



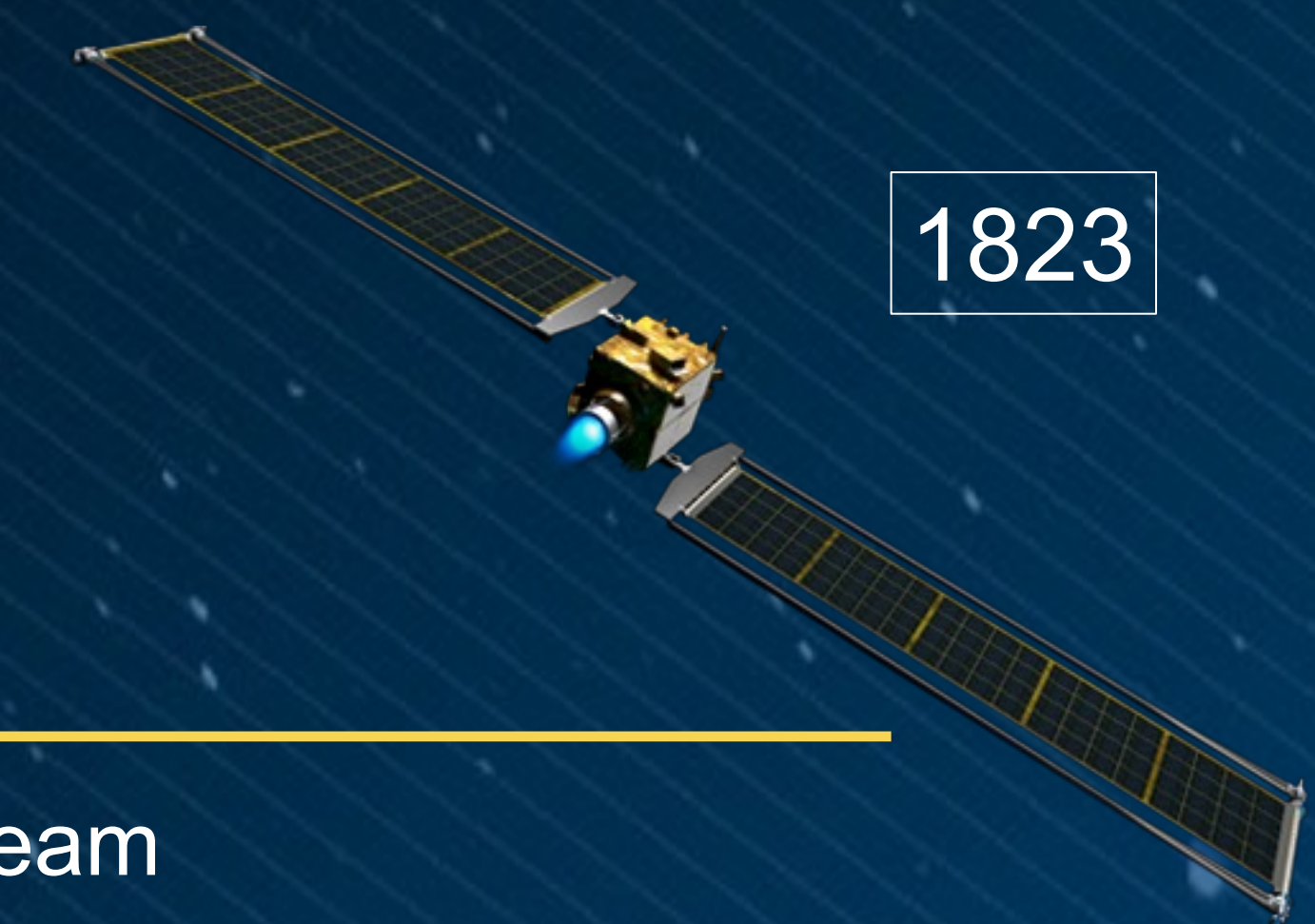
Automated Data Processing and Image Quality Analysis for the DART DRACO Instrument

