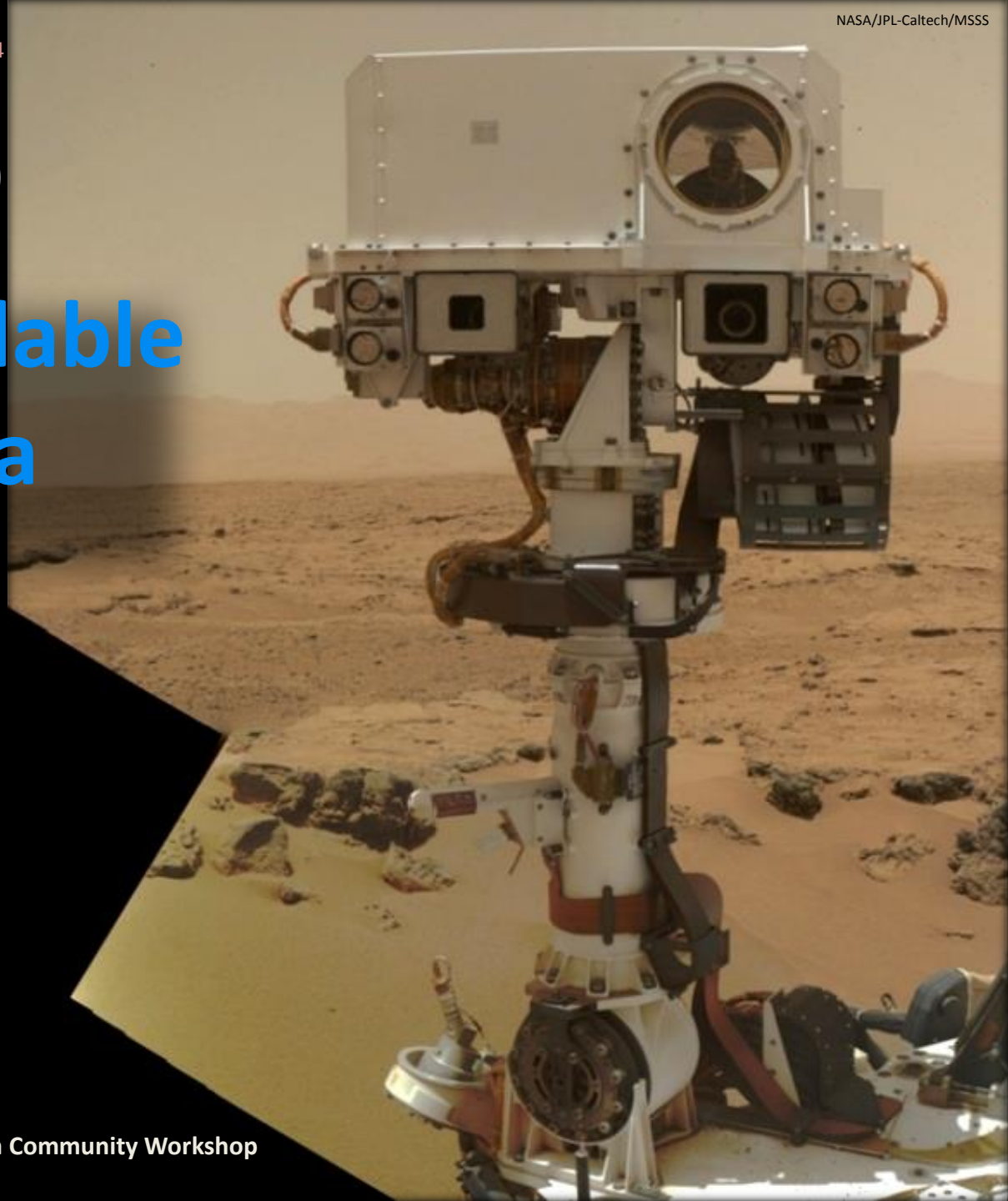


Lunar and Planetary Science Conference, March 16th, 2014

COMMUNITY USER WORKSHOP
ON PLANETARY LIBS (CHEMCAM)
DATA

Currently available ChemCam data (and how to find it)

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



Main ChemCam data products

Up to sol 449 on March 17 (tomorrow!)

