A Taste of ISIS:

Hands-on tutorial in using ISIS-3 to process

CASSINI ISS, RADAR, VIMS data

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NASA Planetary Data Workshop
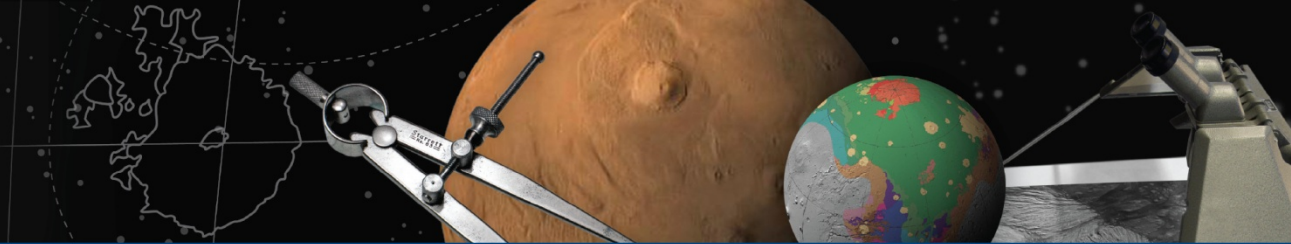
June 26, 2012

What is ISIS

- Integrated Software for Imagers and Spectrometers
  - Over 275 image processing applications
  - Strong emphasis on geometric knowledge
    - Photogrammetry / Camera models
    - Cartography / Map projections
    - Photometry
    - Improving instrument position & orientation / Bundle adjustment
    - Controlled digital mosaics
  - In use for over 30 years (PICS, ISIS2, ISIS3)
  - Support for over 35 NASA/ESA instruments
  - Support for Cassini ISS, RADAR, & VIMS data will be perpetuated into future of ISIS

Cassini VIMS 64x64 raw cube (ISIS qview)
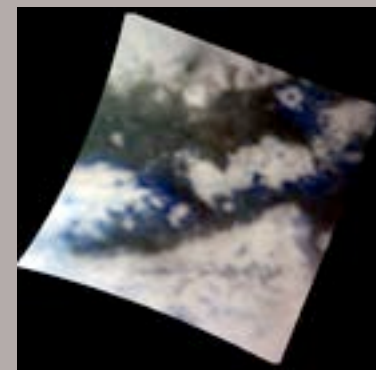
Calibrated and converted to a map projection in ISIS 3

MISSION INSTRUMENTS SUPPORTED BY ISIS

- Lunar Orbiter III, IV, &, V
- Clementine UVIS, NIR, HIRES, & LWIR
- Lunar Reconnaissance Orbiter NAC & WAC
- Voyager 1 & 2
- Galileo SSI
- Cassini ISS, VIMS, & RADAR
- Mariner 10
- Messenger MDIS

- Viking Orbiter 1 & 2
- Mars Global Surveyor WAC & NAC
- Mars Odyssey THEMIS VIS & IR
- Mars Express HRSC
- Mars Reconnaissance Orbiter HiRISE, CTX, & MARCI
- Apollo Metric 15/16/17
- Dawn FC and VIR
- Future Plans (2012)
 - Apollo Panoramic 15/16/17
  - MRO CRISM, Mariner 9

ISIS S/W for Cassini ISS, RADAR, VIMS - background

- Funding from: Cassini Project, PDS imaging node, PGG Cartography

- Cassini Project funding has been focused on development of necessary ISIS S/W modules and SPICE interfaces

  – ISS specific modules include CISS2ISIS and CISSCAL (radiometry and camera models provided by collaboration with A. McEwen, U of AZ)

  – VIMS specific modules include VIMS2ISIS and VIMSCAL (radiometry and camera models provided by collaboration with R. Brown, U of AZ)

  – RADAR data sets are delivered in Level2 (correlated, geometrocally mapped) to PDS; ISIS S/W PDS2ISIS was upgraded to support RADAR

  – Modifications to SPICEINIT and camera models substantial Cassini effort

  – Numerous specialized scripts/procedures also developed for Cassini data

Most Recent ISIS Release

- ISIS 3.4.0 (Released 5/2012)

- UNIX based
  - Mac OS-X 10.5 & 10.6 (Intel)
  - Debian 6.0 (64 bit)
  - Fedora 16 (64 bit)
  - Redhat Enterprise 5.6 (32 & 64 bit)
  - Redhat Enterprise 6.1 (64 bit)
  - SUSE 11.3 (64 bit)
  - Ubuntu 10.04

