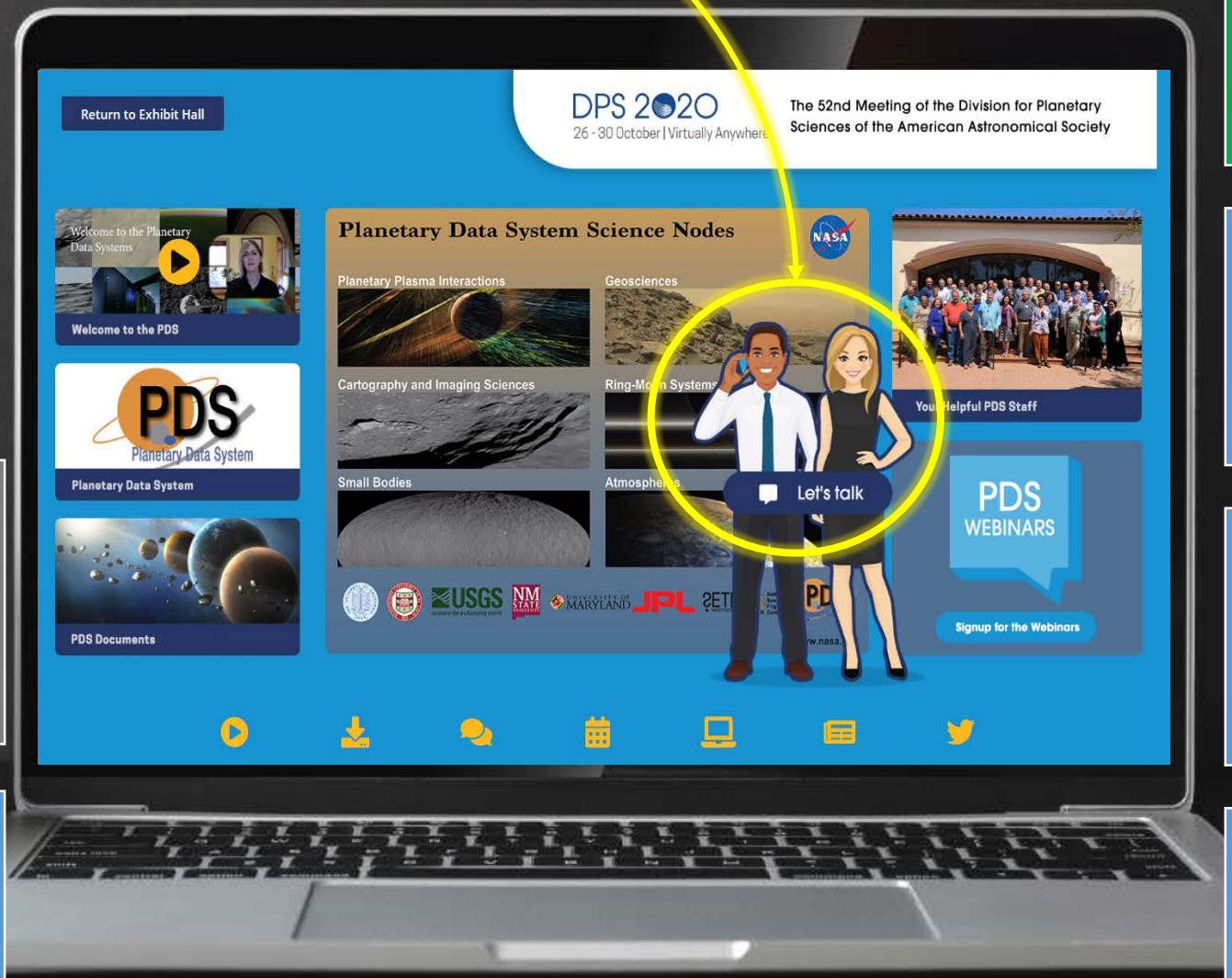
Mars Reconnaissance Orbiter CRISM Hyperspectral Data Sets and Analysis Tools

Ray Arvidson
Washington University in Saint Louis
52nd DPS (Virtual Meeting)
Zoom Tutorial
10/26/20
2:30 to 3:30 PM, EDT

To enter a tutorial session, click on “Let’s talk” at the **PDS Exhibitor Booth** at the DPS web site.



