The Analyst's Notebook: Providing Context for Landed Operations and Adding Value to Mission Archives

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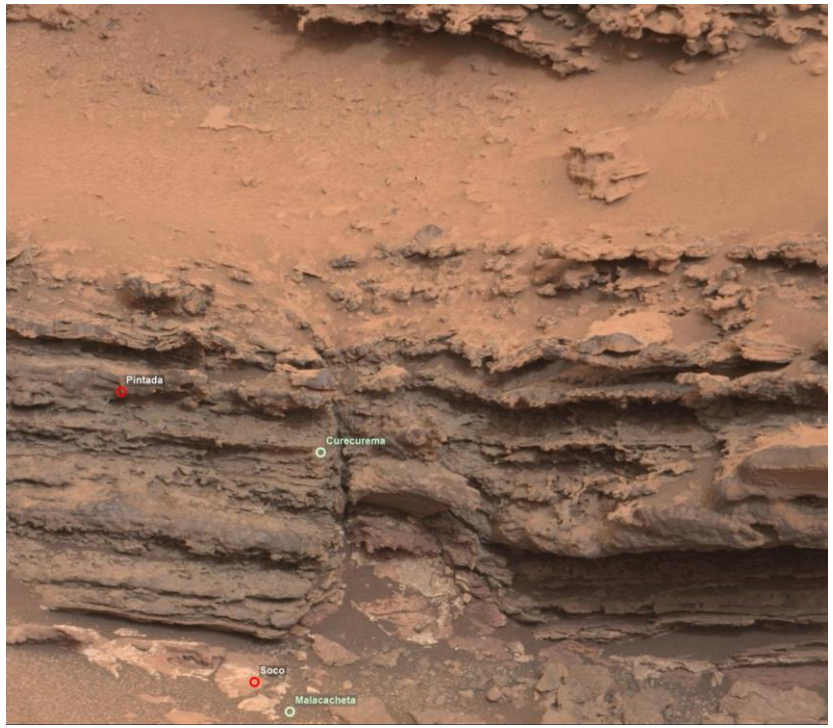
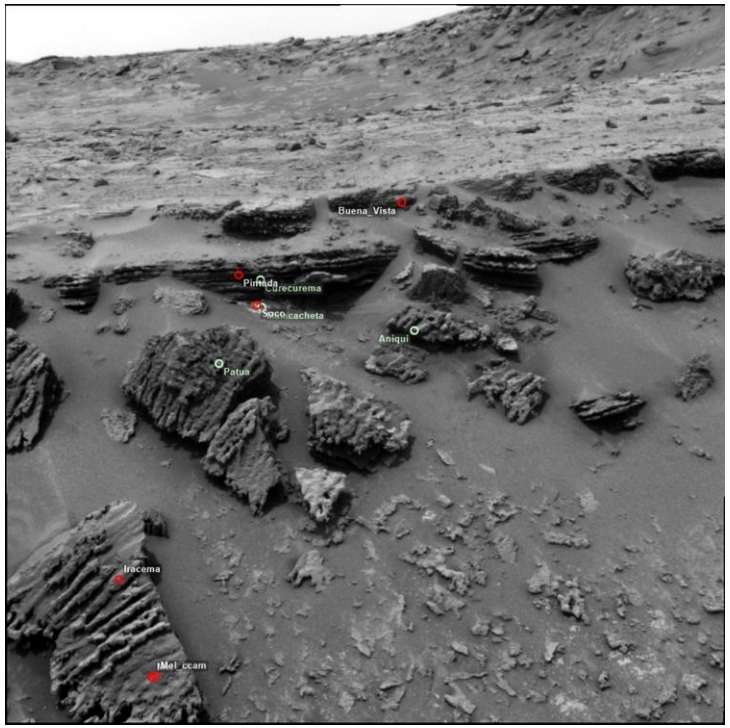
PV2023: Adding value (to) and preserving Scientific & Technical data
2023-0502

Planetary data archives of surface missions contain data from numerous hosted instruments. Because of the nondeterministic nature of surface missions, it is not possible to assess the data without understanding the context in which they were collected.





Data discovery

PDS Planetary Data System | Find a Node

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

+ NASA Homepage
+ NASA en Español
+ Contact NASA

PDS Geosciences Node
Washington University in St. Louis

HOME | DATA AND SERVICES | TOOLS | ABOUT US | CONTACT US | SITE MAP

Services
- Analyst's Notebooks
- Orbital Data Explorers
- Spectral Library
- FTP Access
- Workshops

Geosciences Node Data
- Mars
  - Mars Exploration
  - Mars 2020
  - InSight
  - MSL
    - About MSL
    - APXS
    - ChemCam
    - CheMin
    - DAN
    - SAM
  - MRO
  - MER
  - Mars Express
  - Odyssey
  - Phoenix
  - MGS
  - Pathfinder
  - Prototype Rovers
  - Viking Orbiter
  - Viking Lander
  - Mariner
  - Earth Based Data
- Venus
- Mercury
- Moon
- Earth
- Asteroids
- Radio Science
- Gravity Models
- All Geosciences DOIs
- All Geosciences Data Holdings

Help
- Frequently Asked Questions
- Geosciences Node Forums
- Help for Data Users
- Help for Data Reviewers
- Help for Proposers
- About PDS4
- About Checksums
- Cite PDS On Your Poster
- Email Us

Scheduled Maintenance

This site may be down on **Thursdays** between 7:00 and 9:30 pm Central Time for maintenance.

Mars Science Laboratory (MSL)

March 21, 2023. SAM EDR data for sols 3548-3644 have been added to the **SAM EDR safed data set**.

March 16, 2023. MSL Release 32 includes new raw and derived data from sols 3548-3644.

February 7, 2023. New data have been added to the **ChemCam Passive Surface Spectra** bundle.

The Mars Science Laboratory (MSL) rover, Curiosity, landed on Mars and began operations on August 6, 2012. On June 25, 2014, the rover marked one Mars year (687 Earth days) of operations on the surface.

Science data from Curiosity's suite of instruments is released by PDS three times a year. See the complete release schedule below.

Instruments and Archives

Instrument *Follow links to instrument team web sites*	PDS Archives
APXS - Alpha Particle X-ray Spectrometer	**APXS Archive**
ChemCam - Laser-Induced Breakdown Spectrometer (LIBS) and Remote Micro-Imager (RMI)	**ChemCam Archive**
CheMin - Chemistry and Mineralogy	**CheMin Archive**
DAN - Dynamic Albedo of Neutrons	**DAN Archive**
Engineering Cameras - Hazard Avoidance Cameras and Navigation Cameras	**Engineering Camera Archives** *at the PDS Imaging Node*
MAHLI - Mars Hand Lens Imager	**MAHLI, MARDI, and Mastcam Archives** *at the PDS Imaging Node*
MARDI - Mars Descent Imager	
Mastcam - Mast Camera	
PLACES - Maps and rover localization data	**PLACES Archive** *at the PDS Imaging Node*
RAD - Radiation Assessment Detector	**RAD Archive** *at the PDS PPI Node*
REMS - Rover Environmental Monitoring Station	**REMS Archive** *at the PDS Atmospheres Node*
SAM - Sample Analysis at Mars	**SAM Archive**
SPICE - Spacecraft, Planet, Instrument, Pointing C-Matrix, and Event Kernels	**SPICE Archive** *at the NAIF Node*

Derived Products from Individual Investigators

Investigator / Program	PDS Archives
Jeff Johnson	**Mastcam Photometry Cubes** (PDS4)
Jeff Johnson /	**ChemCam Passive Surface Spectra**

Analyst's Notebook

What's New

March 21, 2023. SAM EDR data for sols 3548-3644 have been added to the **SAM EDR safed data set**.