- Download via Internet
  - Full distribution 130GB
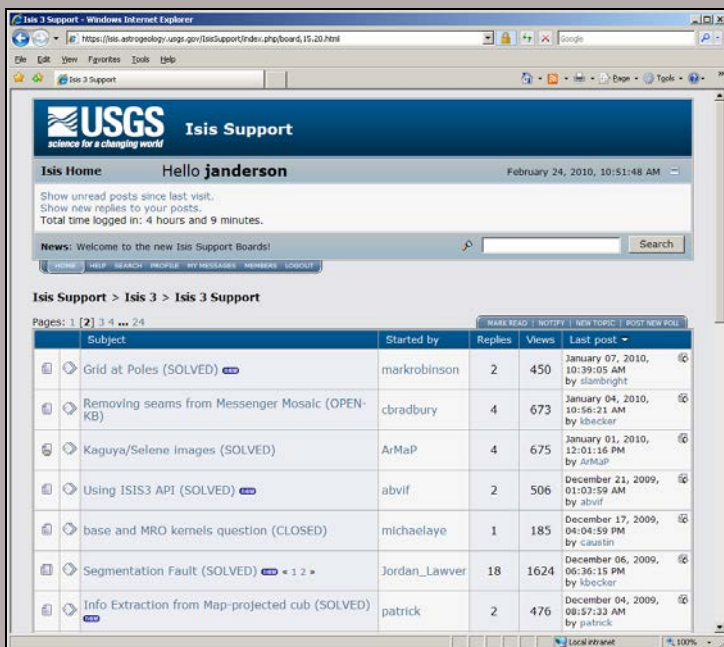 - Selective download
  - *New!* SPICE web access

http://isis.astrogeology.usgs.gov/documents/InstallGuide
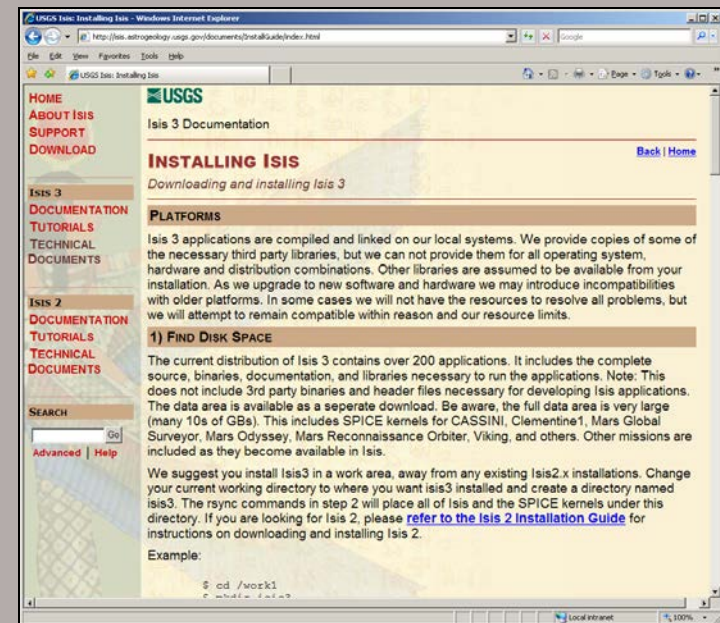
HOW TO GET ISIS 3

- Start at the ISIS Website
  - http://isis.astrogeology.usgs.gov
  - See the 'Install Guide' for info on installing ISIS for your OS and platform
    - http://isis.astrogeology.usgs.gov/documents/InstallGuide
  - Create a separate 'ISIS3' directory, 'cd' into it and then copy the software and two data files there
    - Base data and mission-specific data are both required
  - Use 'rsync' to download the latest version of ISIS 3 software and data files
    - Example for MAC OSX 10.5 Intel (software):
      - % rsync -azv --delete isisdist.wr.usgs.gov::x86_darwin_OSX/isis .
      - Be sure to include the '.' at the end!!!
    - Example for Cassini (data), two files:
      - 1) % rsync -azv - -delete isisdist.wr.usgs.gov::isis3data/data/base data/
      - 2) % rsync -azv - -delete isisdist.wr.usgs.gov::isis3data/data/cassini data/
  - Set up environment variable & run startup script (examples for C shells)
    - % setenv ISISROOT /work1/isis3/isis
    - % source $ISISROOT/scripts/isis3Startup.csh