Webinars

Introduction to PDS Geosciences Node Data Sets and Analysis Tools
Monday, October 26
12:00 to 12:30 PM EDT

Introduction to PDS Geosciences Node Orbital Data Explorers and Landed Mission Analyst Notebooks
Wednesday, October 28
2:00 to 2:30 PM EDT

Tutorials

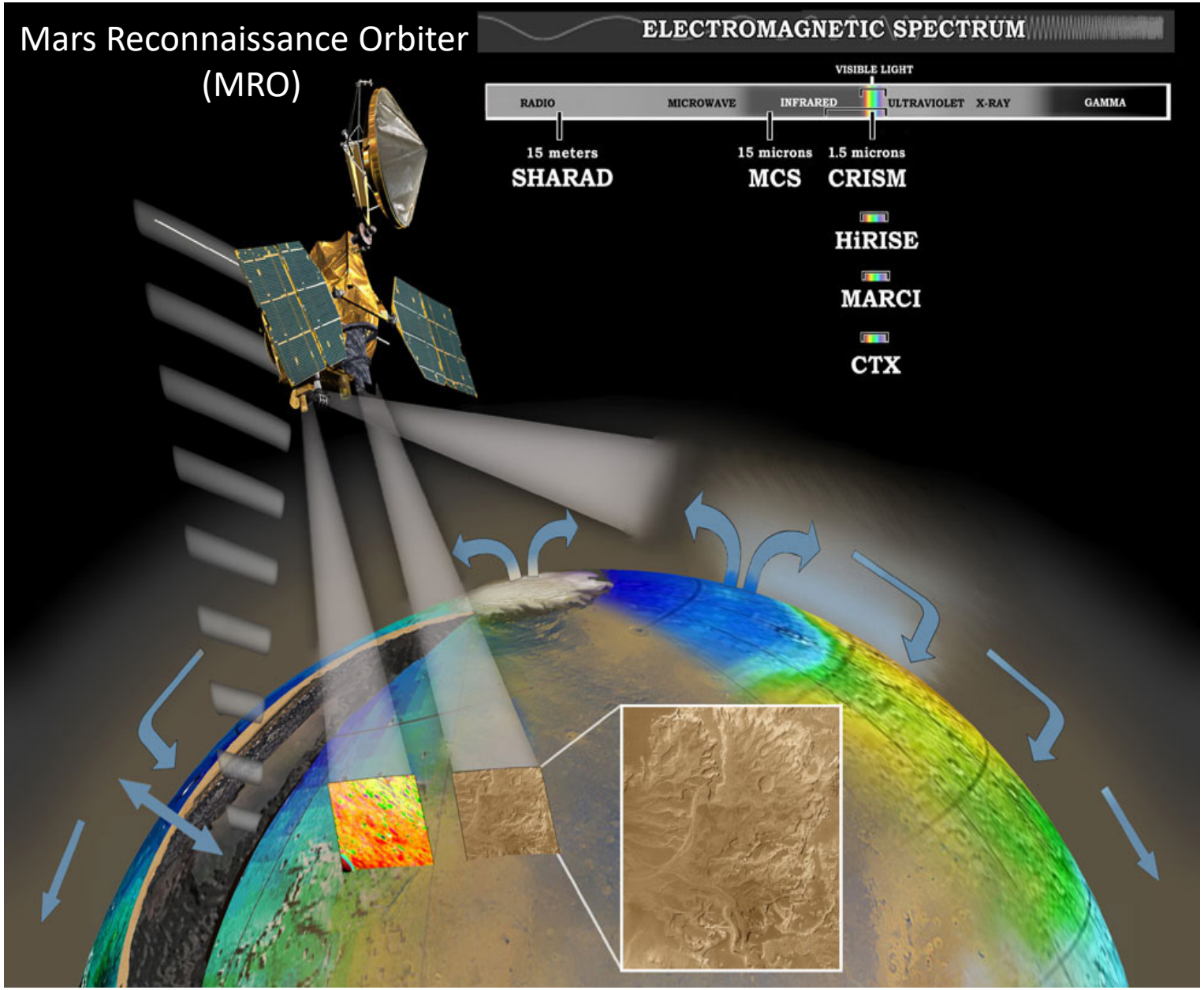
MRO CRISM Hyperspectral Data Sets and Analysis Tools
Monday, October 26
2:30 to 3:30 PM EDT