March 16, 2023. MSL Release 32 includes new raw and derived data from sols 3548-3644.

February 7, 2023. New data have been added to the **ChemCam Passive Surface Spectra** bundle.

December 9, 2022. SAM EDR data for sols 3424-3547 have been added to the **SAM EDR safed data set**.

December 5, 2022. MSL Release 31 includes new raw and derived data from sols 3424-3547.

August 24, 2022. The **MSL Mastcam Photometry bundle** from Jeff Johnson is released.

August 3, 2022. SAM EDR data for sols 3290-3423 have been added to the **SAM EDR safed data set**.

August 1, 2022. MSL Release 30 includes new raw and derived data from sols 3290-3423.

June 20, 2022. Corrupted data products found in the **ChemCam Passive Surface Spectra** bundle have been redelivered.

March 22, 2022. SAM EDR data for sols 3193-3289 have been added to the **SAM EDR safed data set**.

March 16, 2022. MSL Release 29 includes new raw and derived data from sols 3193-3289.

February 10, 2022. New data have been added to the **ChemCam Passive Surface Spectra** bundle.

December 8, 2021. SAM EDR data for sols 3069-3192 have been added to the **SAM EDR safed data set**.

December 6, 2021. MSL

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pds-geosciences.wustl.edu - /msl/msl-m-chemcam-v1/mslccm_1xxx/data/sol03641/

[To Parent Directory]

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2/10/2023 11:37 AM	28110	cl5_720715624ccs_f0980144ccam01641p3.lbl
2/10/2023 11:37 AM	2241731	cl5_720715624rdr_f0980144ccam01641p3.csv
2/10/2023 11:37 AM	28302	cl5_720715624rdr_f0980144ccam01641p3.lbl
2/10/2023 11:37 AM	3005416	cl5_720715704ccs_f0980144ccam01641p3.csv
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PDS Imaging Node
Jet Propulsion Laboratory | U.S. Geological Survey

PDS Imaging Node: Data Archive

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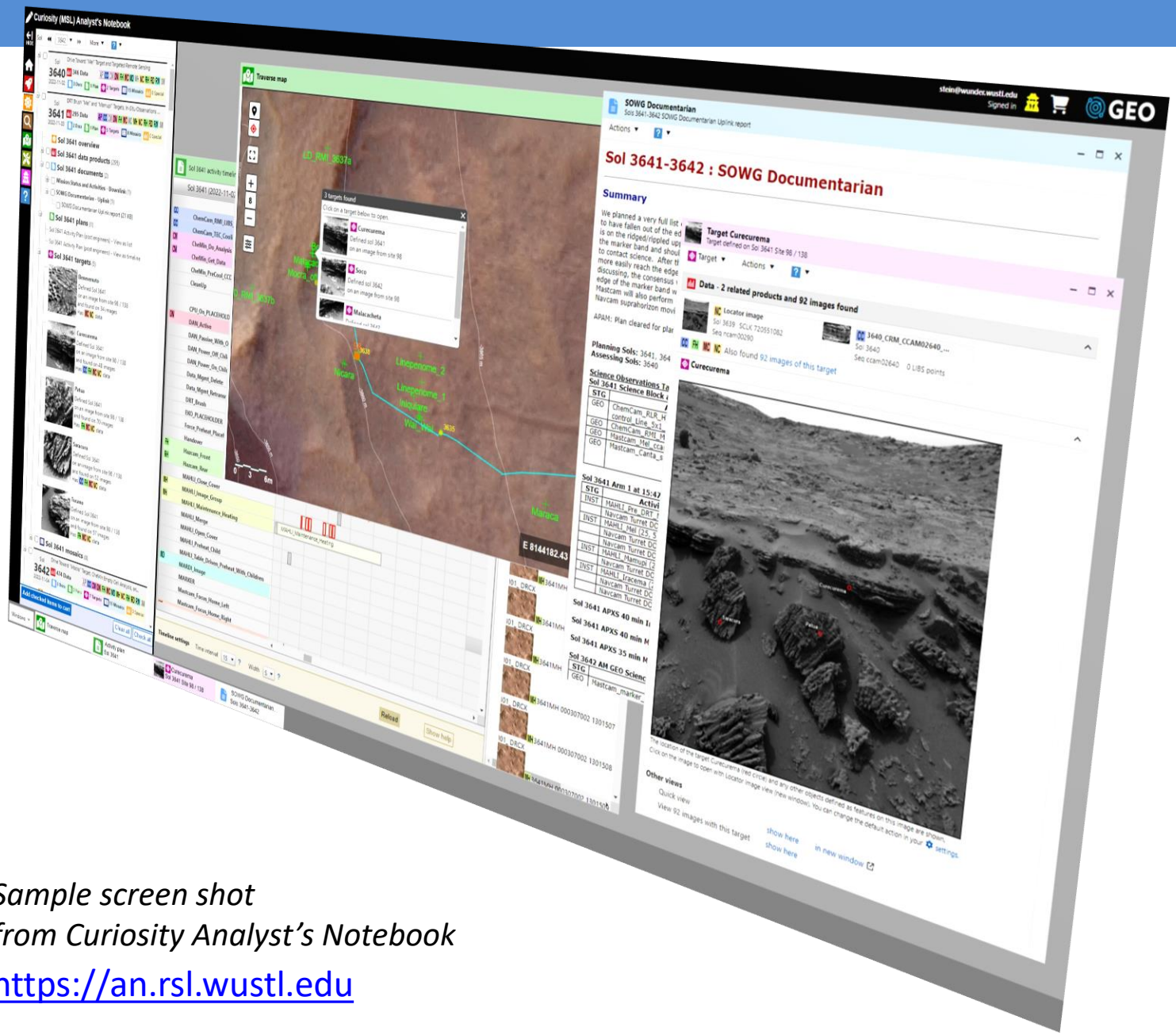
Analyst's Notebook

The Analyst's Notebook supports data discoverability and access for landed missions by integrating sequence information, engineering and science data, observation planning and targeting, and documentation into a web-based application.

Updated commensurate with scheduled public archive releases.

InSight release 17	30 Jun 2023
Mars 2020 release 7	27 Jul 2023
MSL release 33	01 Aug 2023



Sample screen shot
from Curiosity Analyst's Notebook

https://an.rsl.wustl.edu

Adding value to the PDS archives

Standard PDS Release

Archived Data
- Standard EDR and RDR data products

Documentation
- Software Interface Specification
- Spacecraft and instrument reports

Calibration Data
- Calibration reports and data

Additional data and tools in the Notebook

Special Products
- Additional products of interest
- Science team supplemental products

Documentation
- Daily operations reports
- Science team reports
- Historical reports

Resources
- Historical mission overview
- Science paper references
- Links to additional resources

Value Added Elements

Suite of tools and data representations that enhance archive use
- Faceted search
- Interactive maps
- Image measurement
- Integrated plans / timeline
- Data transformation
- Cross instrument data browsing
- Context mosaics

Planetary data archives are enhanced by incorporating higher order products and external resources into the AN.

Measurement tools

Drawing

- Line, arrow, rectangle, ellipse, polygon, polyline, and text.