- **LIBS**

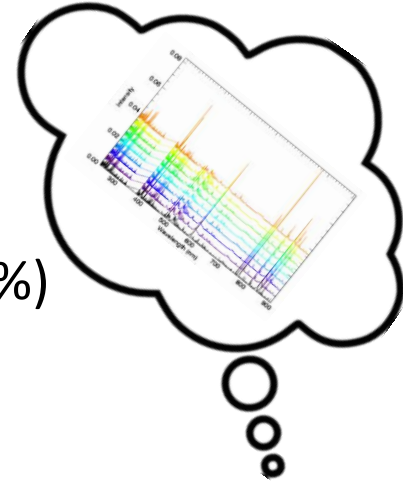
- Spectral data (raw and processed)
 - Includes passive spectra (darks)
- Element quantification (PLS oxide weight %)
- Coming soon: Spectral similarity (ICA)

- **RMI**

- Image data (raw and processed)
 - Standalone RMIs
 - Z-stack (3D info)
- Coming soon: RMI mosaics

- **LIBS calibration data**

- Laboratory spectral data



Raster types

msl-chemcam.com → Results (2nd tab) → ChemCam - Results

- 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)

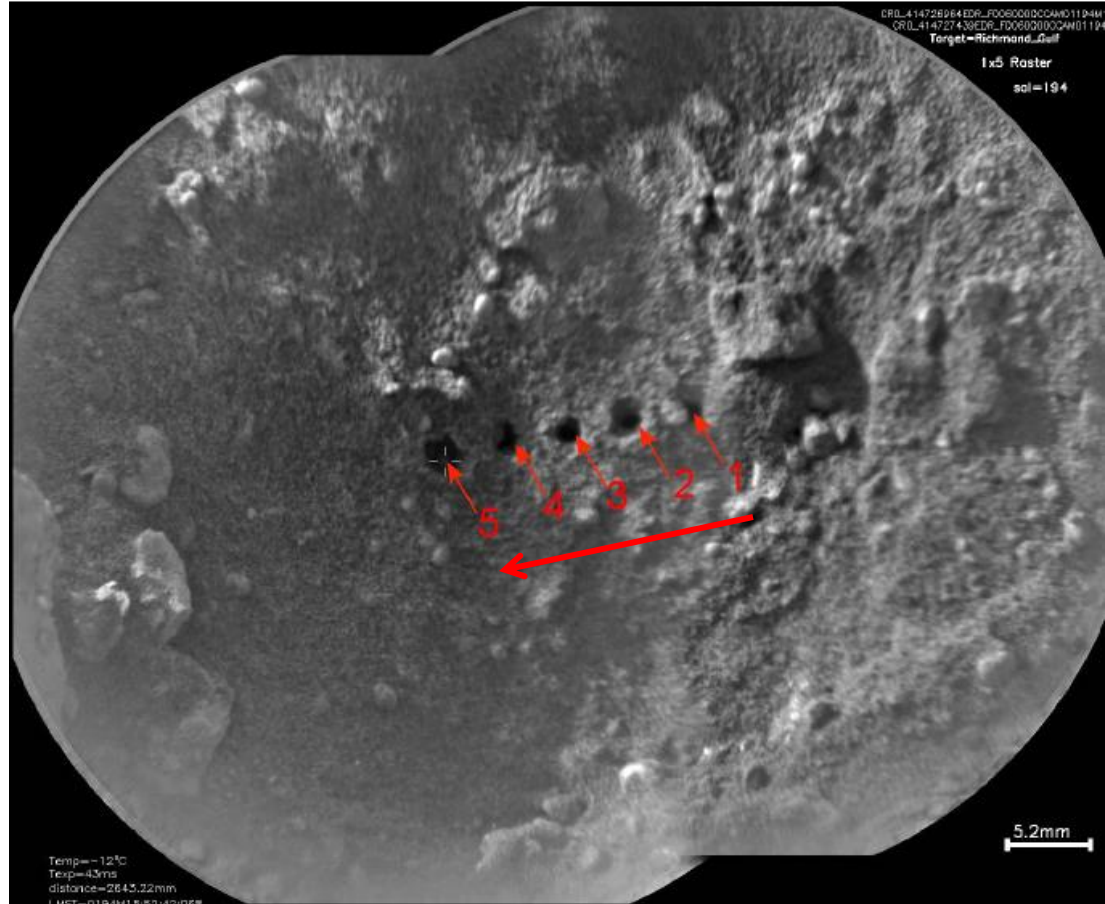


Richmond Gulf, sol 194

Raster types

msl-chemcam.com → Results (2nd tab) → ChemCam - Results

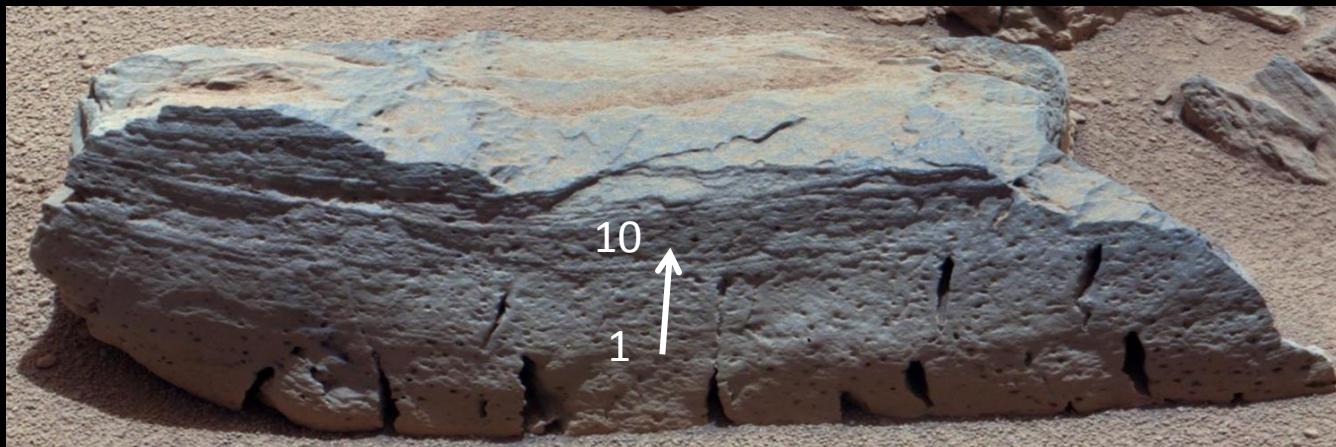
- Single location
- Line
 - Horizontal, vertical, diagonal
 - 5x1, 1x10, etc.