Mars Rover In Situ X-ray Compositional Data Sets and Analysis Tools
Tuesday, October 27
3:00 to 4:00 PM EDT

Content and Use of PDS Geosciences Node Orbital Data Explorers
- *Wednesday, October 28*
4:00 to 5:00 PM EDT

Content and Use of PDS Geosciences Node Landed Mission Analyst Notebooks
Thursday, October 29
3:00 to 4:00 PM EDT

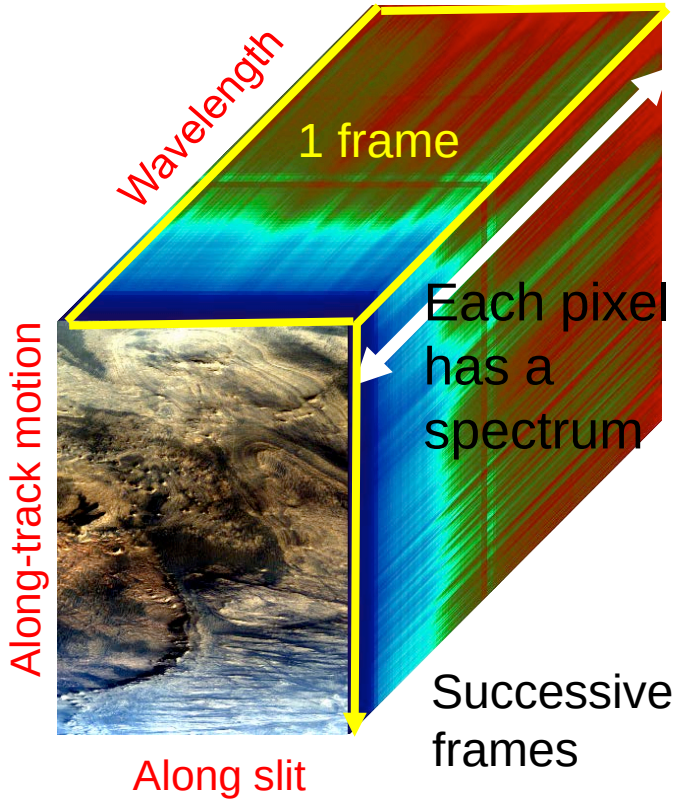
Compact Reconnaissance Imaging Spectrometer for Mars (CRISM)