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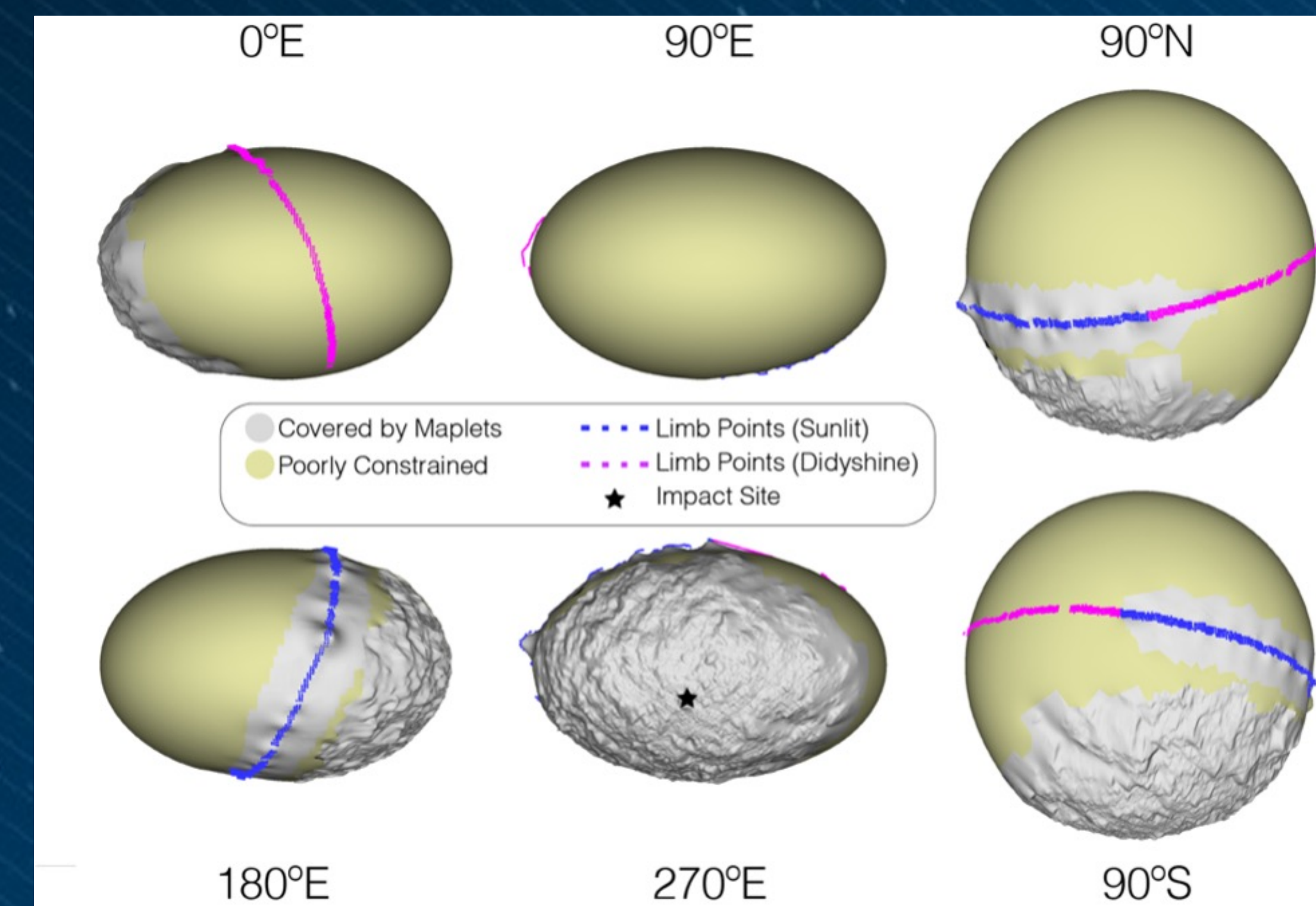
DART
Double Asteroid Redirection Test

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1. Science and engineering data delivered to the Science Operations Center (SOC) from the Mission Operation Center (MOC)
2. Automated software detects new MOC delivery via SOC database registration and kicks off data product and image quality analysis pipelines
3. New raw and calibrated data products delivered via web portal to Investigation Team (IT) for analysis and modeling