Location

- Find a location from known coordinates
  - Provide (x, y) or (x, y, z) values in Site, Rover, or Local frame.
  - Provide map coordinates as easting and northing.
- Location metadata
  - Image pixel coordinate
  - Ground location in local, rover, or site frame
  - Distance from rover frame origin
  - Azimuth and elevation relative to head frame.

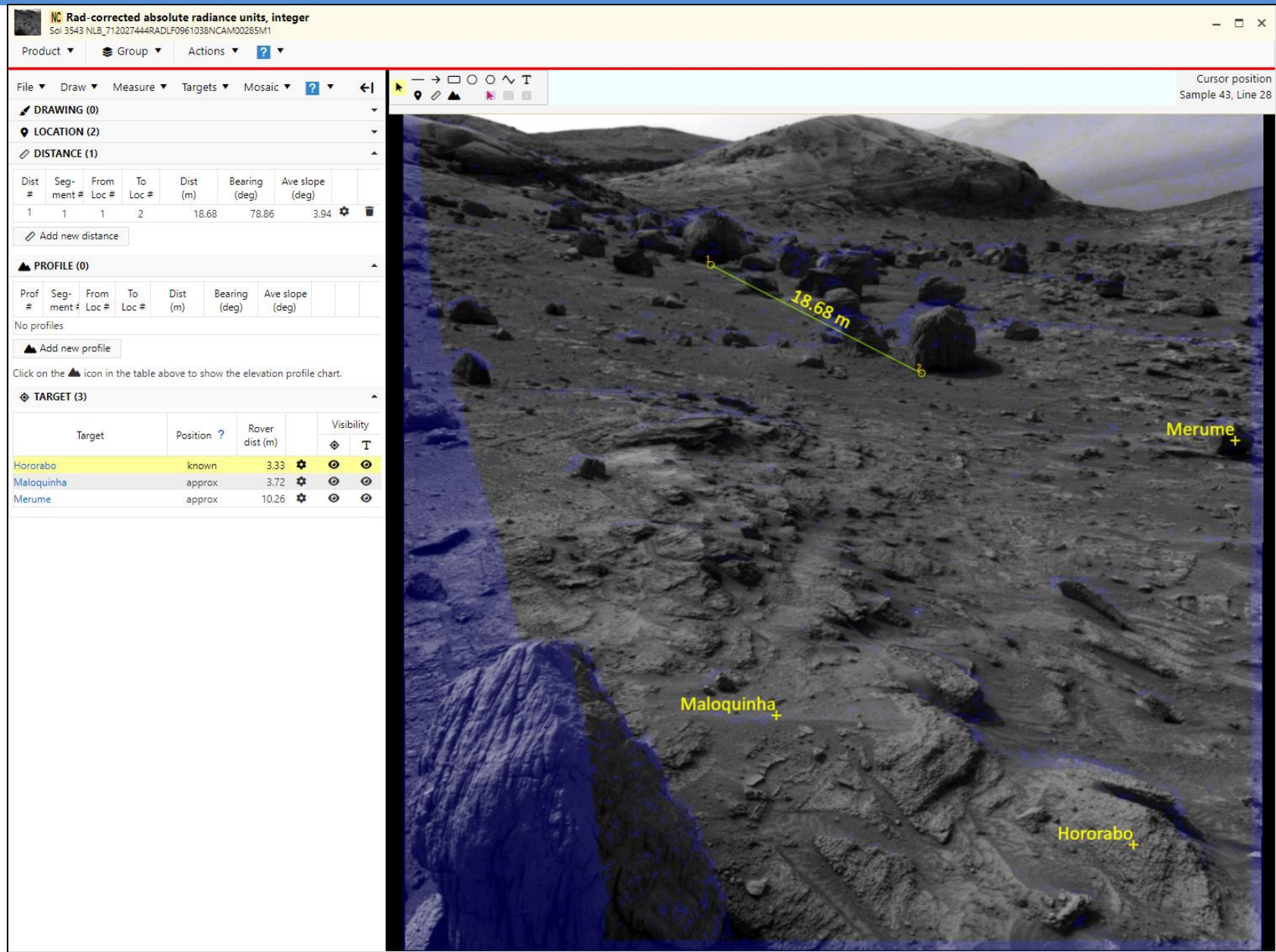
Distance

- Between two points or along a polyline.

Elevation profile

- Between two points or along polyline.

Measurements use archive XYZ products.

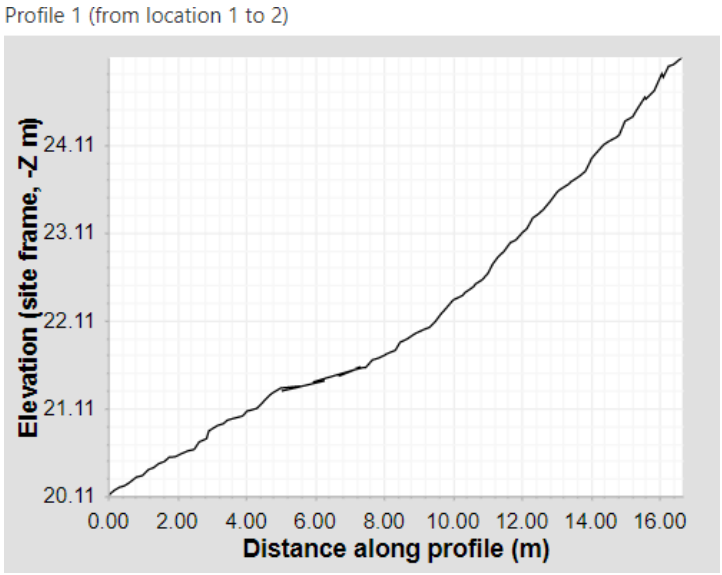


Profile tool

Elevation profile between two points or along polyline.