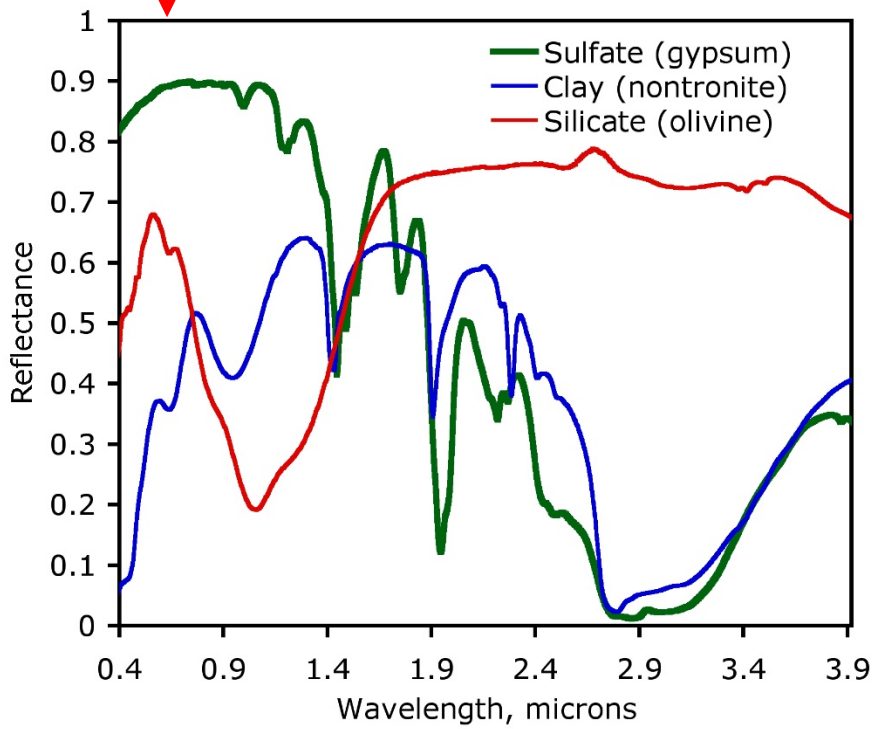


- CRISM*, HiRISE, and CTX synergistically characterize surface geologic features
- MARCI, MCS, and CRISM track spatial and seasonal variations in the atmosphere
- CRISM S and L Data: 0.362–3.920 μm at 6.55 nm per band
- Full Resolution Targeted Mode (FRT) 18 m/pixel

*Murchie et al., 2007, JGR-Planets, DOI: 10.1029/2006JE002682

CRISM: Basic Structure of the Data is a Cube Composed of Successive Frames Acquired Along Orbital Track



