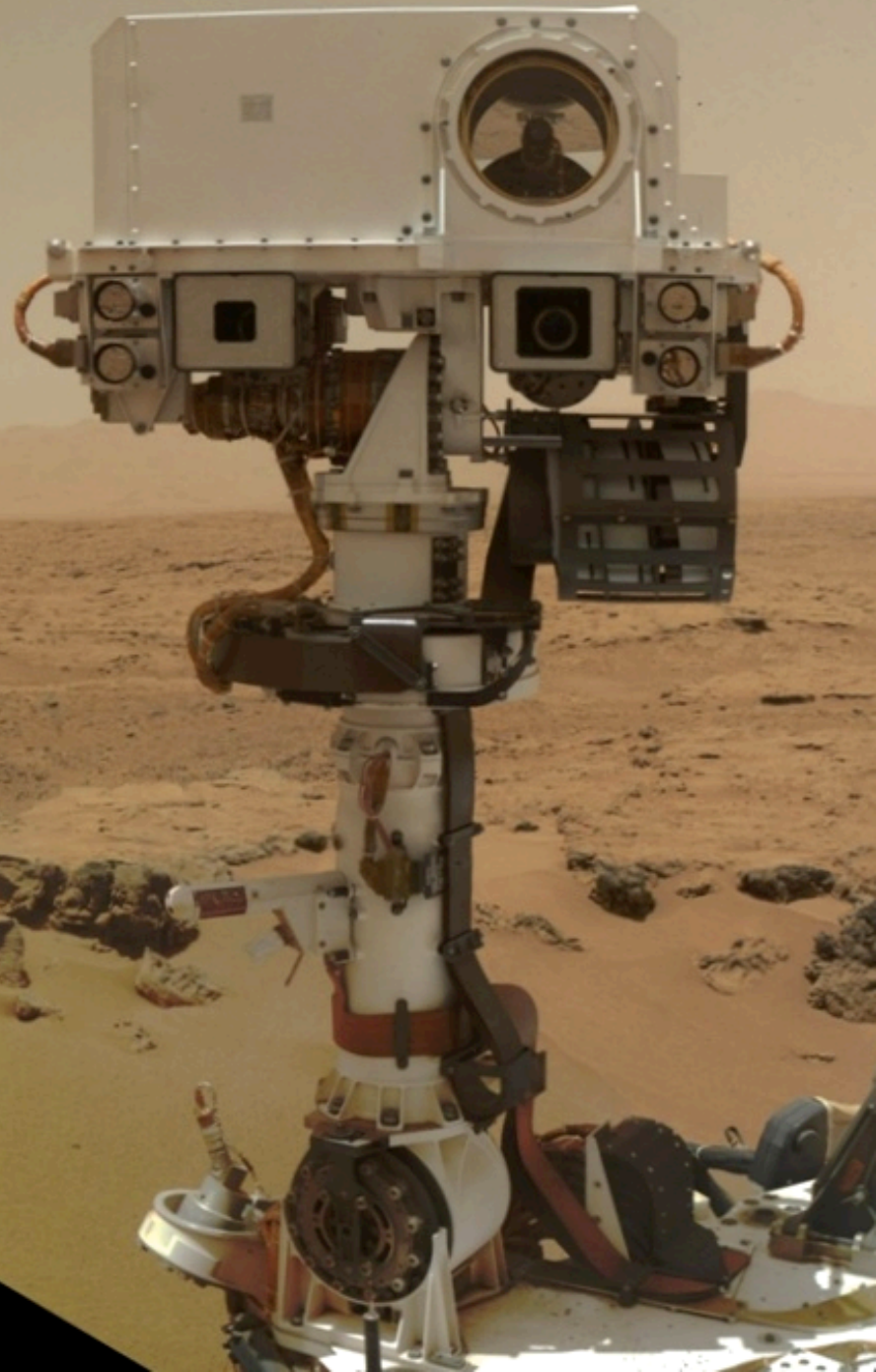


Lunar and Planetary Science Conference, March 18<sup>th</sup>, 2015

COMMUNITY USER WORKSHOP  
ON PLANETARY LIBS (CHEMCAM)  
DATA

# Currently available ChemCam data (and how to find it)

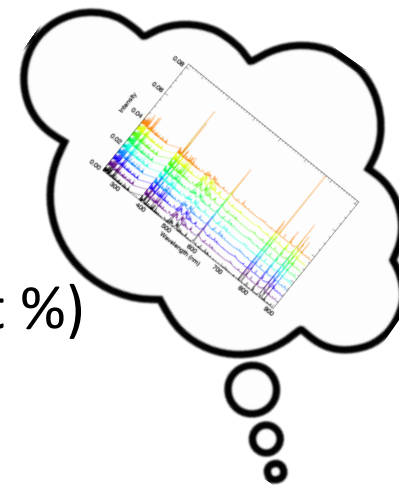
Dot DeLapp and Nina Lanza  
ddelapp@lanl.gov  
nlanza@lanl.gov



# Main ChemCam data products

Up to sol 804 on March 16

- **LIBS**
  - Spectral data (raw and processed)
    - Includes passive spectra (darks)
  - Element quantification (PLS oxide weight %)
- **RMI**
  - Image data (raw and processed)
    - Standalone RMIs
    - Z-stack (3D info)
  - RMI mosaics
- **LIBS calibration data**
  - Laboratory spectral data



# Raster types (sols 0-801)

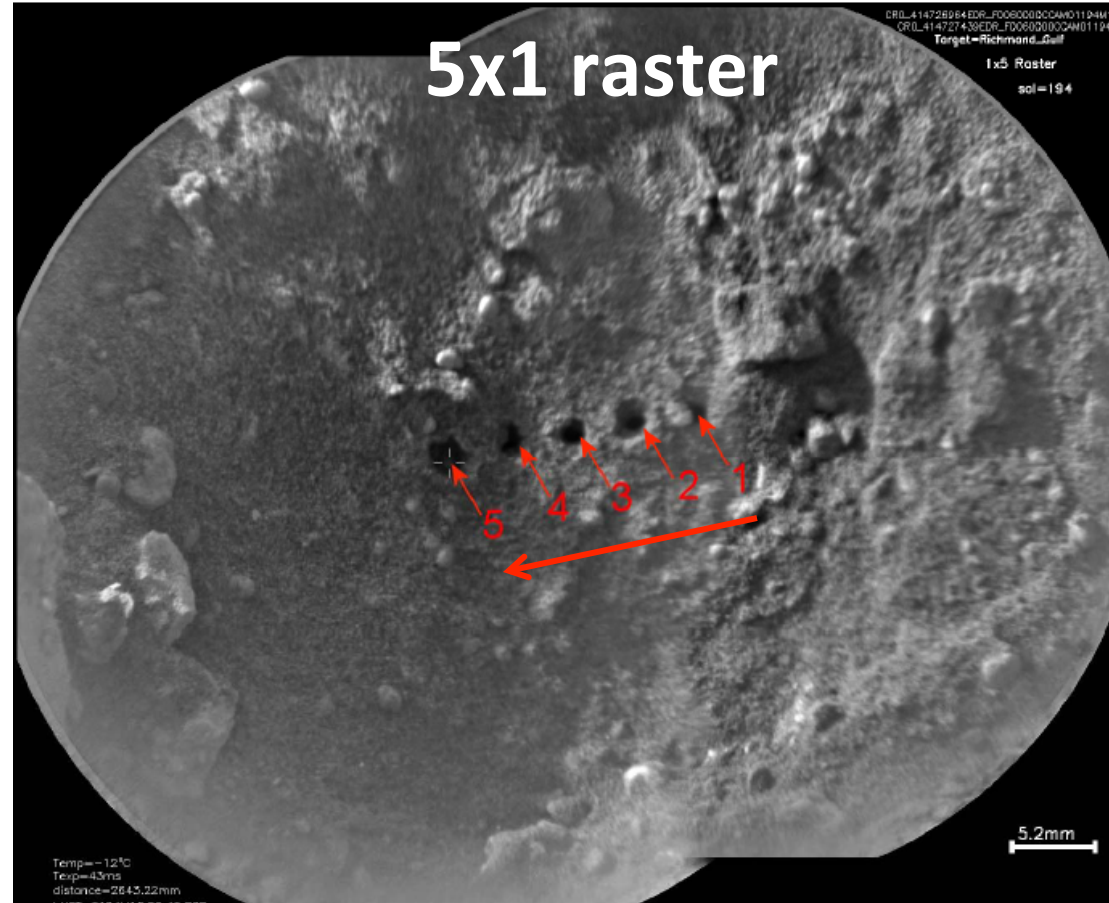
- Single location
- Line
  - Horizontal, vertical, diagonal
  - 5x1, 1x10, etc.
- Square
  - 3x3, 5x5, etc.
- Right → Left  
Down → Up
  - File name order (sclock)
- Typically 30 LIBS shots per location
  - 30 individual spectra
  - Depth profile ( >50 shots)



Richmond Gulf, sol 194

# Raster types (sols 0-801)

- Single location
- Line
  - Horizontal, vertical, diagonal
  - 5x1, 1x10, etc.
- Square
  - 3x3, 5x5, etc.
- Right → Left  
Down → Up
  - File name order (sclock)
- Typically 30 LIBS shots per location
  - 30 individual spectra
  - Depth profile ( >50 shots)