ISIS DOCUMENTATION AND USER GUIDES

- General Information
  - isis.astrogeology.usgs.gov
- Online Workshops
  - isis.astrogeology.usgs.gov/IsisWorkshop
- Table of ISIS Applications
  - isis.astrogeology.usgs.gov/Application
- User Support Forums
  - isis.astrogeology.usgs.gov/IsisSupport
- Installation Guide
  - isis.astrogeology.usgs.gov/documents/InstallGuide
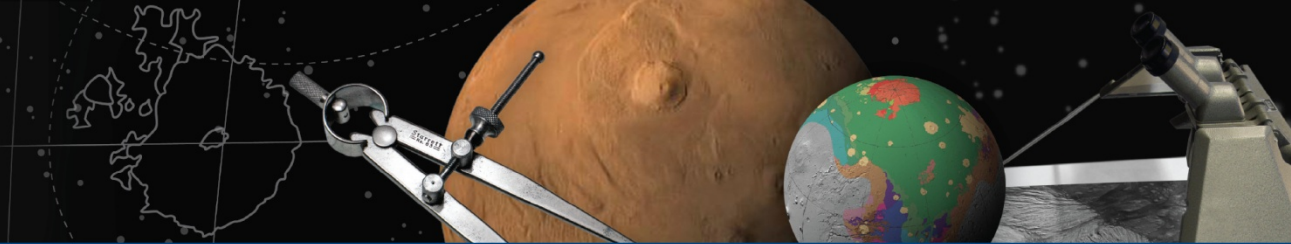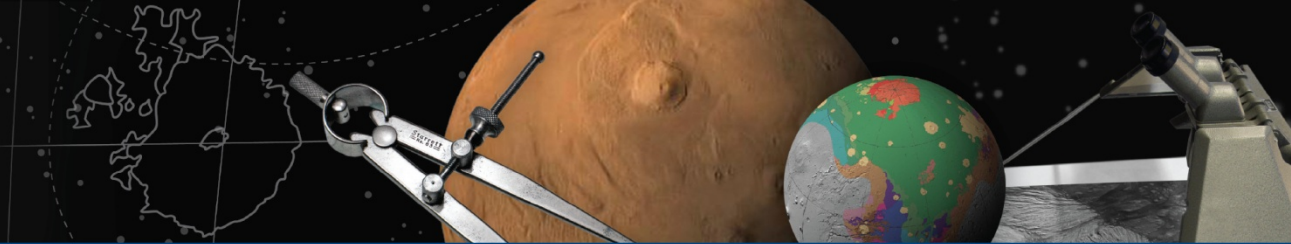
ISIS User Guides for ISS, RADAR, VIMS Now Online

- On October 20 USGS released an updated version of the ISIS-3 online self-guided "Workshop" that now includes **User Guides, tutorials, and demonstrations for processing and analysis of Cassini ISS images, of RADAR datasets, and of VIMS spectral cubes**---this new ISIS User Guide is online at: http://isis.astrogeology.usgs.gov/IsisWorkshop/index.php/IsisWorkshop

- This series of online user guides, tutorials and self-guided workshops will be continually updated and released on the same cycle as are new releases of ISIS 3 (~3 month) and will include new scripts and procedures as well as new S/W modules.

Today's ISIS-3 Tutorial–ISS, RADAR SAR & VIMS –Goals & Scope

- Provide an introduction to ISIS

  1. Find and download data sets using the PDS Planetary Atlas
  2. ISIS GUI and utility tools
  3. Automated processing methods (command line, pl scripts, awk)
  4. Importing & adding SPICE
  5. Radiometric calibration: ISS/VIMS
  6. Visualization tools for images & spectra (qview)
  7. Map projecting/mosaicking images
  8. How to control digital mosaics