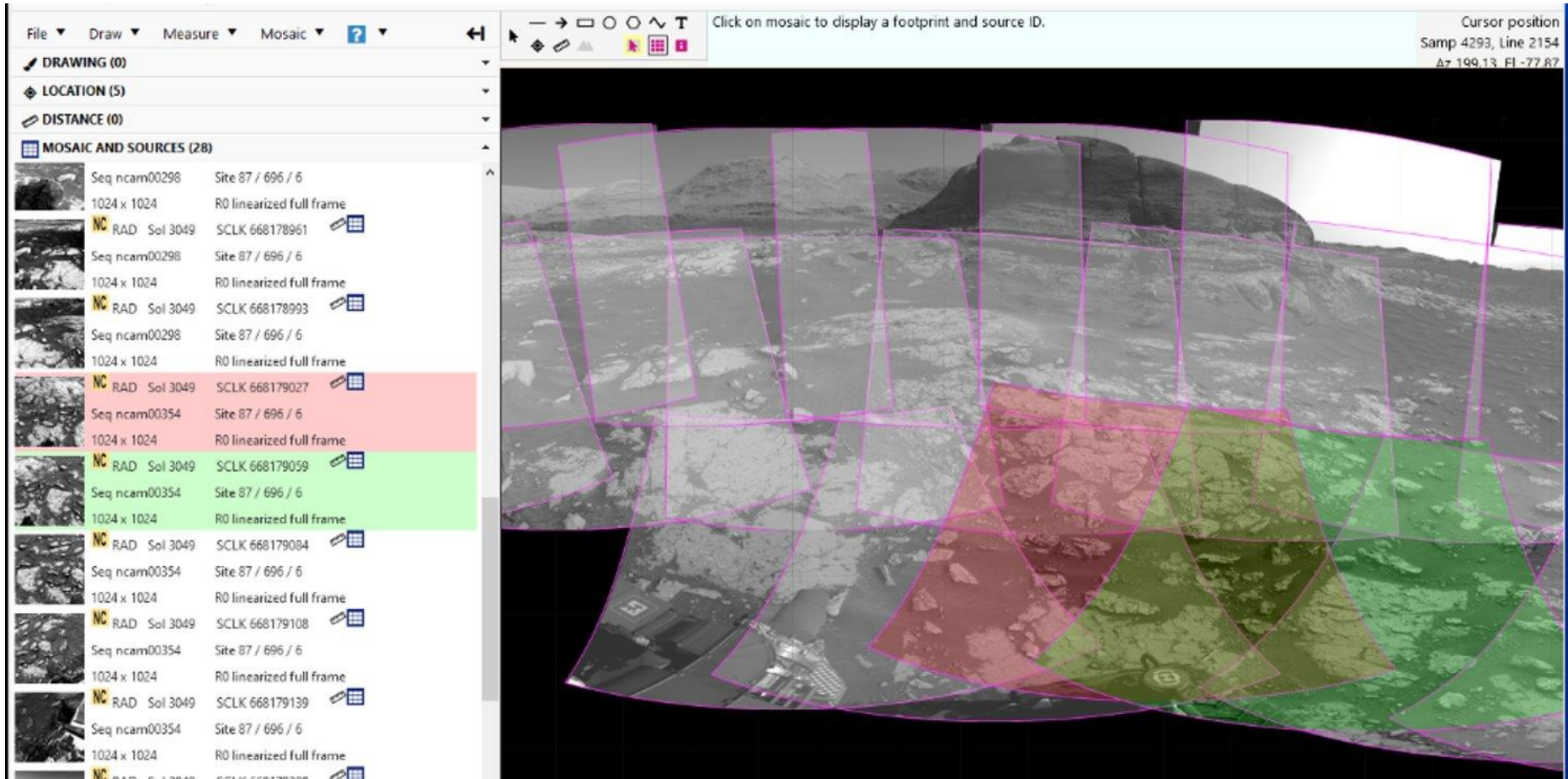
Elevations calculated along a path as if it were "dropped on the ground" between the two points.

The profile is not simply the elevation values of the image pixels under the straight line drawn on the image.