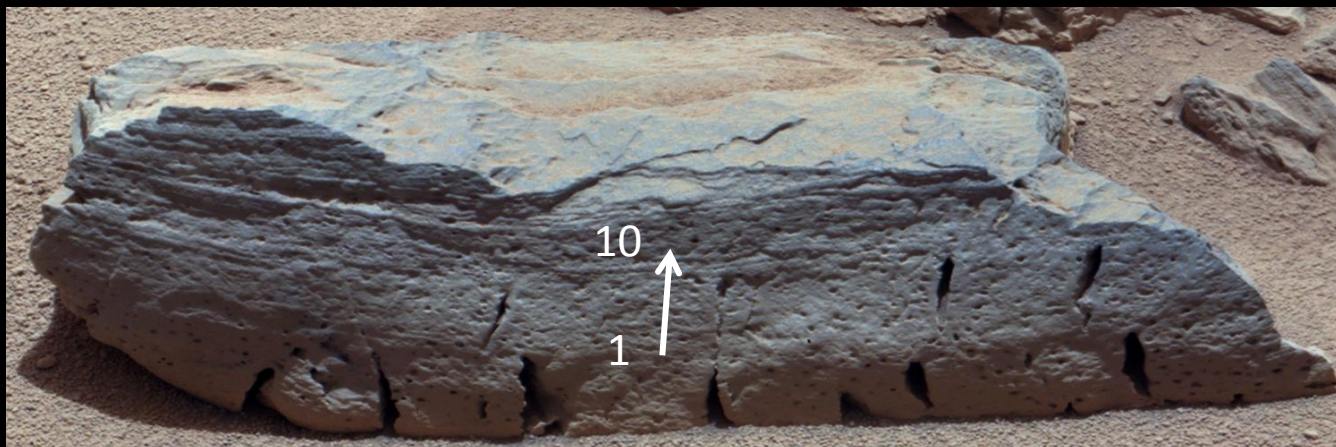


Richmond Gulf, sol 194



# A typical CCAM sequence

Ex: Rocknest3 1x10 (sol 83)



1. Pre-LIBS RMI



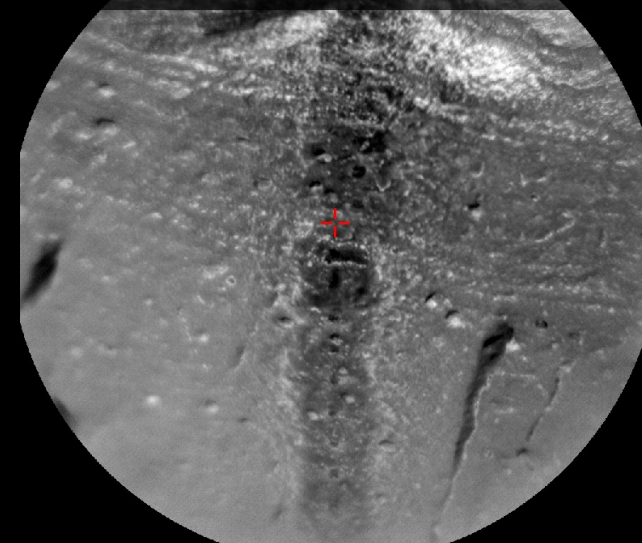
2. (LIBS, dark) x 10

30 shots ● 10 ↑  
⋮  
30 shots ● 3  
30 shots ● 2  
30 shots ● 1

Data products:

10 LIBS, 10 darks, 2 RMIs

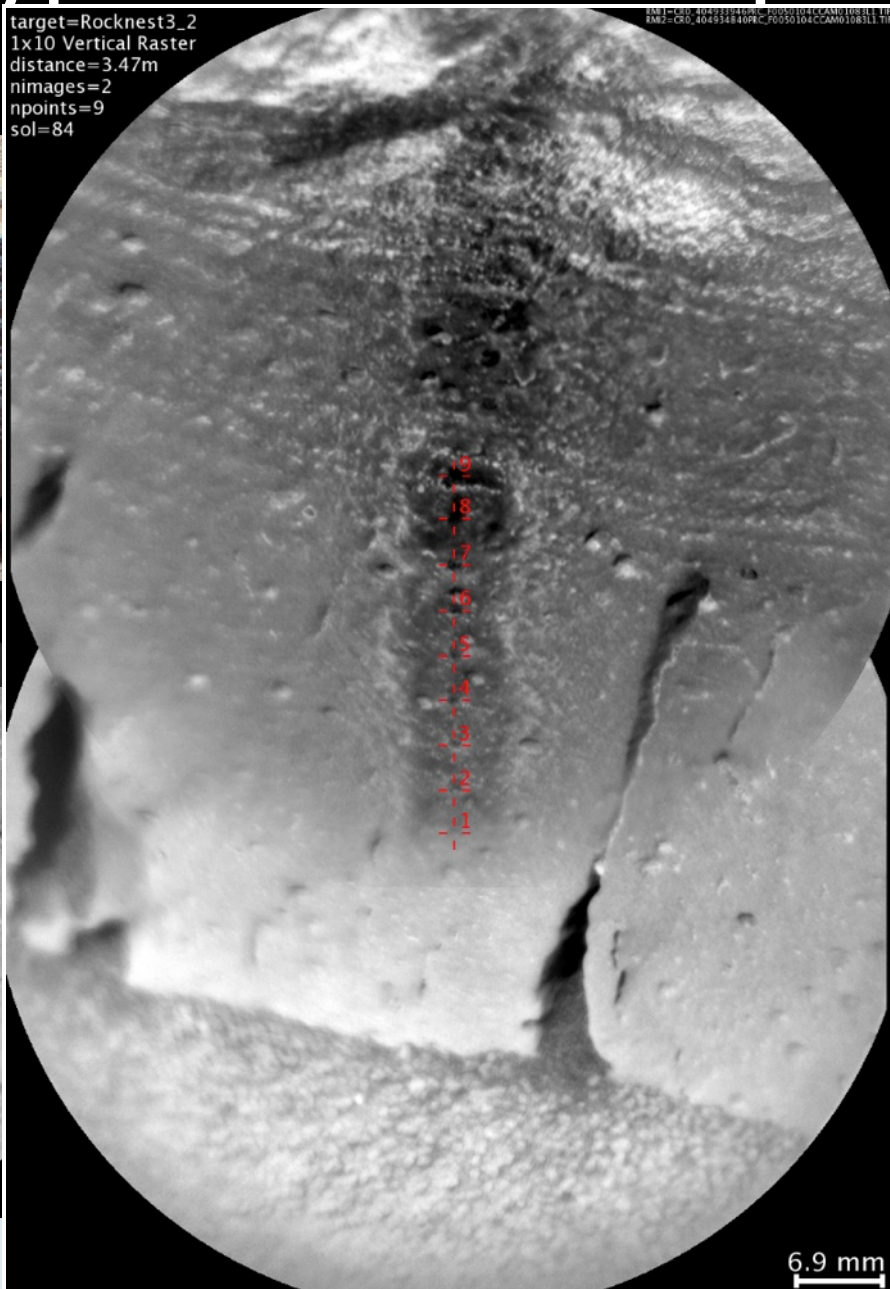
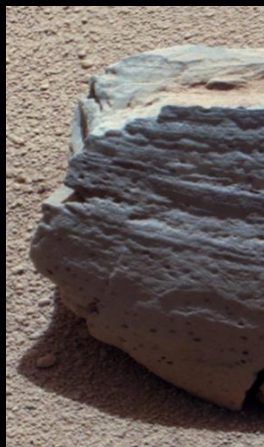
3. Post-LIBS RMI



# A typical CCAM sequence

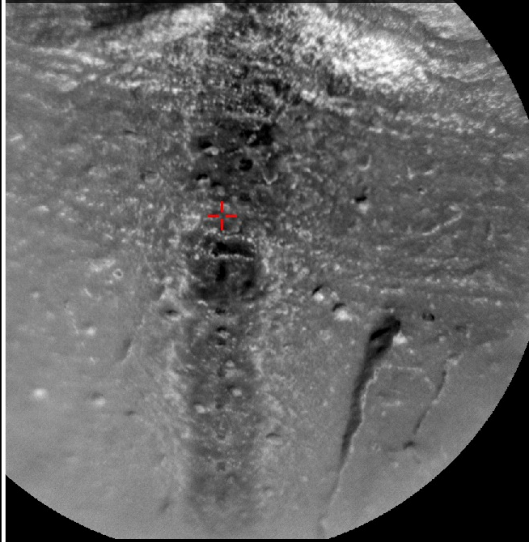
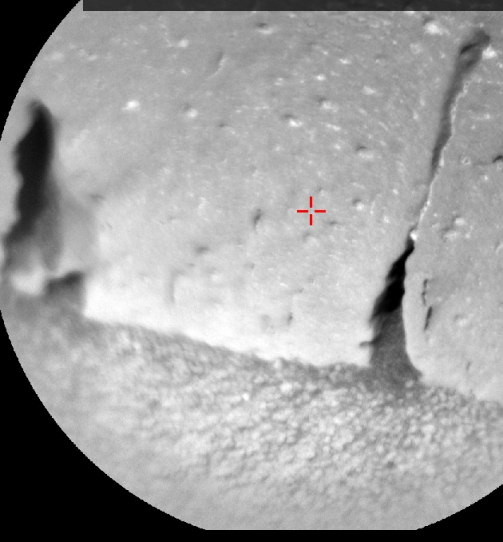
target=Rocknest3\_2  
1x10 Vertical Raster  
distance=3.47m  
nimages=2  
npoints=9  
sol=84

