number of individual steps including:

Parameters:

infile - the OCAMS MapCam L1 FITS files (including standard OCAMS header/metadata) to extract the point sources from, SPICE kernels (SPK S/C, Bennu SPK, Instrument Kernel)

outfile – an internal intermediary file used by Astrometrica that feeds into the following algorithms: Photometric Reduction, Astrometric Reduction, Moving Object Detection and Manual Validation of Satellite Candidates

Algorithm equations:

- o The Astrometrica software has been used for ~20 years to support ground-based astronomical observations of asteroids, comets and stars. As a COTS product, it is one of the primary tools used by asteroid observers. The software was also used by the NASA Dawn mission in support

of their search for natural satellites around the asteroid Vesta (McFadden et al. 2016). The algorithms used by Astrometrica for the detection of point sources have been tested and proven over ~20 years of asteroid study. Since the software is extensively used and has been vetted by the astronomical community, the algorithms to be used do not need to be specifically presented here.

Proposed software:

Astrometrica

Additional references:

- o McFadden et al. 2016. Vesta's missing moons: comprehensive search for natural satellites of Vesta by the Dawn spacecraft. *Icarus* 257, 207-216.