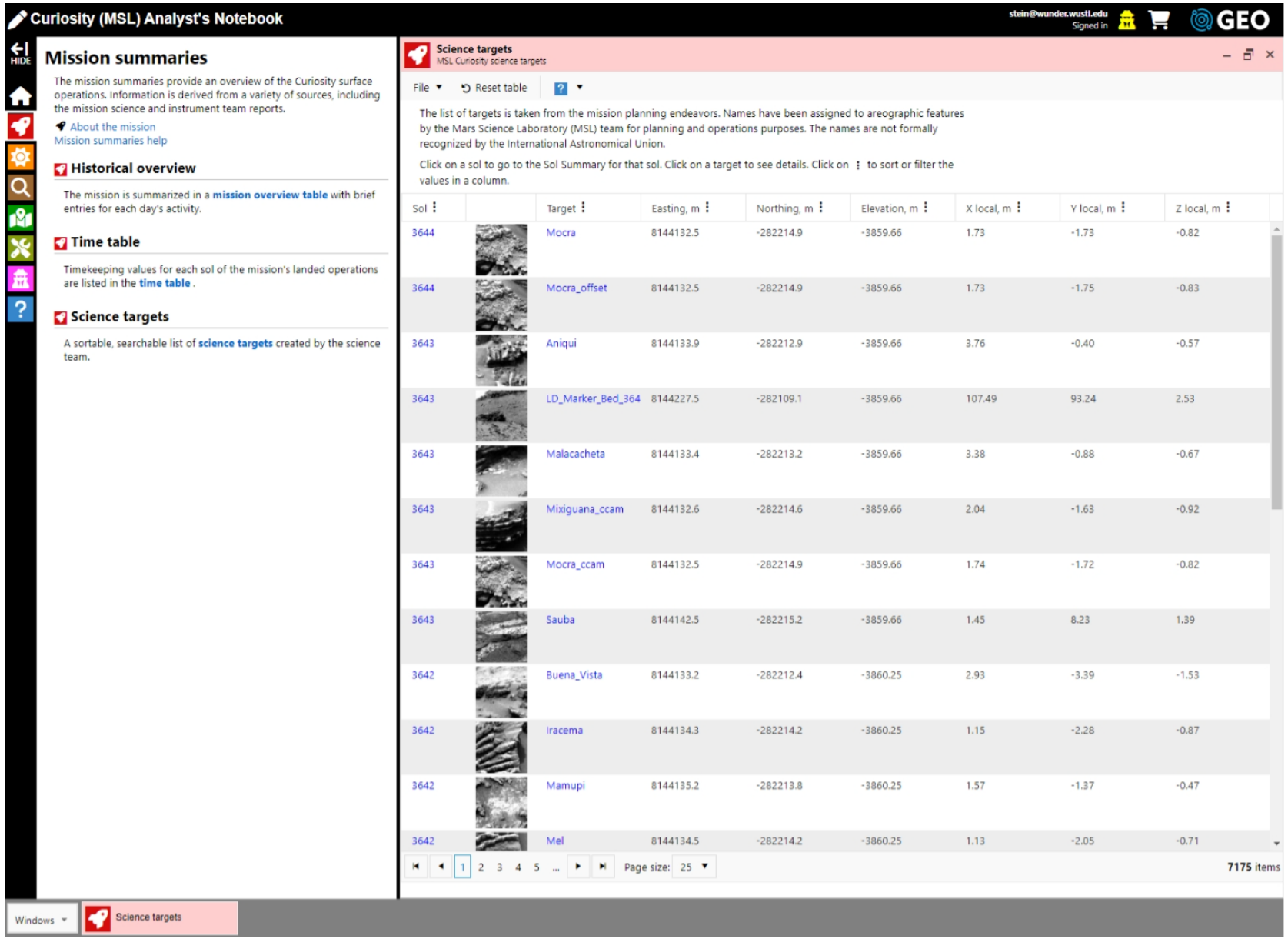


Working with mosaics

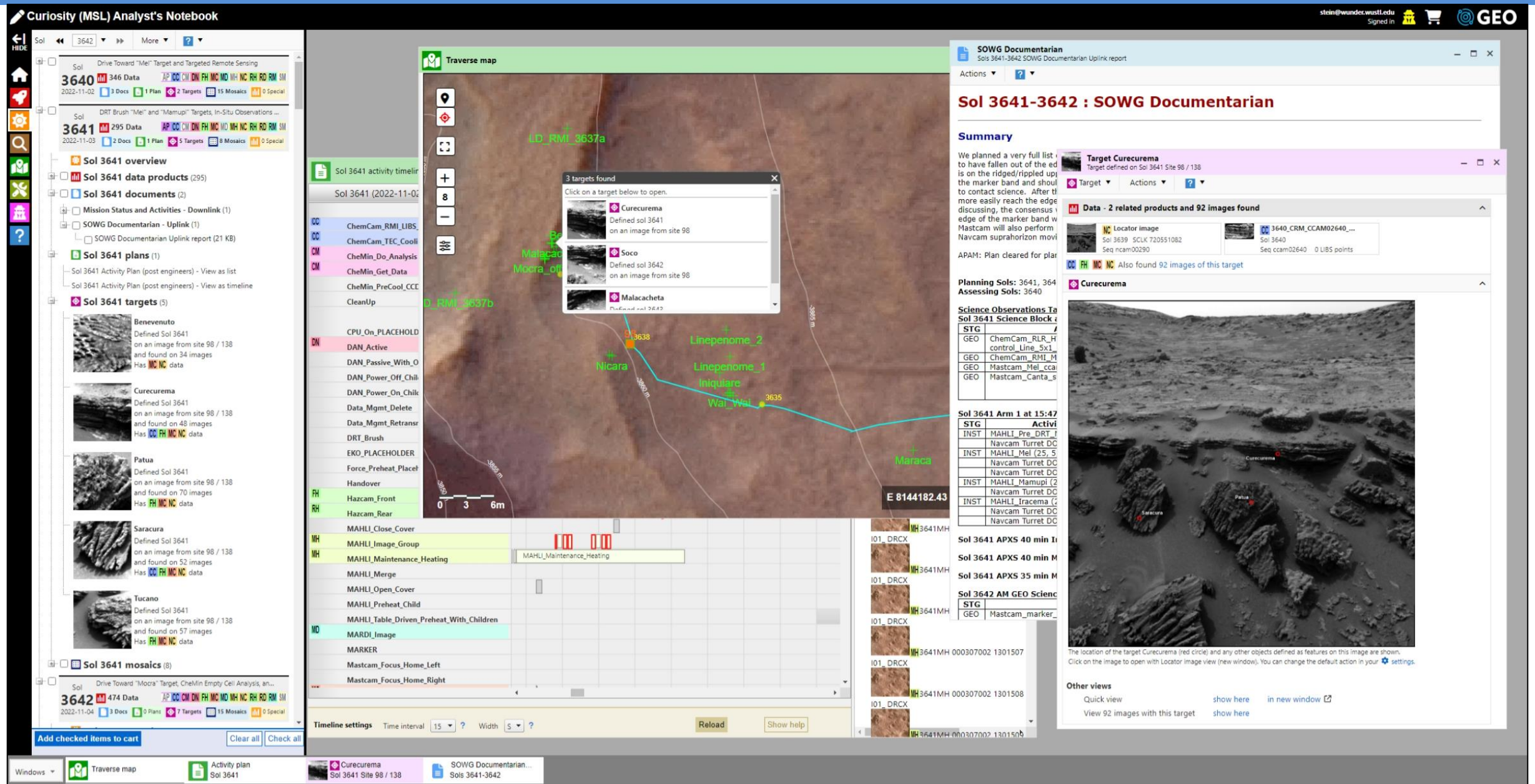
- Location and distance tools are available for mosaics made from source frames with XYZ data.
- Footprint overlays show boundaries and help identify source frames.