RMI=CRD\_40423184000\_0025104CCAM108311.TIF  
RMC=CRD\_404231840PRCC\_0025104CCAM108311.TIF



1. Pre-LIBS RMI

3. Post-LIBS RMI

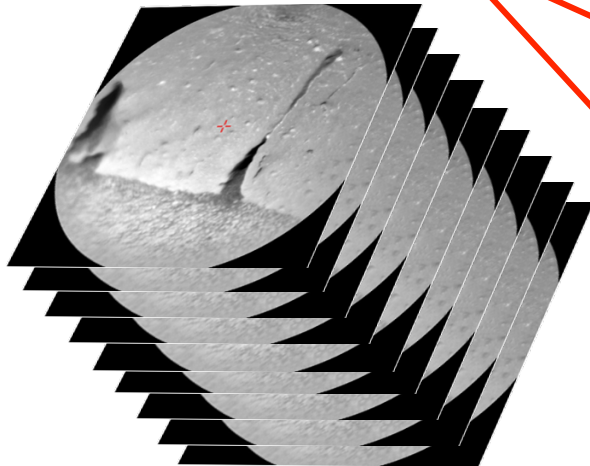




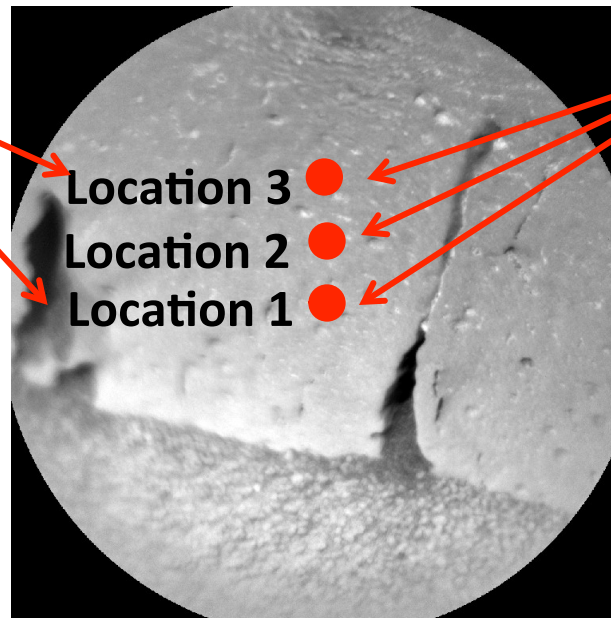
# Raster types (sols 802-present)

- No longer using autofocus (CWL)
- Focusing using specific motor positions
- Typically 1x3 raster with RMI at first and last location
  - Usually 9 focal planes (LIBS and RMI)
  - PDL determines plane(s) of best focus for LIBS and RMI data

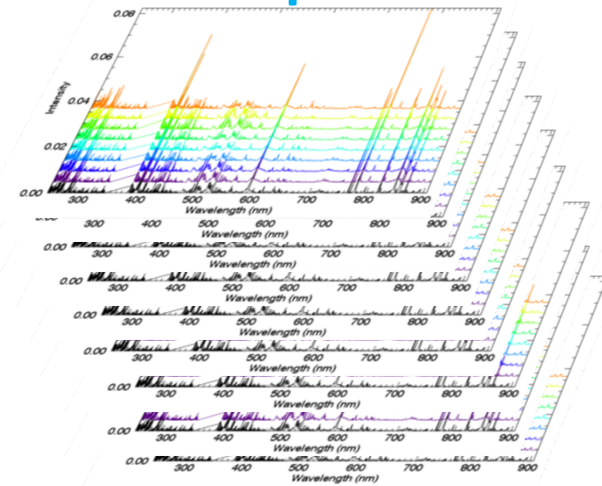
**Locations 1, 3**  
**1 RMI x 9 focal planes**



**9 RMIs per location**  
**(18 total)**



**Locations 1, 2, 3**  
**30 LIBS shots x**  
**9 focal planes**



**270 shots per location**  
**(810 total)**

# Raster types (sols 802-present)

- No longer using autofocus (CWL)
- Focusing using specific motor positions
- Typically 1x3 raster with RMI at first and last location
  - Usually 9 focal planes (LIBS and RMI)
  - PDL determines plane(s) of best focus for LIBS and RMI data

**Stay tuned for updates!**

- Best motor positions automatically selected for target
  - No need for multiple focal planes in single locations
- Back to sols 0-801 type rasters

**9 RMIs per location  
(18 total)**

**270 shots per location  
(810 total)**



# ChemCam RMI mosaics

msl-chemcam.com → Results (2<sup>nd</sup> tab) → ChemCam - Results

msl-chemcam.com/index.php?menu=images\_result&rubrique=63&sousrubrique=248&sousrubrique=0&art=587&titre\_url=Results%20-%20ChemCam%20-%20Results#.VPDe2PnF\_wM

**CHEM CAM ON MARS**

SOL 910

Home Results ChemCam Team Multimedia Newsroom Education Links

You are here: Results > ChemCam > Results

RESULTS (420) - DOWNLOAD ALL FILES

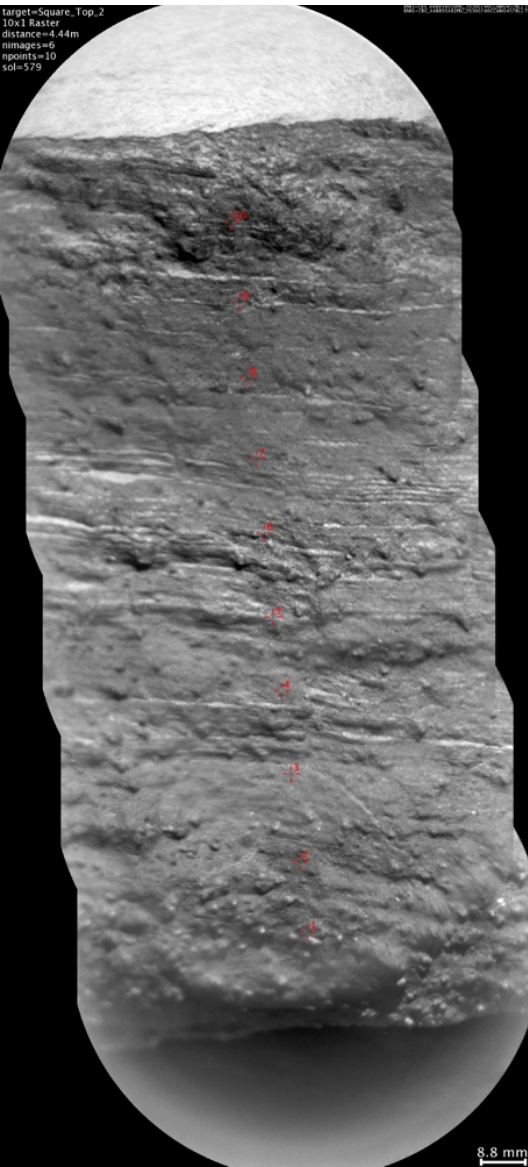
ChemCam - Results ChemCam

PAGES: 1 2 3 4 5 6 7 8 9

Sol 582	NASA/JPL- Caltech/CNES/CNRS/LANL/IRAP/IAS/LPGN	Dune_Field	
Sol 581	NASA/JPL- Caltech/CNES/CNRS/LANL/IRAP/IAS/LPGN	Erskine	
Sol 581	NASA/JPL- Caltech/CNES/CNRS/LANL/IRAP/IAS/LPGN	Elgee	
Sol 579	NASA/JPL- Caltech/CNES/CNRS/LANL/IRAP/IAS/LPGN	Petaluma	

# ChemCam RMI mosaics

msl-chemcam.com → Results (2<sup>nd</sup> tab) → ChemCam - Results



- Shot locations and order
- Mosaics through sol 582 available (to be updated)

# Data labeling (sols 0-999)

CL5\_414268531CCS\_F0060000CCAM01189P3.csv

1. Data type: CL5 = LIBS, CL9 = dark, CR0 = RMI, CL0 = passive (avg)
2. Spacecraft clock (sclock) → Time order that file was obtained
3. Processing level  
EDR = raw, RDR = Level 1a, CCS = Level 1b, MOC = Level 2, PRC = processed RMI
4. Flight software version
5. Sequence ID: CCAM01189 = Instrument + sequence order (01) + sol (189)
6. Version: Always use the latest P# when available → latest (P1 = auto, P2 = PDL analysis, P3=validated, P4=Modified,etc.)
7. File type

# Data labeling (sol 1000+)

CL5\_414268531CCS\_F0060000CCAM01189P3.csv

1. Data type: CL5 = LIBS, CL9 = dark, CRO = RMI, CLO = passive (avg)
2. Spacecraft clock (sclock) → Time order that file was obtained
3. Processing level  
EDR = raw, RDR = Level 1a, CCS = Level 1b, MOC = Level 2, PRC = processed RMI
4. Flight software version: **Indicates pre- or post-1000 sols**  
Ex: F0100000 = sols 1000-1999  
F0200000 = sols 2000-2999
5. Sequence ID: CCAM01189 = Instrument + sequence order (01) + sol (1000+189)  
**Warning: SeqIDs will be reused! Check flight software version.**
6. Version: Always use the latest P# when available → latest (P1 = auto, P2 = PDL analysis, P3=Validated, P4=Modified, etc.)

Sol 1000+ changes



# Getting data from PDS

<http://pds-geosciences.wustl.edu/missions/msl/chemcam.htm>

geosciences.wustl.edu/missions/msl/chemcam.htm

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
- Virtual Astronaut
- Orbital Data Explorers
- Spectral Library
- FTP Access
- Workshops

**Geosciences Node Data**

Mars

- Mars Exploration
- MSL
  - About MSL
  - APXS
  - ChemCam**
  - ChemMin
  - DAN
  - SAM
- Phoenix
- MRO
- MER
- Mars Express
- Odyssey
- MGS
- Pathfinder
- Prototype Rovers
- Viking Orbiter
- Viking Lander
- Earth Based Data

Venus

- Mercury
- Moon
- Earth
- Asteroids
- Gravity Models
- All Geosciences Data Holdings

**MSL: ChemCam**

**December 13, 2013.** MSL Release 4 includes new ChemCam raw (EDR) and derived (RDR) data from sols 270 through 359, along with revised versions of ChemCam LIBS MOC derived products for sols 13 through 234. Browse images for sols 13 through 176 and 192 have been updated. See [ERRATA.TXT](#) for details.

ChemCam combines the LIBS (Laser Induced Breakdown Spectrometer) and the RMI (Remote Micro-Imager) to analyze the elemental composition of laser-vaporized materials from the surface of Martian rocks and soils. ChemCam data sets are produced by the ChemCam team at Los Alamos National Laboratory and the Centre National D'Etudes Spatiales (CESR), Toulouse, France.