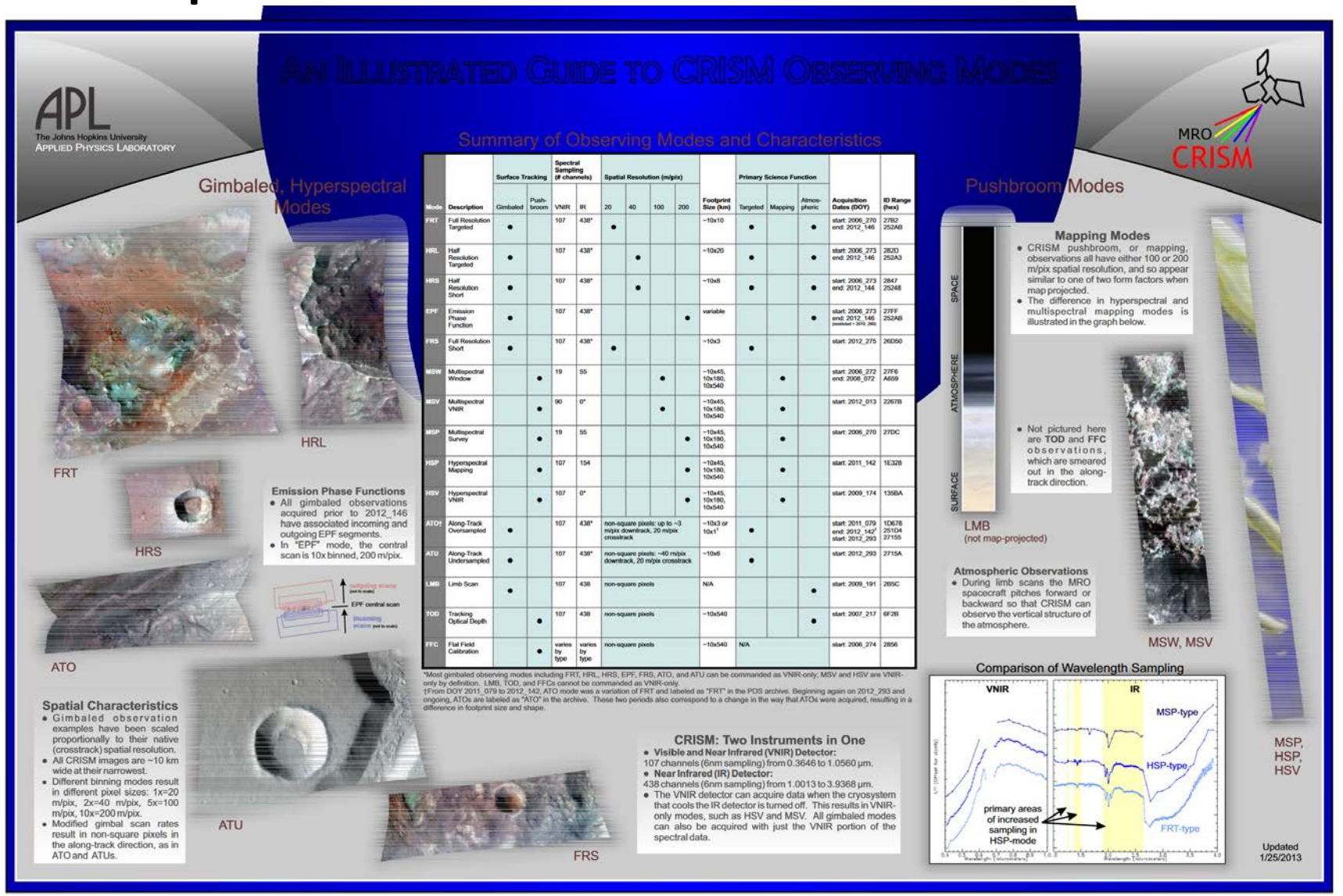


Each readout of the detector is one line of a spatial image. An image is acquired as MRO moves along its ground track, thereby collecting adjacent lines.

Each pixel has a spectrum whose absorptions can be compared with minerals

CRISM Operational Modes

- CRISM has many operational modes, producing an array of data products.
- This tutorial will focus on use of the CRISM Analysis Tool (CAT) for processing and analysis of a single Half Resolution (HRL) VNIR and IR data set covering Jezero crater and delta (i.e., Perseverance rover landing site).
- Will use CAT implemented in ENVI5.5.3, although there is also an open source Java version (JCAT). (ENVI and Java CAT versions are available on the PDS Geosciences Node web site.)