Science targets table



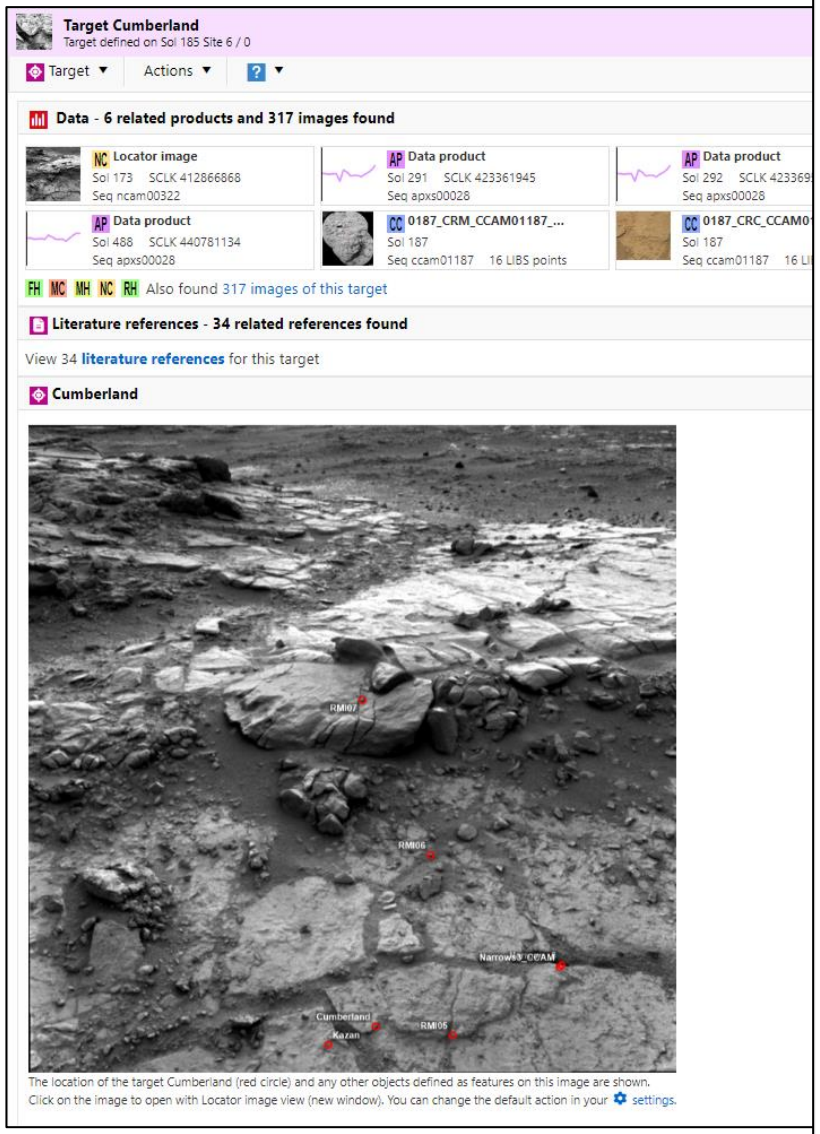
Science target links

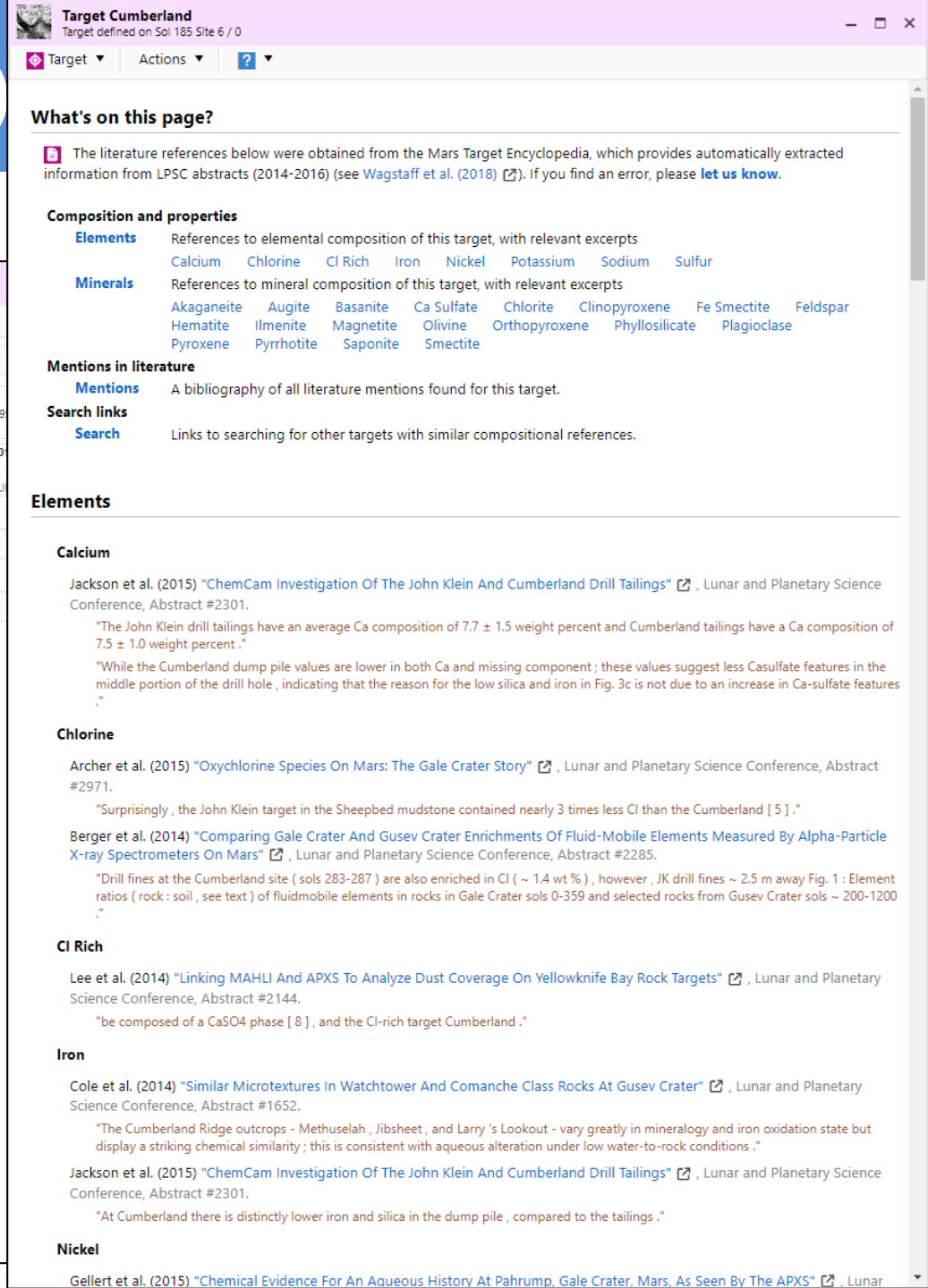


Mars Target Encyclopedia (MTE)

The MTE is a reference database containing compositional information about targets extracted from publications.

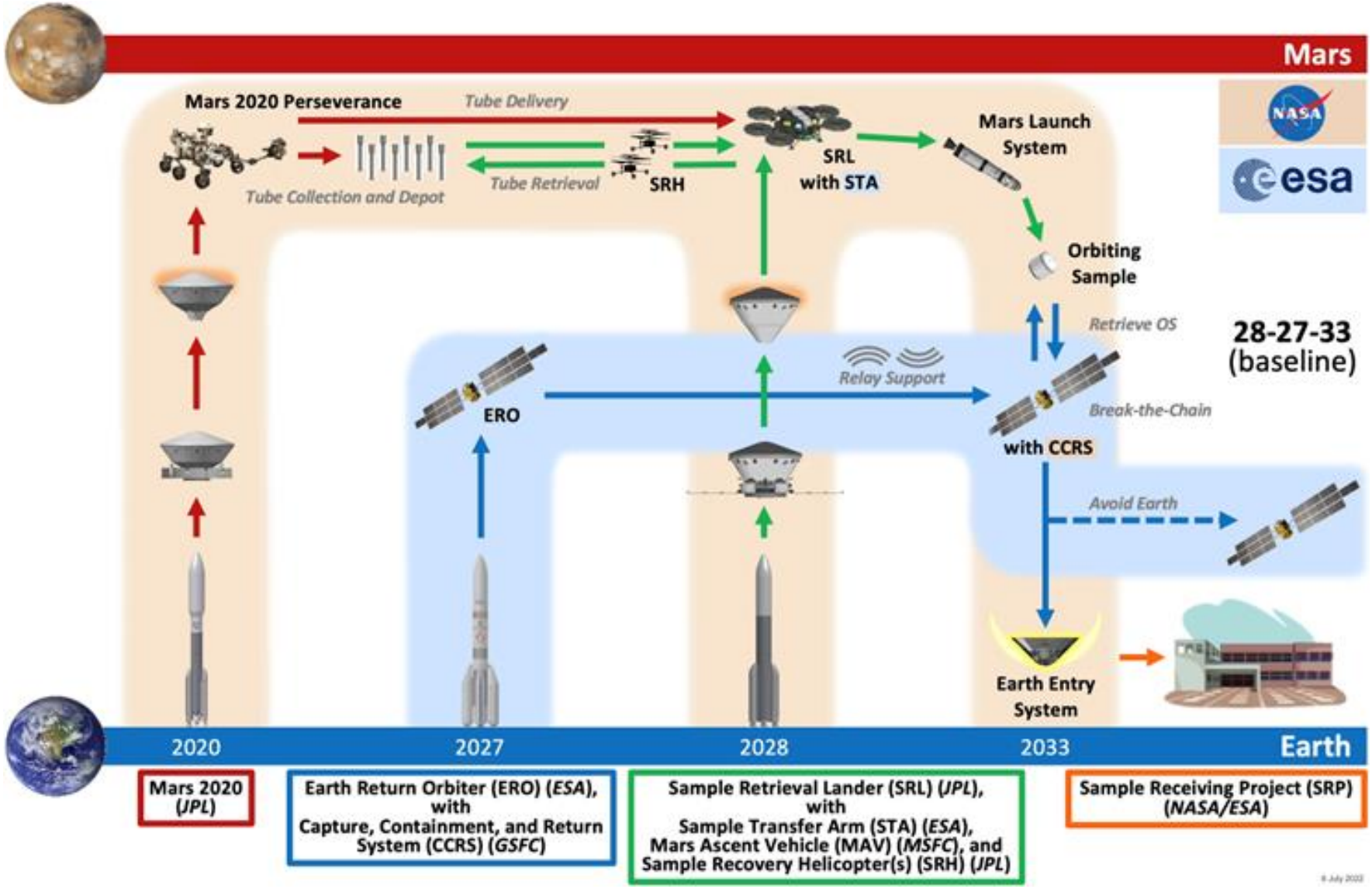
The AN incorporates MTE for Curiosity Rover and Phoenix Lander. An update for Spirit and Opportunity Rover targets is pending.