**ChemCam Data Sets**

- Raw Data Products
- ChemCam LIBS, RMI, and State-of-Health EDR (Experiment Data Records)
- Derived Data Products**
  - ChemCam LIBS and RMI RDR (Reduced Data Records)**

**Online Tools**

- MSL Analyst's Notebook** - This PDS Geosciences Node tool provides access to MSL data in the context of mission operations -- by sol, location, instrument, and other criteria.

**Related Information**

- PDS Catalog Files**
  - ChemCam LIBS EDR (Raw) Data Set Description
  - ChemCam RMI EDR (Raw) Data Set Description

Most people will just want the processed data

But raw data are also available (see backup slides for details)

# Main menu for processed data

ChemCam LIBS and RMI RDR → **mslccm\_1xxx**

← → ↻ pds-geosciences.wustl.edu/msl/msl-m-chemcam-libs-4\_5-rdr-v1/mslccm\_1xxx/

**pds-geosciences.wustl.edu - /msl/msl-m-chemcam-libs-4\_5-rdr-v1/mslccm\_1xxx/**

---

[\[To Parent Directory\]](#)

6/6/2013 11:24 AM	7556 <a href="#">aareadme.txt</a>	<b>aareadme:</b> File structure of Archive
12/12/2013 10:56 AM	<dir> <a href="#">browse</a>	<b>browse:</b> Quicklooks for Mars data
6/7/2013 1:53 PM	<dir> <a href="#">calib</a>	<b>calib:</b> Processed lab calibration data
11/15/2013 2:48 PM	<dir> <a href="#">catalog</a>	
12/12/2013 11:01 AM	<dir> <a href="#">data</a>	<b>data:</b> Processed Mars data (Level 1, 2, RMI)
12/9/2013 3:00 PM	<dir> <a href="#">document</a>	
11/15/2013 4:06 PM	8425 <a href="#">errata.txt</a>	<b>document:</b> Master data list
4/10/2013 10:00 AM	<dir> <a href="#">extras</a>	
11/15/2013 2:48 PM	<dir> <a href="#">index</a>	<b>extras:</b> Master composition table
3/27/2013 10:27 AM	1827 <a href="#">voldesc.cat</a>	

---

# Master list

## misl\_ccam\_obs.csv

	A	B	C	D	E	F	G	H
1	Sol	EDR Type	Spacecraft	EDR Filename	Type of	Target	Sequence	Autof
2	10	CL1	3.98E+08	CL1_398380569EDR_F0030000CCAM04010M1.	1-D Dar	Cal Target 10	ccam04010	No
3	10	CL1	3.98E+08	CL1_398380596EDR_F0030000CCAM04010M1.	1-D Dar	Cal Target 10	ccam04010	No
4	10	CL1	3.98E+08	CL1_398380611EDR_F0030000CCAM04010M1.	1-D Dar	Cal Target 10	ccam04010	No
5	10	CR0	3.98E+08	CR0_398380645EDR_F0030000CCAM04010M1.	Image	Cal Target 10	ccam04010	No
6	10	CL1	3.98E+08	CL1_398380719EDR_F0030000CCAM05010M1.	1-D Dar	Cal Target 9	ccam05010	No
7	10	CL1	3.98E+08	CL1_398380732EDR_F0030000CCAM05010M1.	1-D Dar	Cal Target 9	ccam05010	No
8	10	CL1	3.98E+08	CL1_398380747EDR_F0030000CCAM05010M1.	1-D Dar	Cal Target 9	ccam05010	No
9	10	CR0	3.98E+08	CR0_398380781EDR_F0030000CCAM05010M1.	Image	Cal Target 9	ccam05010	No
10	10	CL1	3.98E+08	CL1_398380829EDR_F0030000CCAM05010M1.	1-D Dar	Cal Target 8	ccam05010	No
11	10	CL1	3.98E+08	CL1_398380841EDR_F0030000CCAM05010M1.	1-D Dar	Cal Target 8	ccam05010	No
12	10	CL1	3.98E+08	CL1_398380856EDR_F0030000CCAM05010M1.	1-D Dar	Cal Target 8	ccam05010	No
13	10	CR0	3.98E+08	CR0_398380890EDR_F0030000CCAM05010M1.	Image	Cal Target 8	ccam05010	No
14	10	CL1	3.98E+08	CL1_398380938EDR_F0030000CCAM05010M1.	1-D Dar	Cal Target 7	ccam05010	No
15	10	CL1	3.98E+08	CL1_398380950EDR_F0030000CCAM05010M1.	1-D Dar	Cal Target 7	ccam05010	No
16	10	CL1	3.98E+08	CL1_398380965EDR_F0030000CCAM05010M1.	1-D Dar	Cal Target 7	ccam05010	No
17	10	CR0	3.98E+08	CR0_398380999EDR_F0030000CCAM05010M1.	Image	Cal Target 7	ccam05010	No
18	10	CL1	3.98E+08	CL1_398381047EDR_F0030000CCAM05010M1.	1-D Dar	Cal Target 6	ccam05010	No
19	10	CL1	3.98E+08	CL1_398381060EDR_F0030000CCAM05010M1.	1-D Dar	Cal Target 6	ccam05010	No
20	10	CL1	3.98E+08	CL1_398381075EDR_F0030000CCAM05010M1.	1-D Dar	Cal Target 6	ccam05010	No
21	10	CR0	3.98E+08	CR0_398381109EDR_F0030000CCAM05010M1.	Image	Cal Target 6	ccam05010	No
22	10	CL1	3.98E+08	CL1_398381188EDR_F0030000CCAM05010M1.	1-D Dar	Cal Target 5	ccam05010	No
23	10	CL1	3.98E+08	CL1_398381201EDR_F0030000CCAM05010M1.	1-D Dar	Cal Target 5	ccam05010	No
24	10	CL1	3.98E+08	CL1_398381216EDR_F0030000CCAM05010M1.	1-D Dar	Cal Target 5	ccam05010	No

# Master list

mslccm\_1xxx → document → **msl\_ccam\_obs.csv**

	V	W	X	Y		AC	AD	AE	AF
Site	RMC Drive	RMC POS	Type of Obs	Comment spe		ir Heterogen	PDS?	Target Type	
4	2644	8	Single obs					Calibration Target	
4	2644	8	Single obs					Calibration Target	
4	2778	4	3x3 Raster					Calibration Target	
4	2778	4	3x3 Raster					Calibration Target	
4	2778	4	3x3 Raster					Calibration Target	
4	2778	4	3x3 Raster					Calibration Target	
4	2778	4	3x3 Raster					Calibration Target	
4	2778	4	3x3 Raster					Calibration Target	
4	2778	4	3x3 Raster					Rock	
4	2778	4	3x3 Raster					Rock	
4	2778	4	3x3 Raster					Rock	
4	2778	4	3x3 Raster					Rock	
4	2778	4	3x3 Raster					Rock	
4	2778	4	3x3 Raster					Rock	
4	2778	4	3x3 Raster				No	Calibration Target	
4	2778	4	3x3 Raster					Calibration Target	
4	2778	4	3x3 Raster					Calibration Target	
4	2778	4	3x3 Raster					Calibration Target	
4	2778	4	3x3 Raster					Calibration Target	
4	2778	4	3x3 Raster					Calibration Target	
4	2778	4	3x3 Raster					Rock	
4	2778	4	3x3 Raster					Rock	
4	2778	4	3x3 Raster					Rock	
4	2778	4	3x3 Raster					Rock	
4	2778	4	3x3 Raster					Rock	
4	3232	6	1x5 Raster					Rock	

Raster type can sometimes be wrong—check number of files

Not all data are in PDS

1. Saturation
2. Low signal
3. Oxide totals >110%



# Master list

mslccm\_1xxx → document → **msl\_ccam\_obs.csv**

There will be additional columns in the Master list for data after sol 801. These fields will represent, Focal Plane number, Best Focus, and Flight Version.

# Getting Mars Level 1+2 data

When you know what you want

ChemCam LIBS and RMI RDR → mslccm\_1xxx → data

← → ↻ pds-geosciences.wustl.edu/msl/msl-m  
pds-geosciences.wustl.edu -

[\[To Parent Directory\]](#)

6/6/2013 11:24 AM	7556	<a href="#">aareadme.txt</a>
12/12/2013 10:56 AM	<dir>	<a href="#">browse</a>
6/7/2013 1:53 PM	<dir>	<a href="#">calib</a>
11/15/2013 2:48 PM	<dir>	<a href="#">catalog</a>
12/12/2013 11:01 AM	<dir>	<a href="#">data</a>
12/9/2013 3:00 PM	<dir>	<a href="#">document</a>
11/15/2013 4:06 PM	8425	<a href="#">errata.txt</a>
4/10/2013 10:00 AM	<dir>	<a href="#">extras</a>
11/15/2013 2:48 PM	<dir>	<a href="#">index</a>
3/27/2013 10:27 AM	1827	<a href="#">voldesc.cat</a>

pds-geosciences.wustl.edu - /  
v1/mslccm\_1xxx/data/

[\[To Parent Directory\]](#)

6/7/2013 1:53 PM	<dir>	<a href="#">sol00010</a>
6/7/2013 1:53 PM	<dir>	<a href="#">sol00012</a>
11/15/2013 2:52 PM	<dir>	<a href="#">sol00013</a>
11/15/2013 2:52 PM	<dir>	<a href="#">sol00014</a>
11/15/2013 2:52 PM	<dir>	<a href="#">sol00015</a>
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11/15/2013 2:53 PM	<dir>	<a href="#">sol00022</a>
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6/7/2013 1:53 PM	<dir>	<a href="#">sol00030</a>
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11/15/2013 2:52 PM	<dir>	<a href="#">sol00057</a>
11/15/2013 2:52 PM	<dir>	<a href="#">sol00059</a>

