

Automated Data Processing and Image Quality Analysis Pipelines for the DART DRACO Instrument

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ABSTRACT

The Double Asteroid Redirection Test (DART) was the first successful demonstration of a kinetic impactor for planetary defense. The lone instrument onboard DART was the Didymos Reconnaissance and Asteroid Camera for Opnav (DRACO), which obtained 250,000+ images during its charge. The DART mission utilizes a novel automated data processing pipeline to quickly produce raw and calibrated images for analysis and visualization, and a semi-automated pipeline to track image quality metrics and collate statistics from all images taken by DRACO over the course of the mission. The automated processing pipeline produces approximately 25 raw images per second and 15 calibrated images per second, which are then passed to the analysis pipeline for timely identification of detector misconfigurations, missing data, and other adverse events. Processing and analysis software was optimized during the commissioning, cruise, and approach phases of the mission, and the processing pipeline was fed images of interest identified by the Science Operations Center during the impact event to prioritize calibration of the most visually and scientifically rich images (see Fig. 2 of Daly et al., 2023). This optimization and automation allowed the final 25 images prior to impact to be calibrated and delivered within minutes after the impact. The DART DRACO data processing software architecture and automation implementation are outlined here as a framework for future planetary defense missions that require rapid data analysis and “scientist in the loop” decision making.