Pipeline philosophy

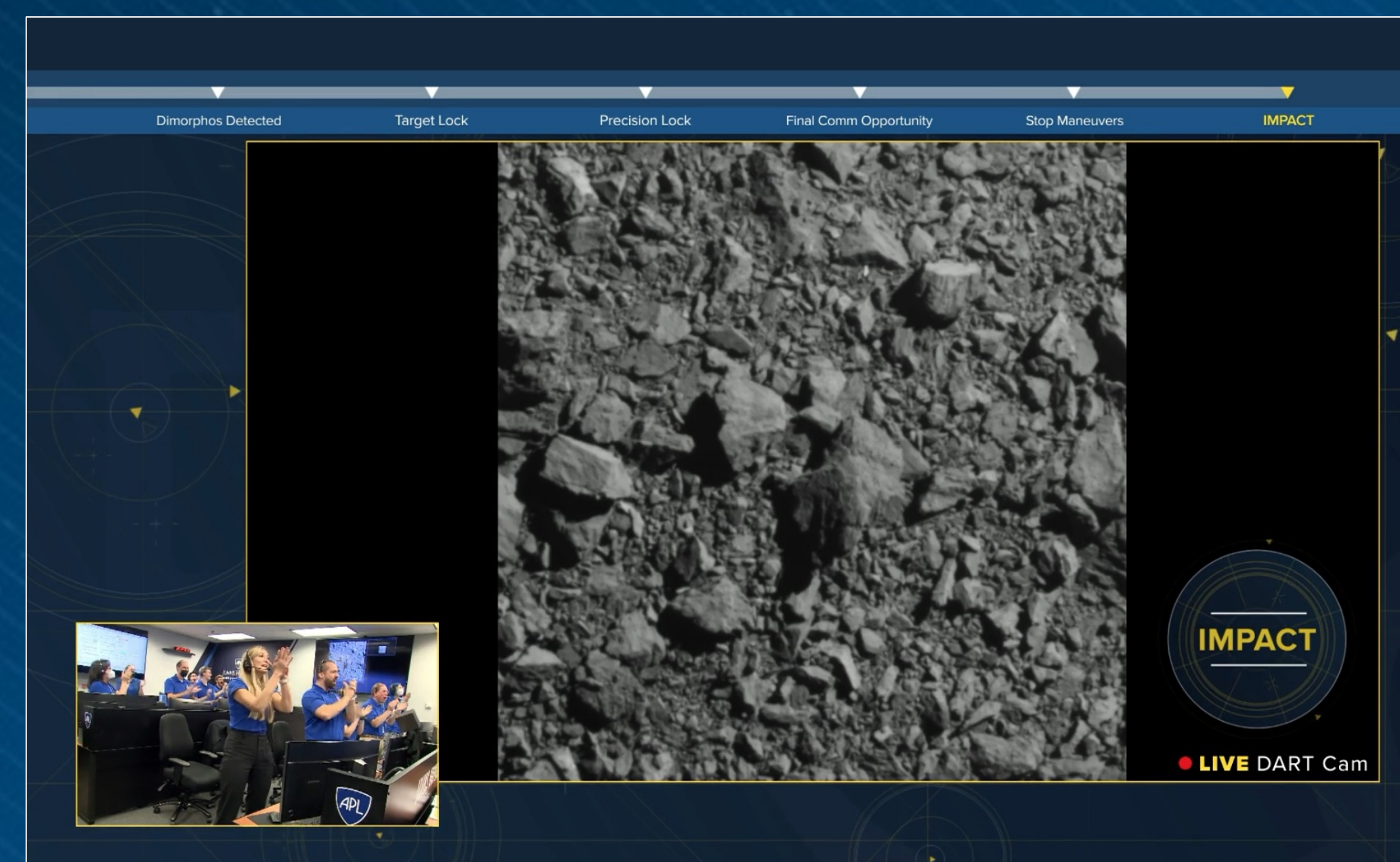
Before launch and during cruise, processing and analysis software was developed and optimized to efficiently handle data from DART's onboard DRACO imager. A data product pipeline was constructed to autonomously handle processing and calibration. An image quality analysis pipeline was constructed to alert users of potential data quality issues or processing errors.

Processing during impact

DRACO images were streamed to Earth in real time at a 1-Hz cadence until just before impact. Within 15 minutes after impact, the final 150 images were calibrated and delivered to the IT. The figure above was modified from an image identified in real time as the last frame to contain all of the lit body of Dimorphos in the field of view. The body is oriented with the north pole toward the top of the image.

Derived product pipeline

Calibrated DRACO images are used for shape modeling of Didymos and Dimorphos. The figure above shows the Dimorphos global digital terrain model (DTM) as viewed along its principal axes [1]. Software for generating derived products such as local DTMs, tilt, and gravity products and labels is currently being organized into a semi-autonomous pipeline.



Open source mindset

The data product pipeline and analysis tools for DART were developed using open source languages and software such as Python, MySQL, Java, and Nextflow. The "DART Toolkit" was distributed to the Investigation Team, and parts of the toolkit are being prepared for public release.

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DART impacted Dimorphos, with more than one million concurrent viewers watching the live NASA broadcast. In total, DRACO obtained >255,000 images from launch on November 24, 2021 until impact. The most recent data release from the PDS is available here:



Next steps

1. Generate geometric backplanes for the best resolved images of Didymos and Dimorphos.
2. Continue work on a new pipeline for data producers to create derived products.
3. Complete final reprocessing and calibration of all DRACO images for delivery to the PDS by mid-2023.

References:

[1] Daly, R.T., et al. (2023), Nature, doi: 10.1038/s41586-023-05810-5