# Getting Mars Level 1+2 data

When you know what you want

pds-geosciences.wustl.edu - /msl/msl-m-chemo  
v1/mslccm\_1xxx/data/sol00050/

← →

pds-

[To Parent Directory] CCS = Level 1b (spectra) MOC = Level 2 (composition)

	5/17/2013	9:05 AM	3007106	<a href="#">cl5_401928245ccs_f0042778ccam01050p3.csv</a>
	7/31/2013	9:26 AM	27968	<a href="#">cl5_401928245ccs_f0042778ccam01050p3.lbl</a>
[To Pa	11/6/2013	4:47 PM	1502	<a href="#">cl5_401928245moc_f0042778ccam01050p3.csv</a>
	11/6/2013	4:47 PM	22841	<a href="#">cl5_401928245moc_f0042778ccam01050p3.lbl</a>
6/6/2	5/17/2013	9:05 AM	2242425	<a href="#">cl5_401928245rdr_f0042778ccam01050p3.csv</a>
12/12/2	7/31/2013	9:34 AM	28160	<a href="#">cl5_401928245rdr_f0042778ccam01050p3.lbl</a>
6/7/2	5/17/2013	9:05 AM	3006883	<a href="#">cl5_401928321ccs_f0042778ccam01050p3.csv</a>
11/15/2	7/31/2013	9:26 AM	28005	<a href="#">cl5_401928321ccs_f0042778ccam01050p3.lbl</a>
12/12/2	11/6/2013	4:47 PM	1502	<a href="#">cl5_401928321moc_f0042778ccam01050p3.csv</a>
12/9/2	11/6/2013	4:47 PM	22878	<a href="#">cl5_401928321moc_f0042778ccam01050p3.lbl</a>
11/15/2	5/17/2013	9:05 AM	2241335	<a href="#">cl5_401928321rdr_f0042778ccam01050p3.csv</a>
4/10/2	7/31/2013	9:34 AM	28197	<a href="#">cl5_401928321rdr_f0042778ccam01050p3.lbl</a>
11/15/2	5/17/2013	9:05 AM	3007278	<a href="#">cl5_401928397ccs_f0042778ccam01050p3.csv</a>
3/27/2	7/31/2013	9:26 AM	28003	<a href="#">cl5_401928397ccs_f0042778ccam01050p3.lbl</a>
	11/6/2013	4:47 PM	1505	<a href="#">cl5_401928397moc_f0042778ccam01050p3.csv</a>
	11/6/2013	4:47 PM	22876	<a href="#">cl5_401928397moc_f0042778ccam01050p3.lbl</a>
	5/17/2013	9:05 AM	2241783	<a href="#">cl5_401928397rdr_f0042778ccam01050p3.csv</a>
	7/31/2013	9:34 AM	28195	<a href="#">cl5_401928397rdr_f0042778ccam01050p3.lbl</a>
18 Ma	5/17/2013	9:05 AM	3007045	<a href="#">cl5_401928508ccs_f0042778ccam01050p3.csv</a>


11/15/2013 2:52 PM <dir> sol00057

11/15/2013 2:52 PM <dir> sol00059

# Getting all Mars Level 2 data

Concatenated PLS compositions

ChemCam LIBS and RMI RDR → mslccm\_1xxx → **extras**  
pds-geosciences.wustl.edu - /msl/m

← → ↻  pds-geosciences.wustl.edu/msl/msl-m

pds-geosciences.wustl.edu -

[\[To Parent Directory\]](#)

6/6/2013 11:24 AM	7556	<a href="#">aareadme.txt</a>
12/12/2013 10:56 AM	<dir>	<a href="#">browse</a>
6/7/2013 1:53 PM	<dir>	<a href="#">calib</a>
11/15/2013 2:48 PM	<dir>	<a href="#">catalog</a>
12/12/2013 11:01 AM	<dir>	<a href="#">data</a>
12/9/2013 3:00 PM	<dir>	<a href="#">document</a>
11/15/2013 4:06 PM	8425	<a href="#">errata.txt</a>
4/10/2013 10:00 AM	<dir>	<a href="#">extras</a>
11/15/2013 2:48 PM	<dir>	<a href="#">index</a>
3/27/2013 10:27 AM	1827	<a href="#">voldesc.cat</a>

[\[To Parent Directory\]](#)

4/10/2013 2:54 PM	754771	<a href="#">dn2engunits_lut.pdf</a>
7/16/2014 4:12 PM	660	<a href="#">extrinfo.txt</a>
6/26/2014 12:50 PM	32078	<a href="#">moc_0000_0089.csv</a>
6/26/2014 12:50 PM	7683	<a href="#">moc_0000_0089.lbl</a>
6/26/2014 12:50 PM	61579	<a href="#">moc_0090_0179.csv</a>
6/26/2014 12:50 PM	7683	<a href="#">moc_0090_0179.lbl</a>
6/26/2014 12:50 PM	30290	<a href="#">moc_0180_0269.csv</a>
6/26/2014 12:50 PM	7683	<a href="#">moc_0180_0269.lbl</a>
6/26/2014 12:50 PM	84886	<a href="#">moc_0270_0359.csv</a>
6/26/2014 12:50 PM	7683	<a href="#">moc_0270_0359.lbl</a>
6/26/2014 12:50 PM	65353	<a href="#">moc_0360_0449.csv</a>
6/26/2014 12:50 PM	7683	<a href="#">moc_0360_0449.lbl</a>
6/26/2014 12:50 PM	57480	<a href="#">moc_0450_0583.csv</a>
6/26/2014 12:50 PM	7683	<a href="#">moc_0450_0583.lbl</a>
10/30/2014 10:33 AM	104233	<a href="#">moc_0584_0707.csv</a>
10/30/2014 10:33 AM	7685	<a href="#">moc_0584_0707.lbl</a>


Table of location-averaged PLS compositions  
(typically averages of 30 shots)

(Future: Also single-shot PLS compositions)

# Getting Mars quicklooks

When you DON'T know what you want

ChemCam LIBS and RMI RDR → mslccm\_1xxx → **browse**

← → ↻  pds-geosciences.wustl.edu/msl/msl-m

pds-geosciences.wustl.edu -

[\[To Parent Directory\]](#)

6/6/2013 11:24 AM	7556	<a href="#">aareadme.txt</a>
12/12/2013 10:56 AM	<dir>	<a href="#">browse</a>
6/7/2013 1:53 PM	<dir>	<a href="#">calib</a>
11/15/2013 2:48 PM	<dir>	<a href="#">catalog</a>
12/12/2013 11:01 AM	<dir>	<a href="#">data</a>
12/9/2013 3:00 PM	<dir>	<a href="#">document</a>
11/15/2013 4:06 PM	8425	<a href="#">errata.txt</a>
4/10/2013 10:00 AM	<dir>	<a href="#">extras</a>
11/15/2013 2:48 PM	<dir>	<a href="#">index</a>
3/27/2013 10:27 AM	1827	<a href="#">voldesc.cat</a>

pds-geosciences.wustl.edu -  
v1/mslccm\_1xxx/browse/

[\[To Parent Directory\]](#)

3/27/2013 10:25 AM	2353	<a href="#">browinfo.txt</a>
6/7/2013 1:51 PM	<dir>	<a href="#">sol00010</a>
6/7/2013 1:51 PM	<dir>	<a href="#">sol00012</a>
11/15/2013 2:50 PM	<dir>	<a href="#">sol00013</a>
11/15/2013 2:49 PM	<dir>	<a href="#">sol00014</a>
11/15/2013 2:49 PM	<dir>	<a href="#">sol00015</a>
11/15/2013 2:50 PM	<dir>	<a href="#">sol00019</a>
11/15/2013 2:50 PM	<dir>	<a href="#">sol00022</a>
11/15/2013 2:50 PM	<dir>	<a href="#">sol00027</a>
6/7/2013 1:51 PM	<dir>	<a href="#">sol00030</a>
11/15/2013 2:49 PM	<dir>	<a href="#">sol00032</a>
11/15/2013 2:50 PM	<dir>	<a href="#">sol00033</a>
6/7/2013 1:51 PM	<dir>	<a href="#">sol00034</a>
11/15/2013 2:51 PM	<dir>	<a href="#">sol00040</a>
11/15/2013 2:49 PM	<dir>	<a href="#">sol00043</a>
11/15/2013 2:49 PM	<dir>	<a href="#">sol00045</a>
6/7/2013 1:51 PM	<dir>	<a href="#">sol00046</a>
6/7/2013 1:51 PM	<dir>	<a href="#">sol00047</a>
11/15/2013 2:50 PM	<dir>	<a href="#">sol00048</a>
11/15/2013 2:48 PM	<dir>	<a href="#">sol00049</a>
11/15/2013 2:49 PM	<dir>	<a href="#">sol00050</a>
11/15/2013 2:49 PM	<dir>	<a href="#">sol00055</a>
11/15/2013 2:48 PM	<dir>	<a href="#">sol00056</a>



# Getting Mars quicklooks

When you DON'T know what you want

Ch pds-geosciences.wustl.edu - /msl/msl-m-chem v1/mslccm\_1xxx/browse/sol00050/ se