Explore four sets of problems

  1. Intercompare ISS, RADAR, and VIMS data for Sinlap c. Ingest ISS/VIMS, spiceinit, calibrate, project to map; project RADAR SAR to same map
  2. Build uncontrolled mosaic of ISS images of Enceladus south polar region; illustrate procedures to control mosaic; seam removal and photometric normalization
  3. Demonstrate scripts for assembly of VIMS 1-line cubes into mosaics
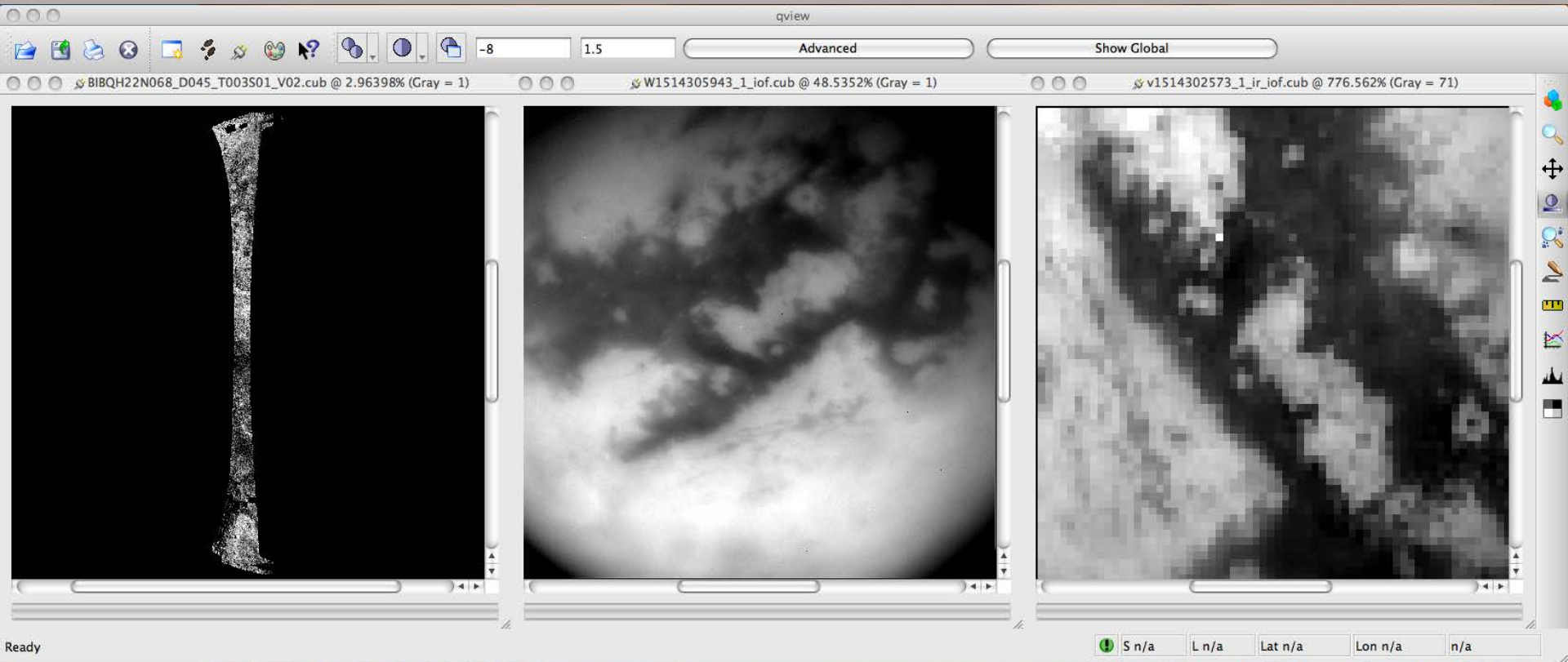 4. Use scripts on VIMS to generate averages in methane transmission windows; use fx to model VIMS Titan photometry