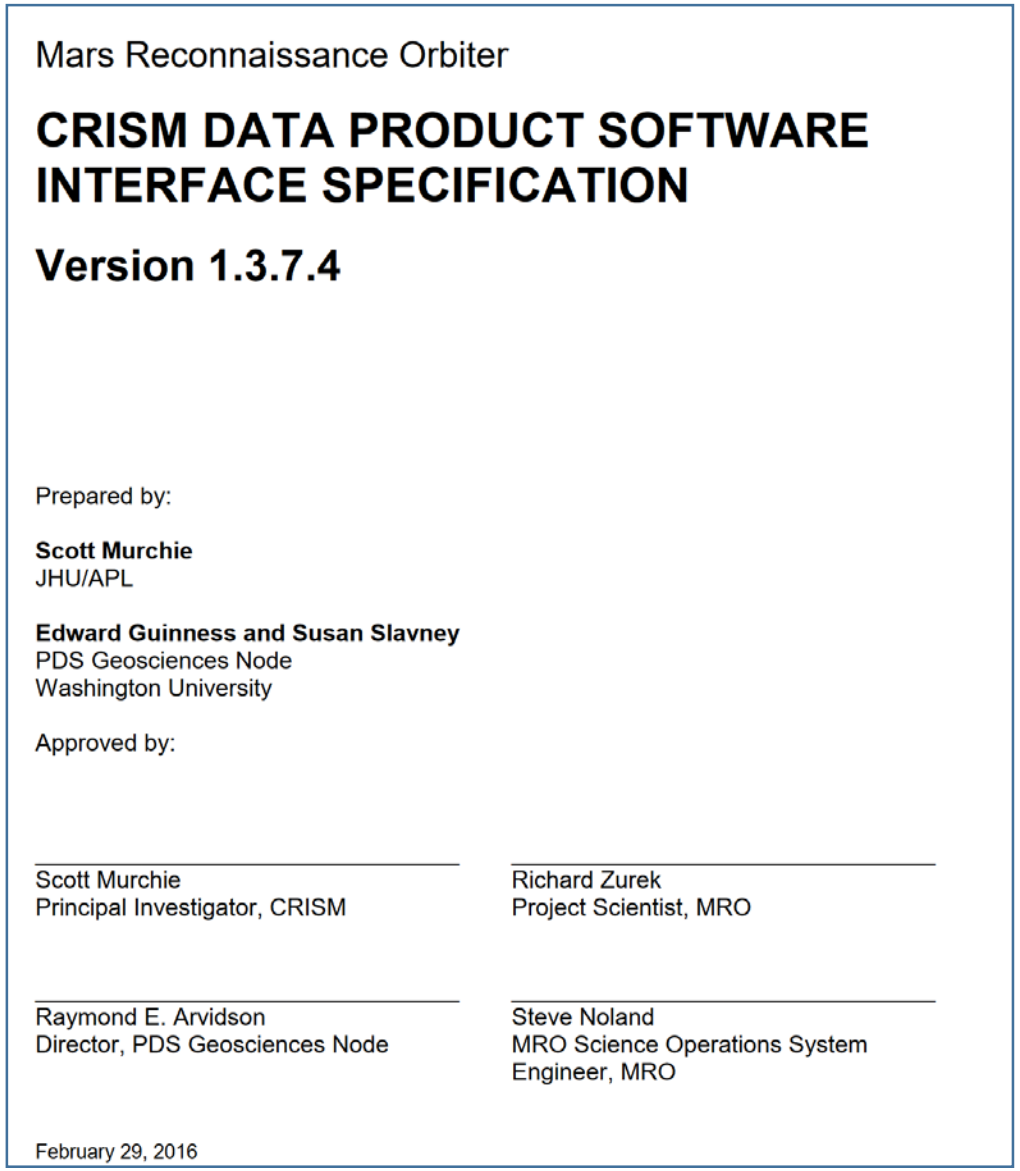


http://crism.jhuapl.edu/instrument/images/observing_modes_poster_v5.pdf

CRISM Background Reading

- For details about the instrument, operations, and an overview of early data products see: Murchie, S. L. et al., CRISM (Compact Reconnaissance Imaging Spectrometer for Mars) on MRO (Mars Reconnaissance Orbiter), *J. Geophys. Res.*, 112, E05S03, doi: 10.1029/2006JE002682

- CRISM SIS is the "Master Manual" for details about CRISM data products in the PDS Geosciences Node.