← → ↻

pds-ge

[To Parent Directory]

libs1 = averaged spectrum  
libs2 = line density plot  
rmi = image quicklook

11/6/2013	4:18 PM	236131	<a href="#">gchemcam_00050_libs1_401928245.jpg</a>		
11/6/2013	4:18 PM	1858	<a href="#">gchemcam_00050_libs1_401928245.lbl</a>		
11/6/2013	4:18 PM	236676	<a href="#">gchemcam_00050_libs1_401928321.jpg</a>		
11/6/2013	4:18 PM	1858	<a href="#">gchemcam_00050_libs1_401928321.lbl</a>	<a href="#">rowinfo.txt</a>	
11/6/2013	4:18 PM	235140	<a href="#">gchemcam_00050_libs1_401928397.jpg</a>	<a href="#">00010</a>	
11/6/2013	4:18 PM	1858	<a href="#">gchemcam_00050_libs1_401928397.lbl</a>	<a href="#">00012</a>	
6/6/2013	11/6/2013	4:18 PM	236793	<a href="#">gchemcam_00050_libs1_401928508.jpg</a>	<a href="#">00013</a>
12/12/2013	11/6/2013	4:18 PM	1858	<a href="#">gchemcam_00050_libs1_401928508.lbl</a>	<a href="#">00014</a>
6/7/2013	11/6/2013	4:18 PM	235815	<a href="#">gchemcam_00050_libs1_401928583.jpg</a>	<a href="#">00015</a>
11/15/2013	11/6/2013	4:18 PM	1858	<a href="#">gchemcam_00050_libs1_401928583.lbl</a>	<a href="#">00019</a>
12/12/2013	11/6/2013	4:18 PM	234071	<a href="#">gchemcam_00050_libs1_401928872.jpg</a>	<a href="#">00022</a>
12/9/2013	11/6/2013	4:18 PM	1858	<a href="#">gchemcam_00050_libs1_401928872.lbl</a>	<a href="#">00027</a>
11/15/2013	11/6/2013	4:18 PM	235776	<a href="#">gchemcam_00050_libs1_401928761.jpg</a>	<a href="#">00030</a>
4/10/2013	11/6/2013	4:18 PM	1858	<a href="#">gchemcam_00050_libs1_401928761.lbl</a>	<a href="#">00032</a>
11/15/2013	11/6/2013	4:18 PM	234071	<a href="#">gchemcam_00050_libs1_401928872.jpg</a>	<a href="#">00033</a>
3/27/2013	11/6/2013	4:18 PM	1858	<a href="#">gchemcam_00050_libs1_401928872.lbl</a>	<a href="#">00034</a>
	11/6/2013	4:18 PM	235947	<a href="#">gchemcam_00050_libs1_401928948.jpg</a>	<a href="#">00040</a>
	11/6/2013	4:18 PM	1858	<a href="#">gchemcam_00050_libs1_401928948.lbl</a>	<a href="#">00043</a>
	11/6/2013	4:18 PM	235449	<a href="#">gchemcam_00050_libs1_401929025.jpg</a>	<a href="#">00045</a>
	11/6/2013	4:18 PM	1858	<a href="#">gchemcam_00050_libs1_401929025.lbl</a>	<a href="#">00046</a>
	11/6/2013	4:18 PM	353423	<a href="#">gchemcam_00050_libs2_401928245.jpg</a>	<a href="#">00047</a>
	11/6/2013	4:18 PM	1858	<a href="#">gchemcam_00050_libs2_401928245.lbl</a>	<a href="#">00048</a>
	11/6/2013	4:18 PM	344743	<a href="#">gchemcam_00050_libs2_401928321.jpg</a>	<a href="#">00049</a>
	11/6/2013	4:18 PM	1858	<a href="#">gchemcam_00050_libs2_401928321.lbl</a>	<a href="#">00050</a>

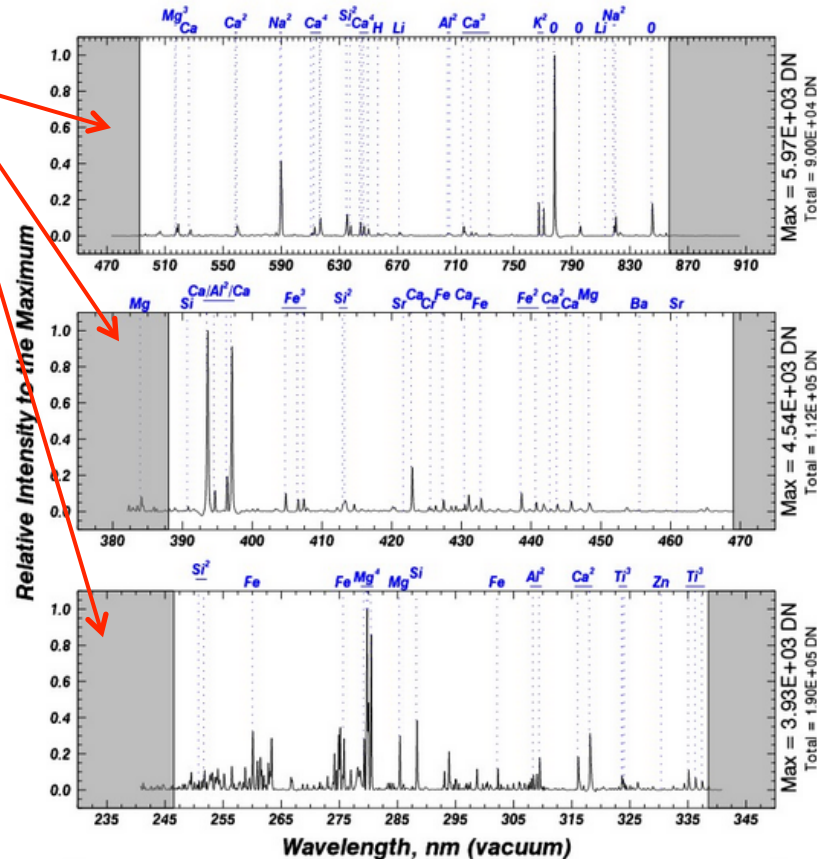
18 Mar 2013

11/15/2013 2:49 PM <dir> sol00055  
11/15/2013 2:48 PM <dir> sol00056


# LIBS1 quicklook

## Averaged spectrum

Average spectrum of all shots (1 location)

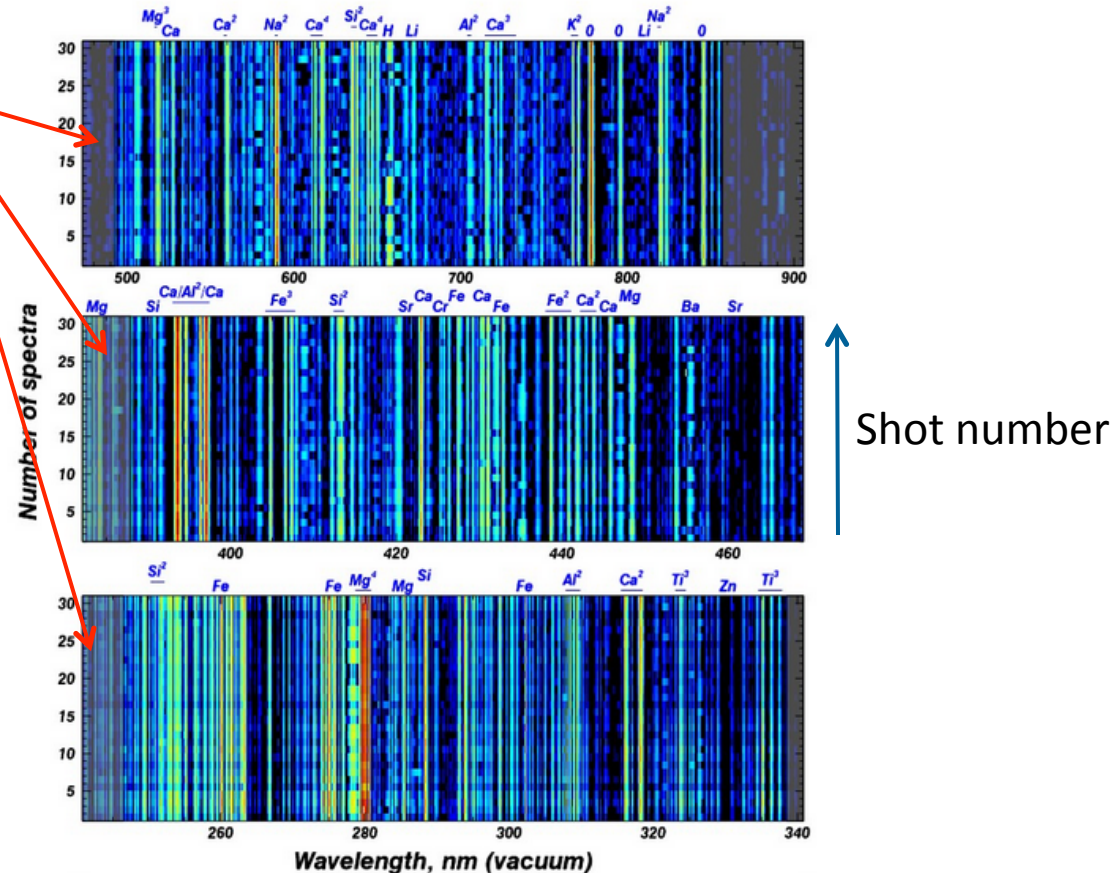


Information about target, sol, number of shots, processing

ChemCam LIBS Quicklook		<input type="checkbox"/> Sanity Check <input type="checkbox"/> Dark subtraction <input checked="" type="checkbox"/> Average <input checked="" type="checkbox"/> Denoise removal <input checked="" type="checkbox"/> Continuum subst. <input type="checkbox"/> Transmission <input checked="" type="checkbox"/> Wave calibration <input type="checkbox"/> Resampling <small>Wave calib: from Sol 00027</small>	
Generated: Fri Aug 9 09:38:59 2013 QChemCam_00050_LIBS1_401928245 <small>(from: CL5_401908245E0F1_F0042790CCAM01050M1.DAT)</small>			
Target: Akaitcho Sol: 00050 LTST: 12:17:48 scik: 401928245 SeqID: ccam01050	Distance: 2.66m # shots: 30 Laser IF T: -25.7 C Spec. B T: -16.2 C Rovmot. #: (4.2778.4)		
<small>NASA/JPL-Caltech/LANL/IRAP - <a href="http://www.msl-chemcam.com">http://www.msl-chemcam.com</a></small>			

# LIBS2 quicklook

## Line density plot



Change in line  
throughout all shots  
(1 location)