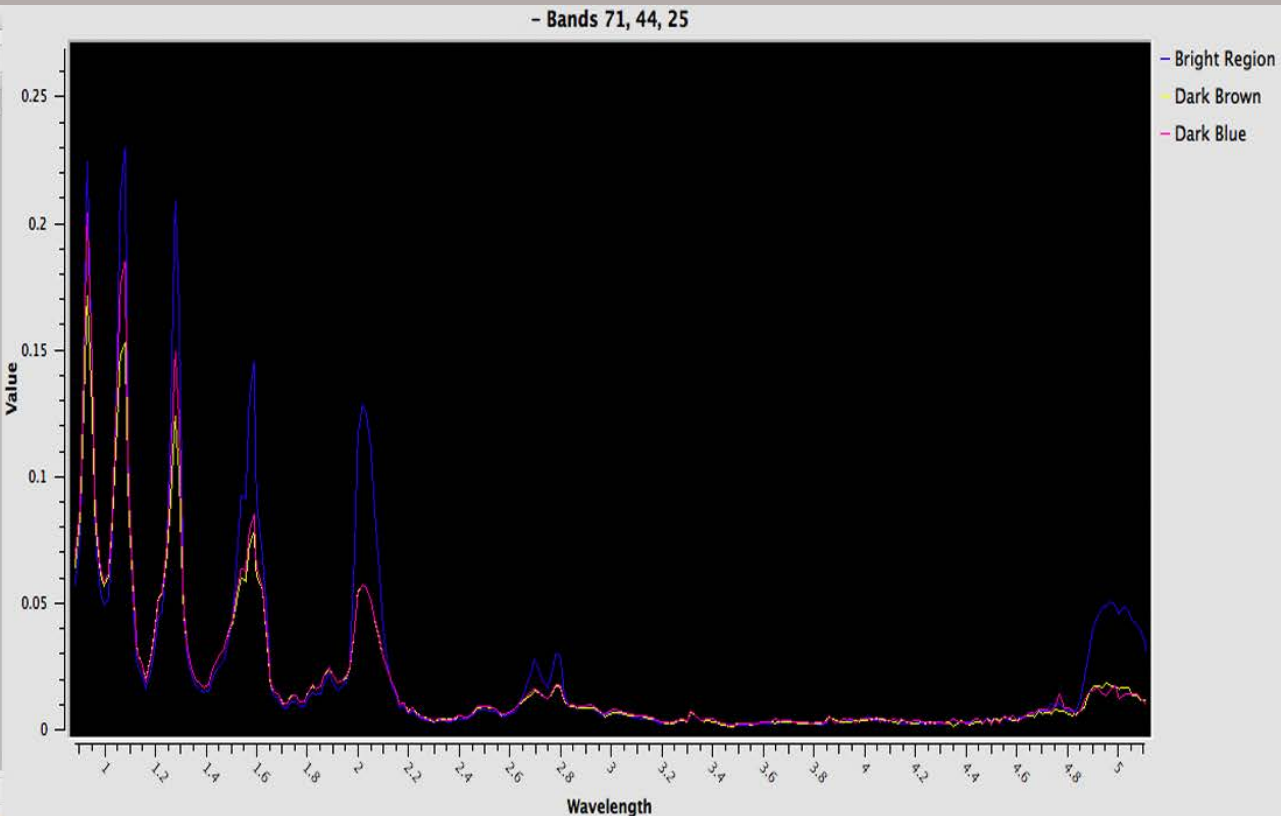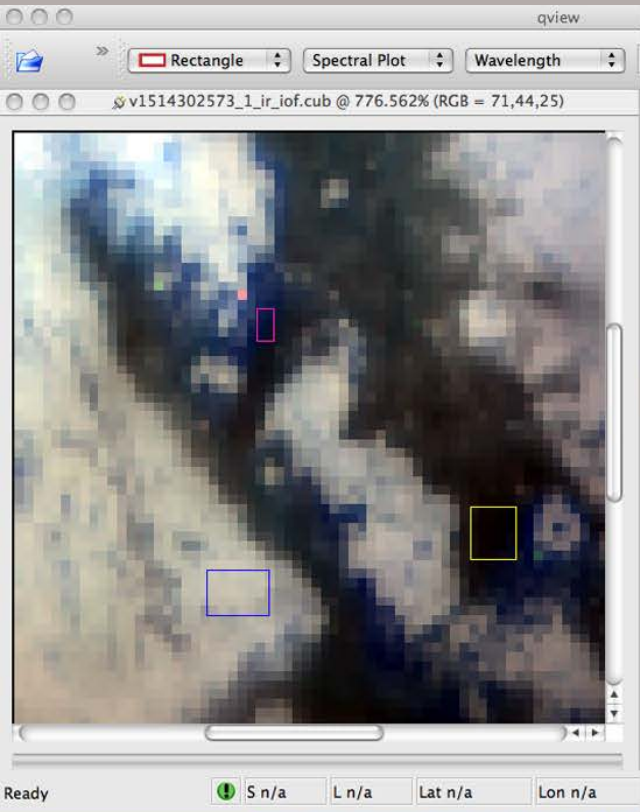# FOUR EXAMPLE PROBLEMS USING ISIS-3 WITH CASSINI DATA

(to be illustrated in today's hands-on tutorials)

Set 1: Download PDS-released data & convert to ISIS - RADAR (pds2isis), ISS (ciss2isis), VIMS (vims2isis)