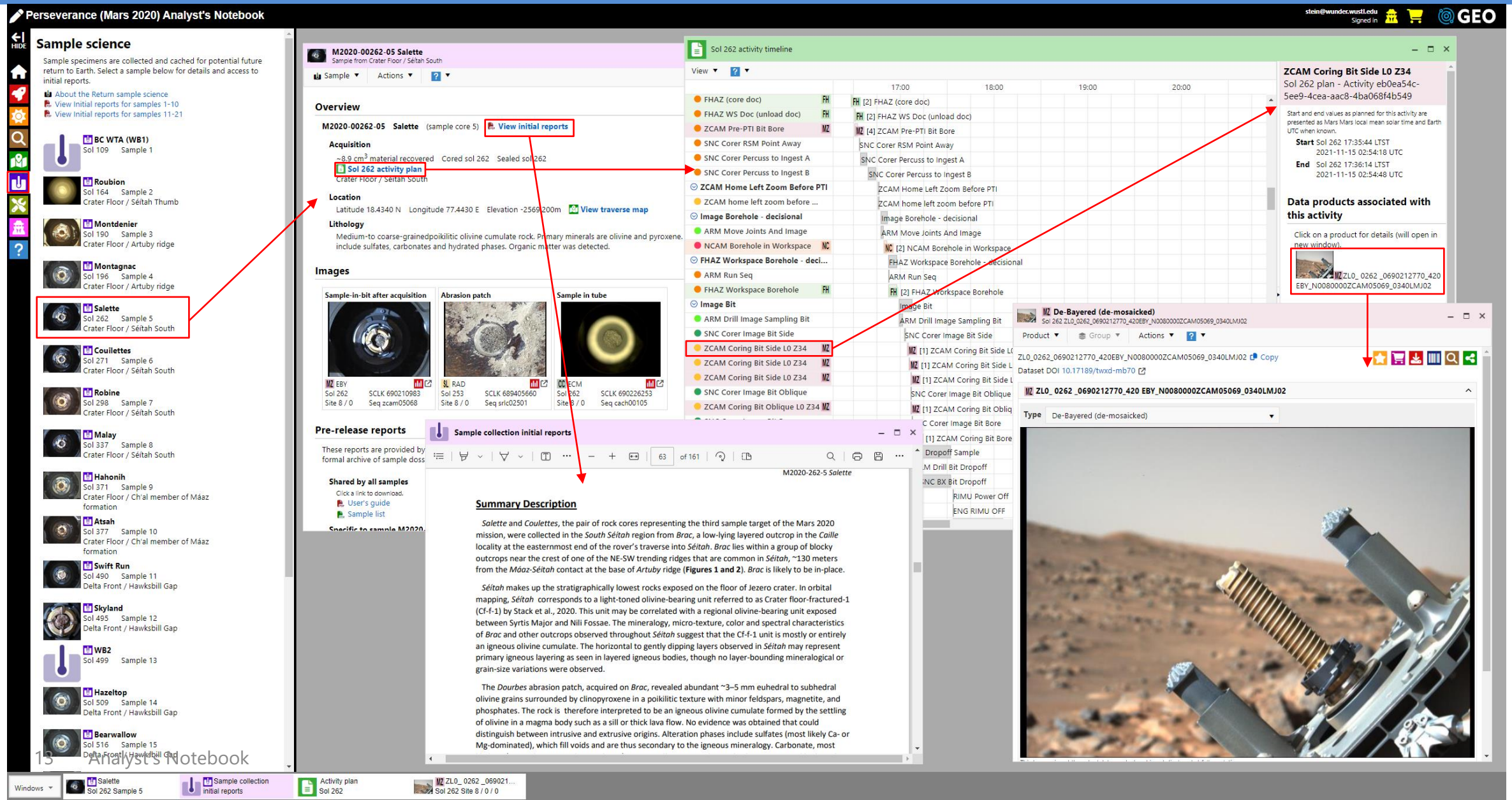


Mars Sample Return program

- Capture and archive operations data and contextual information
  - acquired after sample acquisition (Mars 2020)
  - during operations (MSR program and other MSR projects).
- Incorporate sample collection information into Analyst's Notebook with interoperability to JSC curations.

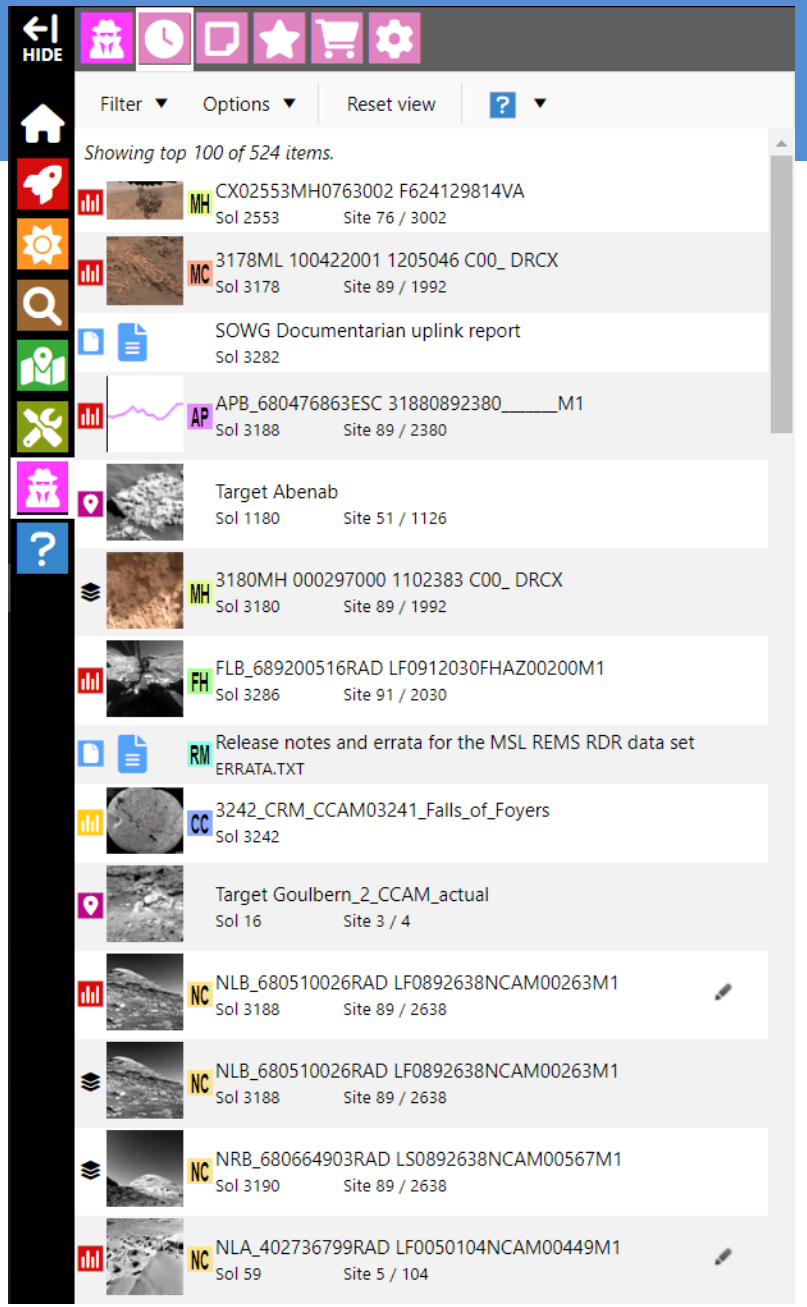


Mars 2020 sample science



User history

- Annotations (drawing and measurement elements) are saved when created.
- Annotations are loaded automatically when the image is subsequently opened in image viewer.
  - User must be signed in with optional account.



Annotated images are identified in the user history by the ✎ icon.

Team version for Curiosity rover

- Developed by the PDS Geosciences Node in collaboration with the MSL science team.
- Available to the team during landed operations as a non-mission critical tool.
- Content (data, plans, traverse data, and support documents) are ingested daily.
- Assists with data validation.

Team Notebook for Curiosity rover

Developed by the PDS Geosciences Node in collaboration with the MSL science team.