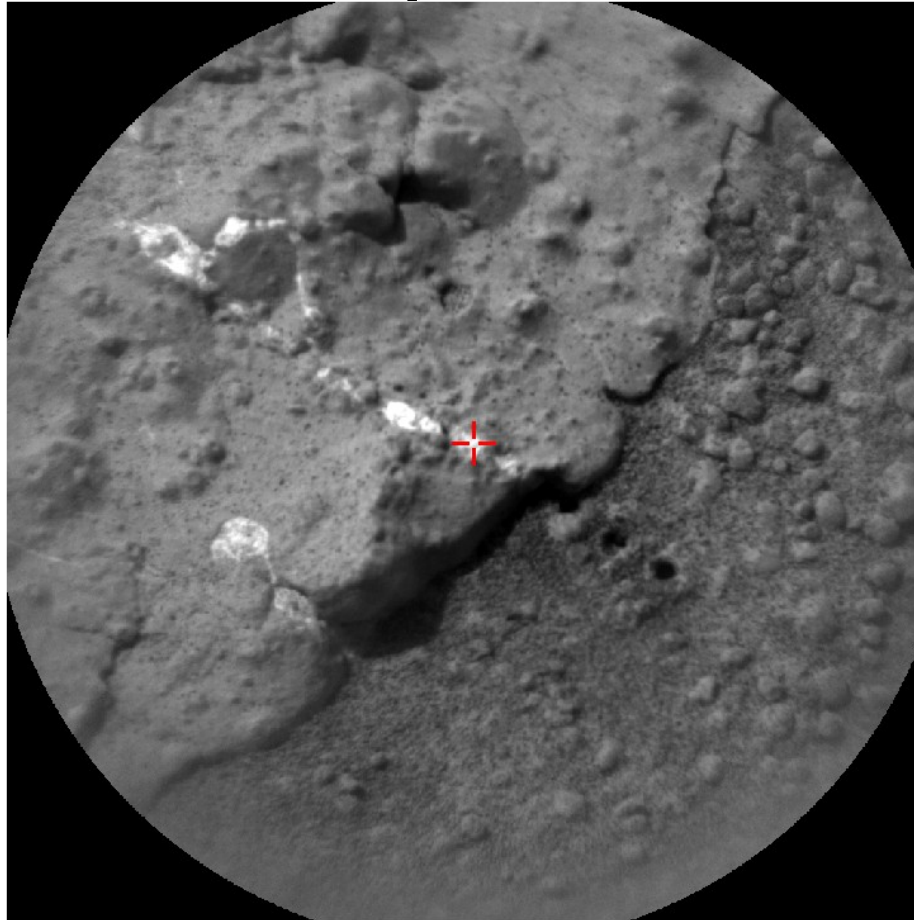
Warm = Strong signal  
Cool = Weak signal

Information about  
target, sol, number of  
shots, processing

ChemCam LIBS Quicklook		<input type="checkbox"/> Sanity Check <input type="checkbox"/> Dark subtraction <input checked="" type="checkbox"/> Average <input checked="" type="checkbox"/> Denoise removal <input type="checkbox"/> Continuum subst. <input type="checkbox"/> Transmission <input checked="" type="checkbox"/> Wave calibration <input type="checkbox"/> Resampling <small>Wave calib: from Sol: 00027</small>	
Generated: Fri Aug 9 09:39:58 2013 QChemCam_00050_LIBS2_401928245 <small>(from: CL5_401928245EDR_F004279CCAM01050M1.DAT)</small>			
Target: Akaitcho	Distance: 2.66m		
Sol: 00050	# shots: 30		
LTST: 12:17:48	Laser IF T: -25.7 C		
scik: 401928245	Spec. B T: -16.2 C		
SeqID: ccam01050	Rovmot. #: (4,2778,4)		

NASA/JPL-Caltech/LANL/IRAP - <http://www.msl-chemcam.com>

# RMI quicklook



Scale (image width, cm): 4.7  
 + co-aligned LIBS laser position

Information about target, sol, exposure, processing

<b>ChemCam RMI Quicklook</b> Generated: Tue Feb 24 23:40:56 2015 QChemCam_00187_RMI_414093565 <small>(from: CR0_414093565EDR_F0060000CCAM02187M1.IMG)</small>		<input checked="" type="checkbox"/> Linearity correction <input checked="" type="checkbox"/> Dark subtraction <input checked="" type="checkbox"/> Smearing correction <input type="checkbox"/> Ghost removal <input checked="" type="checkbox"/> Flat field correction (FLIGHT32) <input checked="" type="checkbox"/> Bad pixels process. <input checked="" type="checkbox"/> Mask applied <input checked="" type="checkbox"/> Contrast enhancement	
Target: seward_1 Sol: 187 LTST: 12:24:02 solk: 414093565 SeqID: ccam02187	Distance, m: 2,311 Tel. temp, °C: -20.7 Exposure, ms: 13 Rov.mot. #: (6,0,2)		
<small>NASA/JPL-Caltech/LANL/IRAP/IAS - <a href="http://www.rmi-chemcam.com">http://www.rmi-chemcam.com</a></small>			



# Getting LIBS lab calibration data

ChemCam LIBS and RMI RDR → mslccm\_1xxx → **calib**

```
← → ↻ pds-geosciences.wustl.edu/msl/msl-m
pds-geosciences.wustl.edu -
[To Parent Directory]
6/6/2013 11:24 AM 7556 aareadme.txt
12/12/2013 10:56 AM <dir> browse
6/7/2013 1:53 PM <dir> calib
11/15/2013 2:48 PM <dir> catalog
12/12/2013 11:01 AM <dir> data
12/9/2013 3:00 PM <dir> document
11/15/2013 4:06 PM 8425 errata.txt
4/10/2013 10:00 AM <dir> extras
11/15/2013 2:48 PM <dir> index
3/27/2013 10:27 AM 1827 voldesc.cat
```

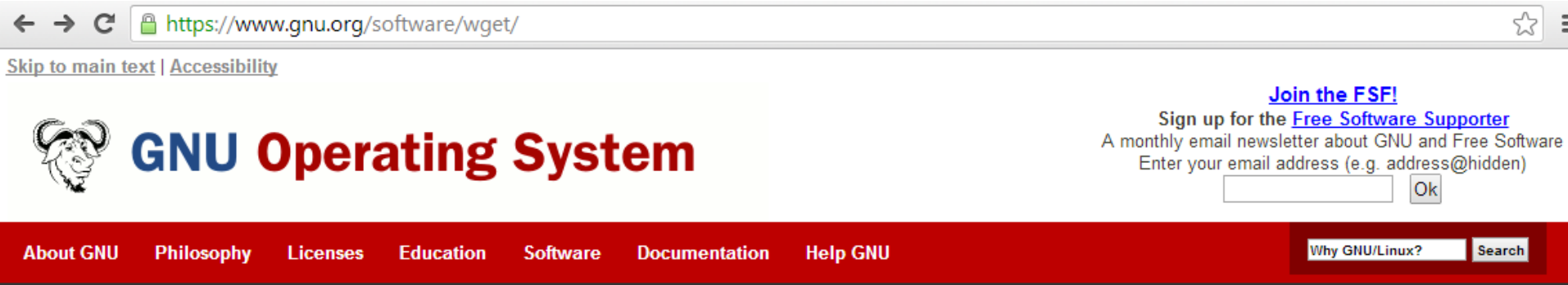
pds-geosciences.wustl.edu - /msl/m  
v1/mslccm\_1xxx/calib/

```
[To Parent Directory]
5/16/2013 2:43 PM 2191 calinfo.txt
6/7/2013 1:53 PM <dir> cleanroom
3/27/2013 10:25 AM 14655054 msl\_ccam\_libs\_calib.csv
4/11/2013 9:00 AM 2952 msl\_ccam\_libs\_calib.tbl
```

1. *msl\_ccam\_libs\_calib.csv*: Averaged and concatenated calibration standards data (all).
2. *Cleanroom (folder)*: Single-shot calibration standards data (all). See Wiens et al. (2013) for details on standards.

# Bulk data downloads

- Can download one file at a time by hand
- For bulk downloads, must use script or software
  - **Wget**: <https://www.gnu.org/software/wget/>



The screenshot shows a web browser window with the address bar containing <https://www.gnu.org/software/wget/>. Below the address bar is a navigation bar with links: [Skip to main text](#) | [Accessibility](#). The main content area features the GNU logo (a ram's head) and the text "GNU Operating System" in large, bold letters. To the right, there is a sign-up form for the "Free Software Supporter" newsletter, with the text "Join the FSF! Sign up for the Free Software Supporter A monthly email newsletter about GNU and Free Software Enter your email address (e.g. address@hidden)" and an "Ok" button. At the bottom, a red navigation bar contains links: [About GNU](#), [Philosophy](#), [Licenses](#), [Education](#), [Software](#), [Documentation](#), and [Help GNU](#). On the right side of this bar is a search box with the text "Why GNU/Linux?" and a "Search" button.

## GNU Wget

### Introduction to GNU Wget

GNU Wget is a [free software](#) package for retrieving files using HTTP, HTTPS and FTP, the most widely-used Internet protocols. It is a non-interactive commandline tool, so it may easily be called from scripts, cron jobs, terminals without X-Windows support, etc.