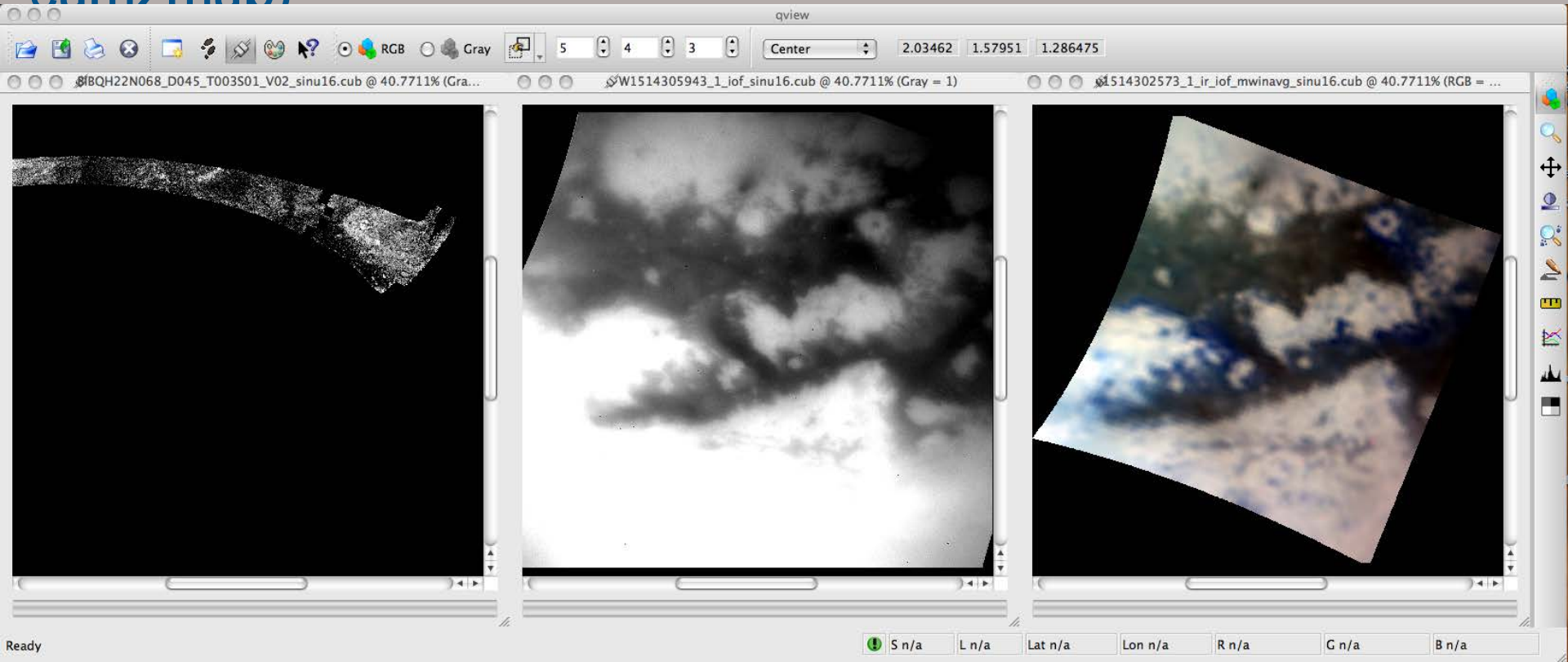# Set 1: qview VIMS spectral extraction example: spectral averages of Level1 cube (radiometry calibrated, geometry raw)
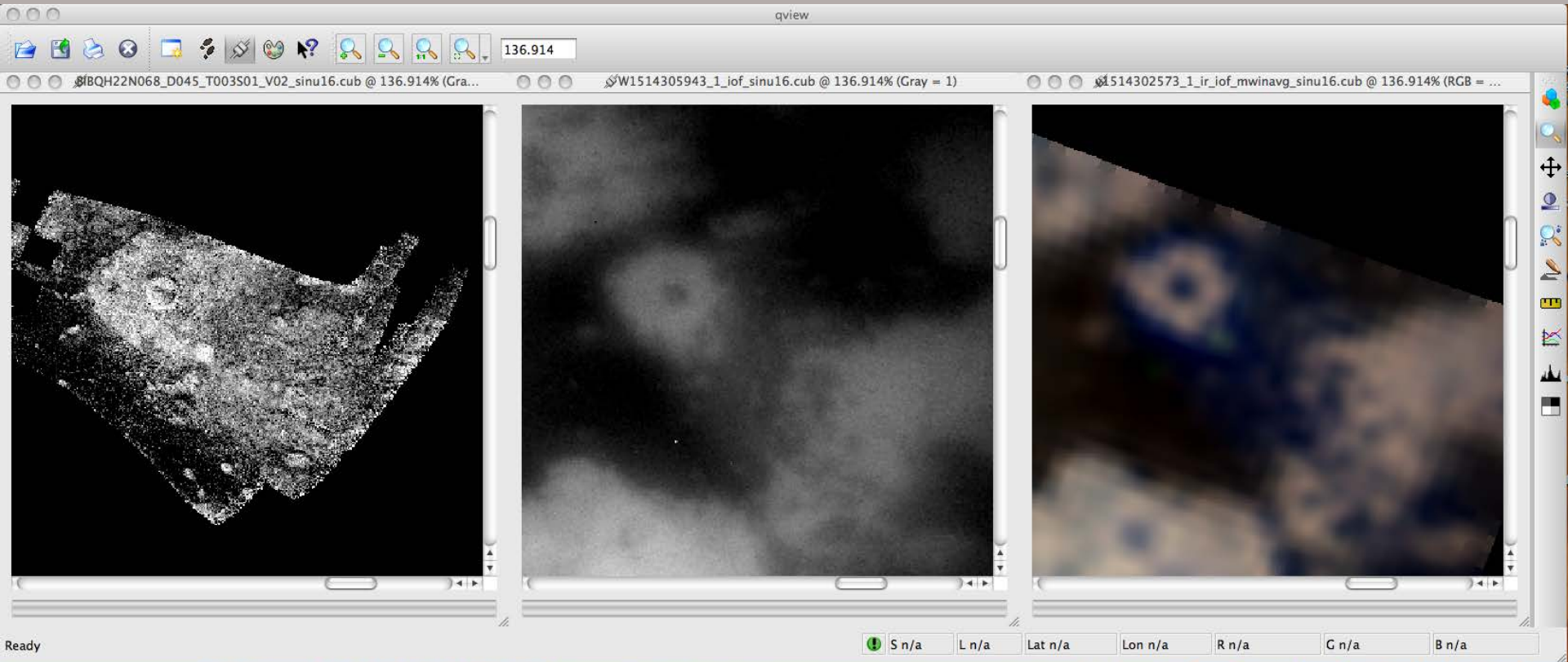
Set 1: Calibrate/project/register/display (qview) RADAR (map2map), ISS & VIMS (cisscal, vimscal, spiceinit, cam2map)