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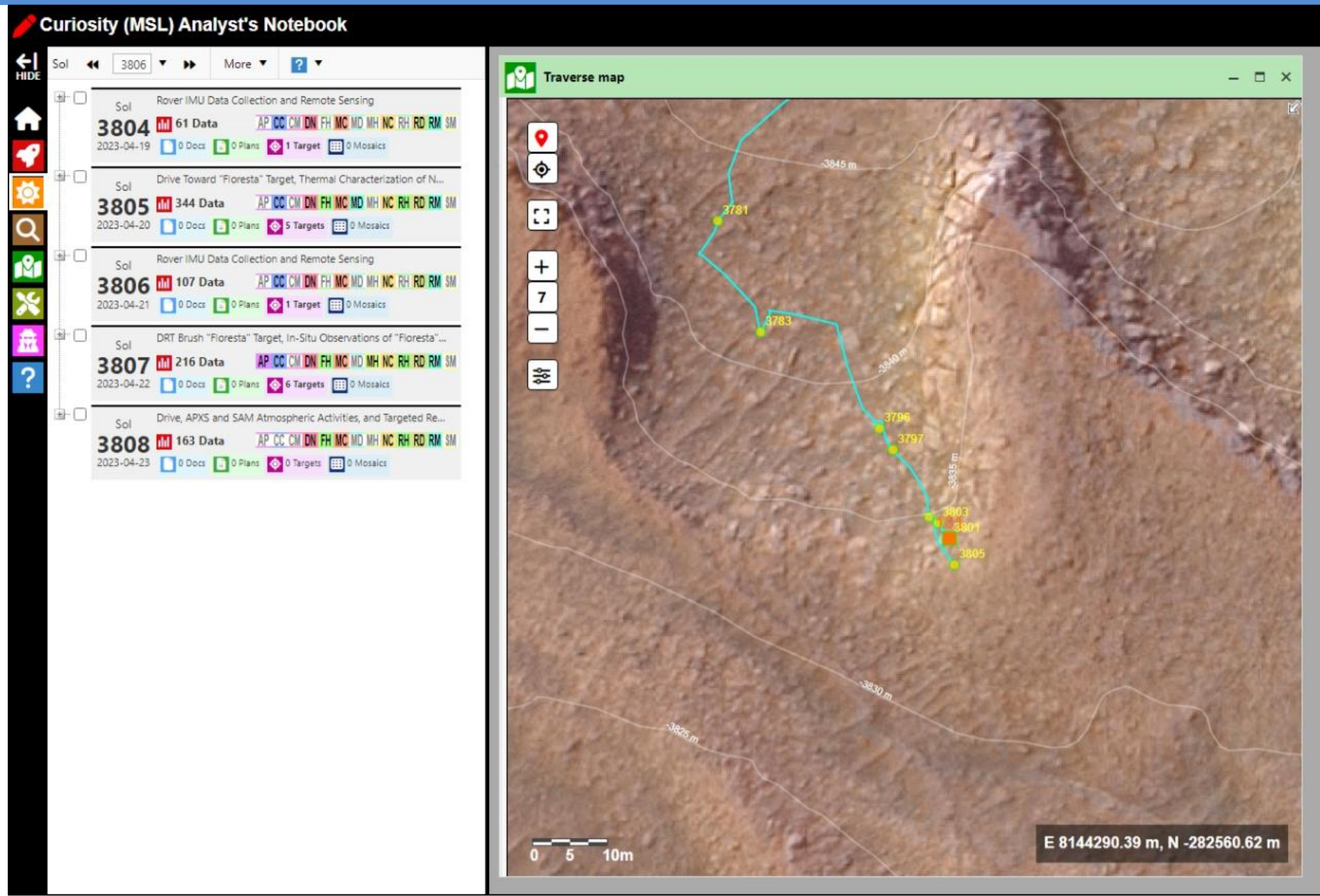


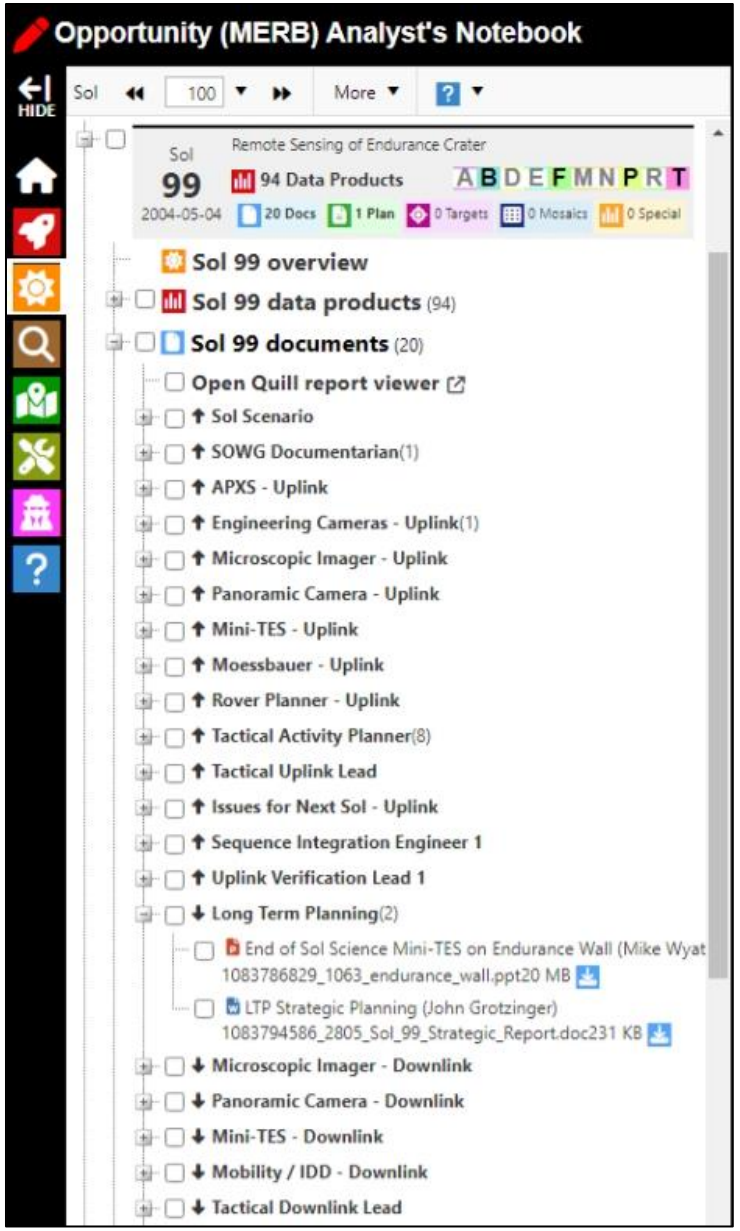
Team Notebook – completed missions

Contents of Public and Team versions are identical with limited exceptions.

Available to team-identified collaborators.

Team-only content may be released to others by agreement.

Goal is to maintain important non-archive components for long term.



Dragonfly

Development of Analyst's Notebook to support landed science of the Dragonfly mission during operations.

PDS Analyst's Notebook

https://an.rsl.wustl.edu/

Notebook online help

https://an.rsl.wustl.edu/help

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The Analyst's Notebook is developed under funding provided by NASA to the PDS Geosciences Node. Cooperation by mission science teams is greatly appreciated.

Additional input provided by the PDS Atmospheres, Imaging, and PPI Nodes, as well as by professional and citizen scientists from around the world.