GNU Wget has many features to make retrieving large files or mirroring entire web or FTP sites easy, including:

- Can resume aborted downloads, using `REST` and `RANGE`

# Bulk data downloads

## Example of wget command:

- Available on most platforms but some what messy to get multiple files.
- Command would look like:

```
wget -e robots=off -r -np -nH --cut-dirs=3 -l 7 -Acsv -I [directory list csv] URL
```

```
wget -e robots=off -r -np -nH --cut-dirs=3 -l 7 -Acsv -I msl/msl-m-chemcam-libs-4_5-rdr-v1/mslccm_1xxx/data/sol00014,msl/msl-m-chemcam-libs-4_5-rdr-v1/mslccm_1xxx/data/sol00015,msl/msl-m-chemcam-libs-4_5-rdr-v1/mslccm_1xxx/data/sol00040 http://pds-geosciences.wustl.edu/msl/msl-m-chemcam-libs-4_5-rdr-v1/mslccm_1xxx/data/
```

# Bulk data downloads

- **lftp**:<http://olex.openlogic.com/packages/lftp>
- Windows version is included in cygwin package

## Example lftp command: (to mirror data)

**lftp** [-e cmds] site

➤ cmds :

➤ mirror [OPTS] [source [target]]

opts: -l “.csv\$”                    include matching files

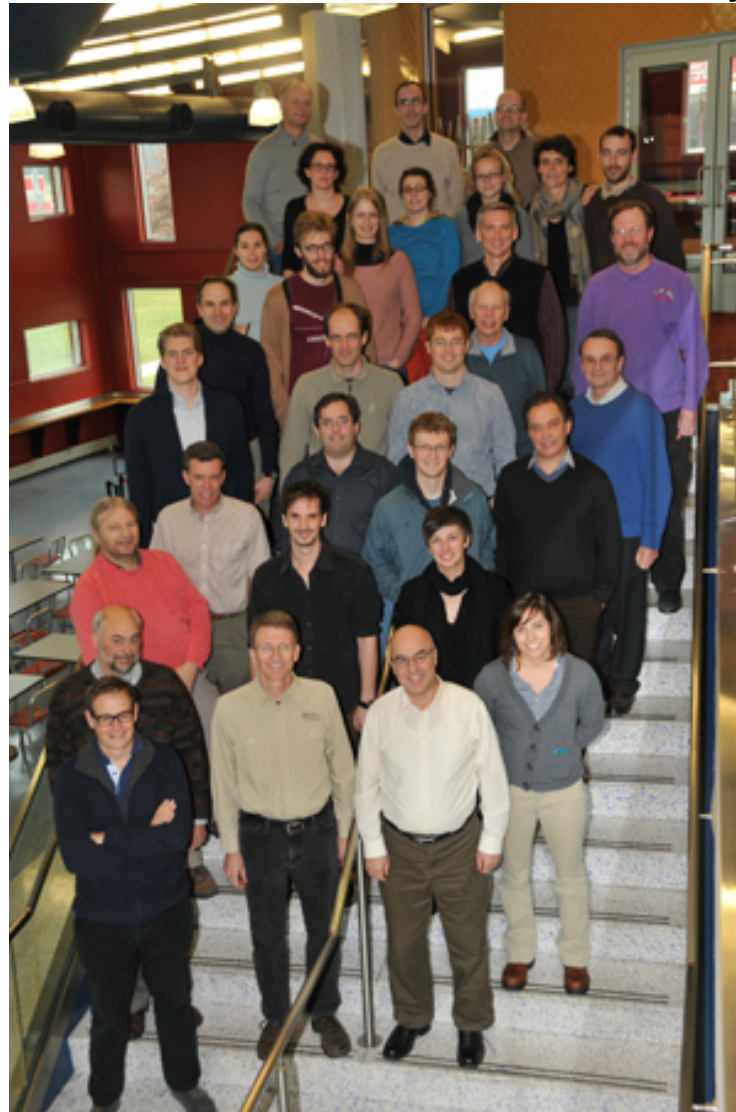
➤ Site: [pds-geosciences.wustl.edu](http://pds-geosciences.wustl.edu)

```
lftp -e 'mirror -l “.csv$” msl/msl-m-chemcam-libs-4_5-rdr-  
v1/mslccm_1xxx/data/ mydata/'
```



# Questions? Ask us!

ChemCam team members are happy to help



# Additional information

## Getting and using raw ChemCam data

# Getting and using raw data from PDS

<http://pds-geosciences.wustl.edu/missions/msl/chemcam.htm>

geosciences.wustl.edu/missions/msl/chemcam.htm

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  
Virtual Astronaut  
Orbital Data Explorers  
Spectral Library  
FTP Access  
Workshops

**Geosciences Node Data**

Mars

- Mars Exploration
- MSL
  - About MSL
  - APXS
  - ChemCam**
  - CheMin
  - DAN
  - SAM
- Phoenix
- MRO
- MER
- Mars Express
- Odyssey
- MGS
- Pathfinder
- Prototype Rovers
- Viking Orbiter
- Viking Lander
- Earth Based Data

Venus  
Mercury  
Moon  
Earth  
Asteroids  
Gravity Models  
All Geosciences Data Holdings

**MSL: ChemCam**

December 13, 2013. MSL Release 4 includes new ChemCam raw (EDR) and derived (RDR) data from sols 270 through 359, along with revised versions of ChemCam LIBS MOC derived products for sols 13 through 234. Browse images for sols 13 through 176 and 192 have been updated. See [ERRATA.TXT](#) for details.

ChemCam combines the LIBS (Laser Induced Breakdown Spectrometer) and the RMI (Remote Micro-Imager) to analyze the elemental composition of laser-vaporized materials from the surface of Martian rocks and soils. ChemCam data sets are produced by the ChemCam team at Los Alamos National Laboratory and the Centre National D'Etudes Spatiales (CESR), Toulouse, France.

**ChemCam Data Sets**

- Raw Data Products**
  - ChemCam LIBS, RMI, and State-of-Health EDR (Experiment Data Records)**
- Derived Data Products**
  - ChemCam LIBS and RMI RDR (Reduced Data Records)

**Online Tools**

- MSL Analyst's Notebook** - This PDS Geosciences Node tool provides access to MSL data in the context of mission operations -- by sol, location, instrument, and other criteria.

**Related Information**

**PDS Catalog Files**

- ChemCam LIBS EDR (Raw) Data Set Description
- ChemCam RMI EDR (Raw) Data Set Description

Raw data available here

# Main menu for raw data

ChemCam LIBS, RMI, and State of Health EDR → **msslccm\_0xxx**

← → ↻

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## pds-geosciences.wustl.edu - /mssl/mssl-m-chemcam-lil

---

[\[To Parent Directory\]](#)

5/15/2013 10:04 AM	10324	<a href="#">aareadme.txt</a>	<b>aareadme:</b> File structure
6/7/2013 2:23 PM	<dir>	<a href="#">calib</a>	<b>calib:</b> Raw lab calibration data
8/28/2013 2:00 PM	<dir>	<a href="#">catalog</a>	
12/12/2013 11:29 AM	<dir>	<a href="#">data</a>	<b>data:</b> Raw Mars data
12/2/2013 5:05 PM	<dir>	<a href="#">document</a>	
12/5/2013 12:24 PM	8814	<a href="#">errata.txt</a>	
12/9/2013 11:46 AM	<dir>	<a href="#">extras</a>	
12/2/2013 4:34 PM	<dir>	<a href="#">index</a>	
11/25/2013 2:45 PM	<dir>	<a href="#">label</a>	
2/13/2013 10:00 AM	2488	<a href="#">voldesc.cat</a>	

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# Getting Mars raw data

When you know what you want

**pds-geosciences.wustl.edu - /m  
v1/mslccm\_0xxx/data/**

← → ↻ 📄 pds-geosciences.wustl.edu/msl/msl-m-cher

**pds-geosciences.wustl.edu - /m**

[\[To Parent Directory\]](#)

5/15/2013 10:04 AM	10324	<a href="#">aareadme.txt</a>
6/7/2013 2:23 PM	<dir>	<a href="#">calib</a>
8/28/2013 2:00 PM	<dir>	<a href="#">catalog</a>
12/12/2013 11:29 AM	<dir>	<a href="#">data</a>
12/2/2013 5:05 PM	<dir>	<a href="#">document</a>
12/5/2013 12:24 PM	8814	<a href="#">errata.txt</a>
12/9/2013 11:46 AM	<dir>	<a href="#">extras</a>
12/2/2013 4:34 PM	<dir>	<a href="#">index</a>
11/25/2013 2:45 PM	<dir>	<a href="#">label</a>
2/13/2013 10:00 AM	2488	<a href="#">voldesc.cat</a>

[\[To Parent Directory\]](#)

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6/7/2013 2:24 PM	<dir>	<a href="#">sol00010</a>
6/7/2013 2:24 PM	<dir>	<a href="#">sol00012</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00013</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00014</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00015</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00019</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00022</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00027</a>
6/7/2013 2:24 PM	<dir>	<a href="#">sol00030</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00032</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00033</a>
6/7/2013 2:24 PM	<dir>	<a href="#">sol00034</a>
6/7/2013 2:24 PM	<dir>	<a href="#">sol00036</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00040</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00043</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00045</a>
6/7/2013 2:24 PM	<dir>	<a href="#">sol00046</a>
6/7/2013 2:24 PM	<dir>	<a href="#">sol00047</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00048</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00049</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00050</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00055</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00056</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00057</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00059</a>
8/28/2013 2:00 PM	<dir>	<a href="#">sol00061</a>



# pds-geosciences.wustl.edu - /msl/msl-m-chemcam-libs v1/mslccm\_0xxx/data/sol00033/

[\[To Parent Directory\]](#)

**edr = experiment data record**

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5/15/2013 10:15 AM	12336	<a href="#">cc0_400420271epw_f0040000ccam00033m1.dat</a>
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.dat files  
(binary file)

.lbl file of same  
name  
describes .dat

# WARNING

## Things to keep in mind when using raw data

VNIR	VIO	UV
474.0-906.5 nm	382.1-469.3 nm	240.1-342.2 nm

- Spectrometer order for raw LIBS data (CL5) is VNIR, VIO, UV → must be **reordered**
- Spectral data is pixel-ordered → **NOT** in wavelength
- 50 blind pixels on either side of each spectrometer range → must be removed
- Header info:
  - Motor position, spectrometer temperature data available
  - Description of header info (format files) found in **Label** directory in main menu (see slide 24)