Set 1: Enlargements of registered Sinlap cubes

Set 2: ISS mosaic of Enceladus' south pole: with/without control & photom

Images:
N1602275390_1
N1604169204_2
N1597183216_2
N1597183061_2
N1597182896_2
N1597182735_2

```
Group = Mapping
    ProjectionName     = POLARSTEREOGRAPHIC
    CenterLongitude    = 0.0
    TargetName         = Enceladus
    EquatorialRadius   = 256600.0 <meters>
    PolarRadius        = 248300.0 <meters>
    LatitudeType       = Planetocentric
    LongitudeDirection = PositiveEast
    LongitudeDomain    = 360
    MinimumLatitude    = -90.0
    MaximumLatitude    = -10.0
    MinimumLongitude   = 0.0
    MaximumLongitude   = 360.0
    UpperLeftCornerX   = -374400.0
    UpperLeftCornerY   = 374400.0
    PixelResolution    = 200.0 <meters/pixel>
    Scale              = 21.929635596439 <pixels/degree>
    CenterLatitude     = -90.0
  End_Group
```
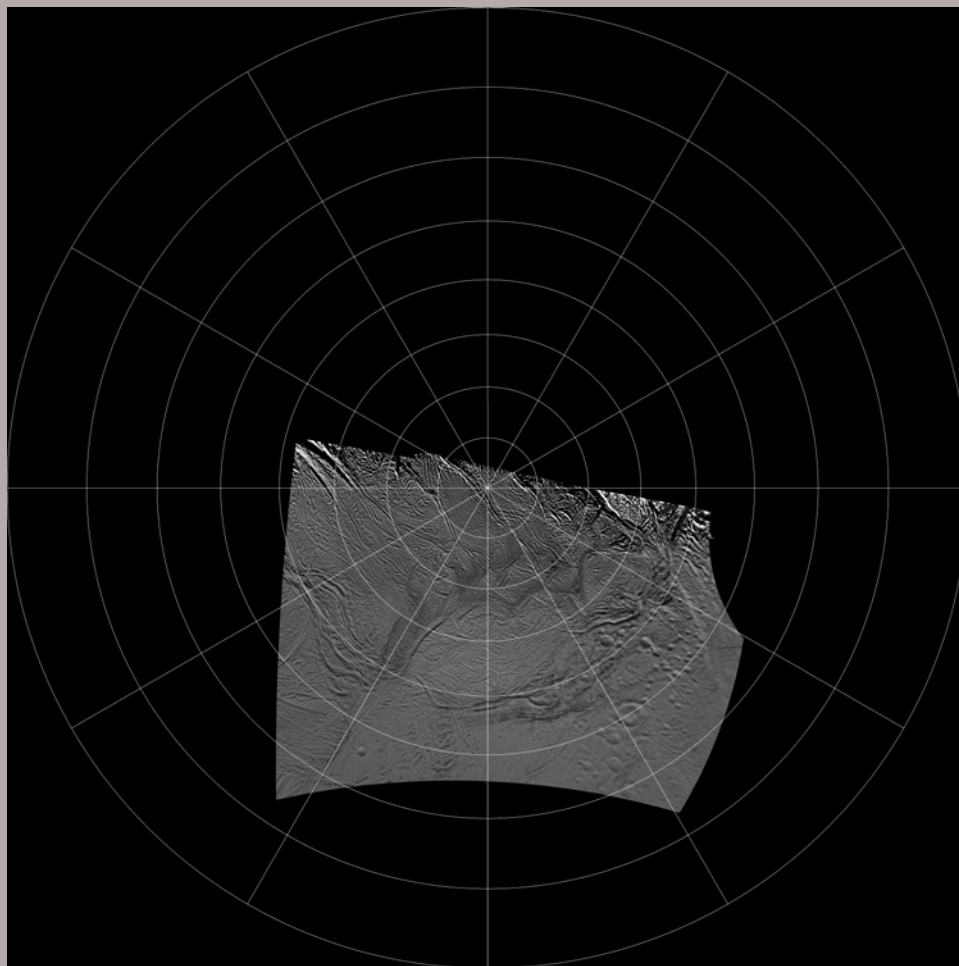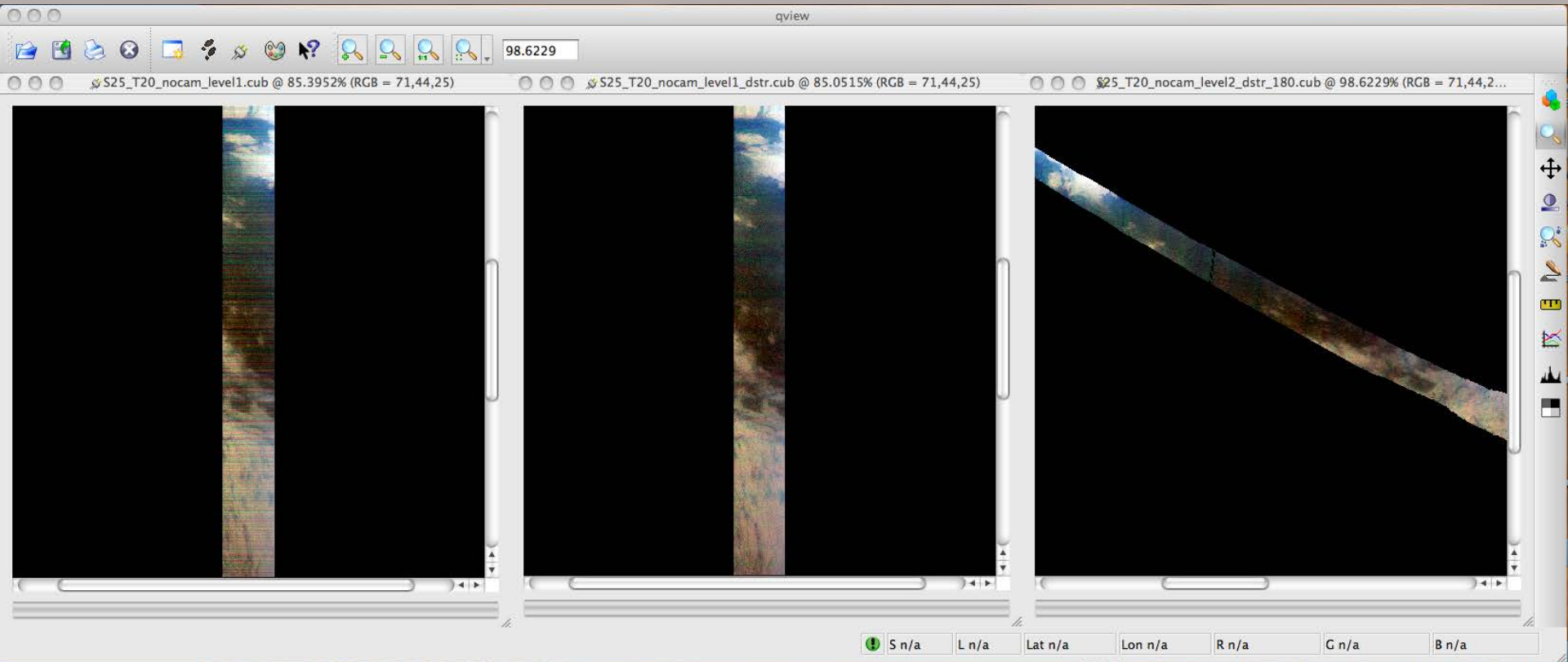
Set 3: VIMS-specific ISIS procedures for analysis of single-line contiguous cubes (582 cubes concatenated)

Set 4: fx example: modeling photometry in a pair of VIMS cubes of Sinlap