Mars Reconnaissance Orbiter

CRISM DATA PRODUCT SOFTWARE INTERFACE SPECIFICATION

Version 1.3.7.4

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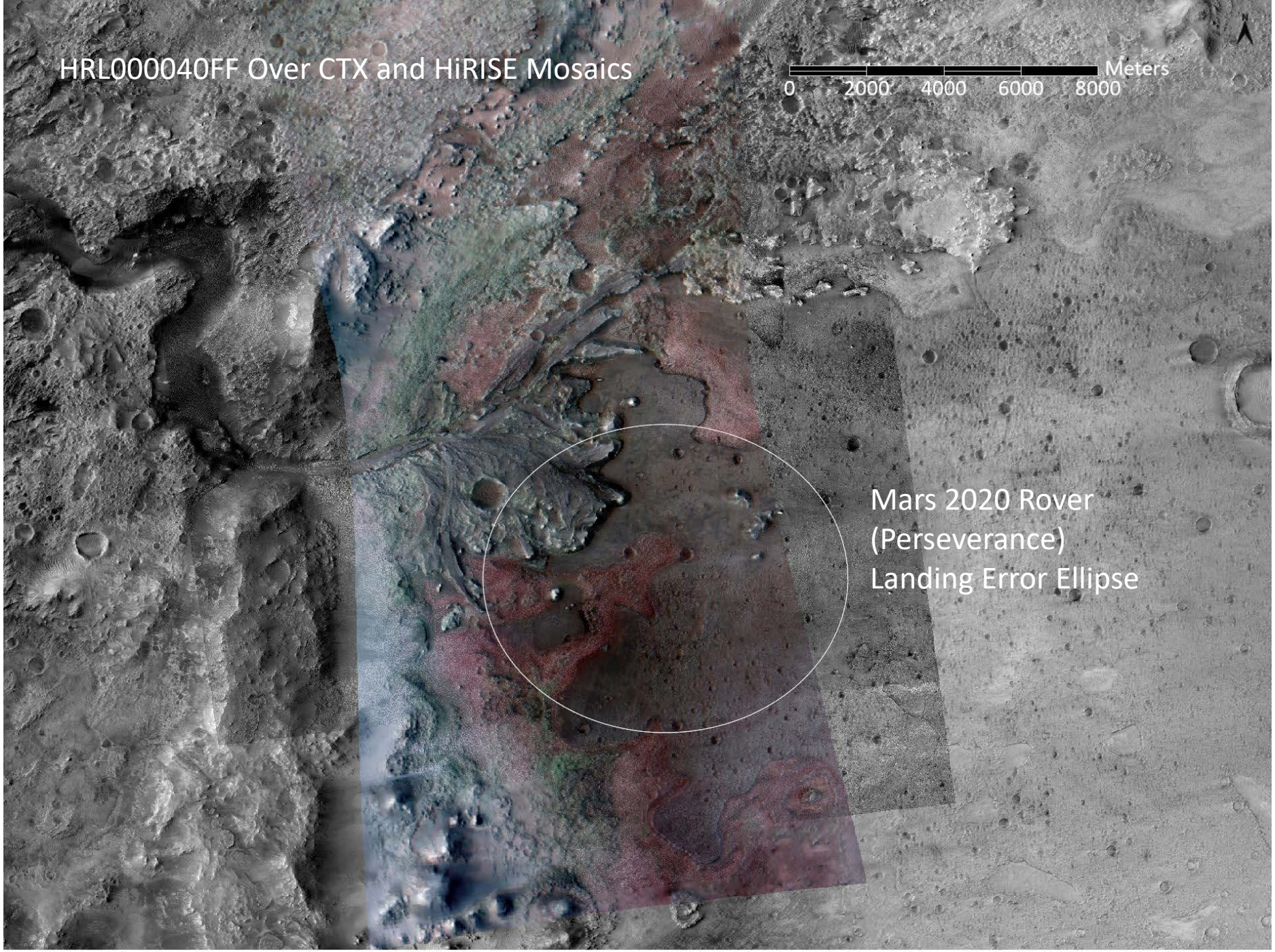
https://pds-geosciences.wustl.edu/mro/mro-m-crism-2-edr-v1/mrocr_0001/document/crism_dpsis.pdf

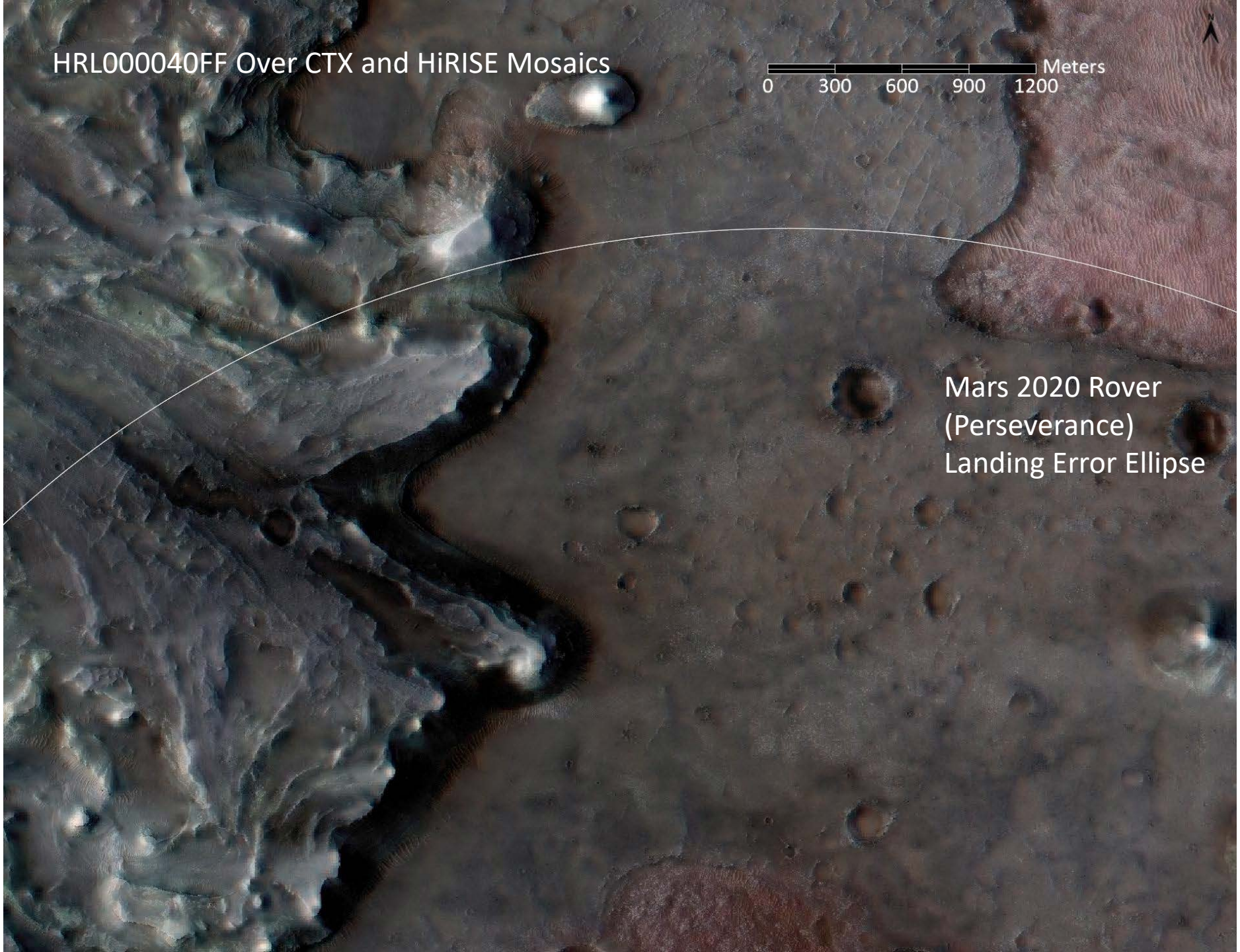
Steps Needed to Get Ready for Processing

- Use the Geosciences Node Mars Orbital Data Explorer to search for CRISM data sets covering Jezero crater. Chose HRL000040FF because of rich mineral and geologic associations.
- Download the S and L I/F and/or radiance cubes and associated Digital Data Records (all in sensor space).

  (See ODE/AN webinar and ODE tutorial session at the DPS meeting.)
- Have CAT installed on ENVI5.X (Geosciences Node help is available to do this installation, if needed. chow@wunder.wustl.edu Feng Zhou)
- Now let's go to the tutorial screens showing ENVI5.5.3 and CAT processing of the data sets:
  - Examine file structures
  - Read CRISM files
  - Do atmospheric correction using "volcano scan" method
  - Generate spectral parameters and flatten
  - Map project data
  - Conduct some initial analyses

Interactive Tutorial Showing ENVI5.6 Screen


HRL000040FF Over CTX and HiRISE Mosaics
0 2000 4000 6000 8000 Meters
Mars 2020 Rover
(Perseverance)
Landing Error Ellipse


HRL000040FF Over CTX and HiRISE Mosaics
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Mars 2020 Rover
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Questions or Comments?