- Square
 - 3x3, 5x5, etc.
- Right → Left
Down → Up
 - File name order (sclock)
- Typically 30 LIBS shots per location
 - 30 individual spectra
 - Depth profile (>50 shots)



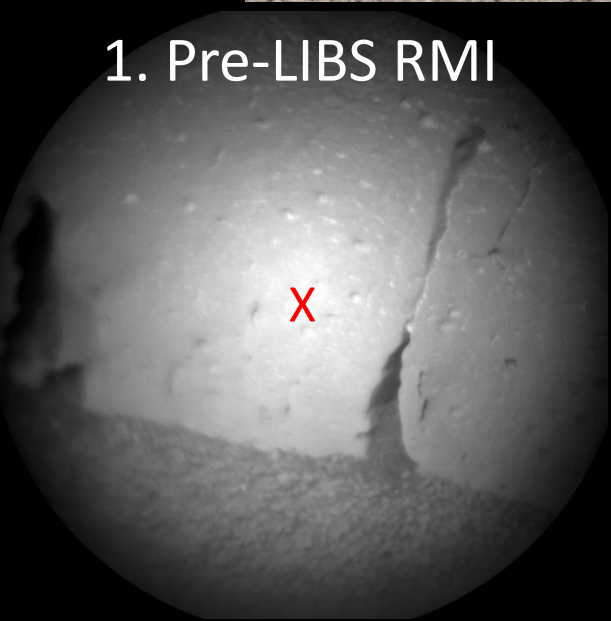
Richmond Gulf, sol 194

A typical CCAM sequence

Ex: Rocknest3 1x10 (sol 83)



1. Pre-LIBS RMI



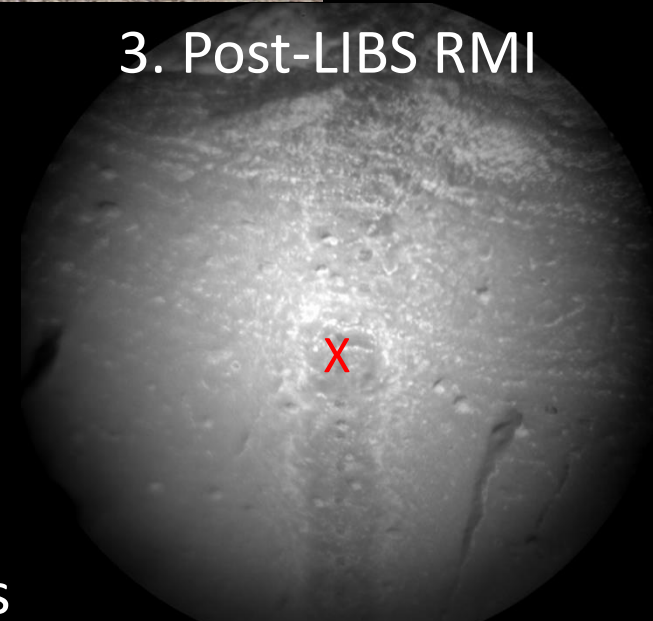
2. (LIBS, dark) x 10

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

Data products:

10 LIBS, 10 darks, 2 RMIs

3. Post-LIBS RMI



Data labeling

CL5_414268531CCS_F0060000CCAM01189P3.csv

The diagram shows the file name 'CL5_414268531CCS_F0060000CCAM01189P3.csv' with brackets and numbers 1 through 7 below it, indicating the structure of the file name. The brackets are positioned as follows: 1 under 'CL5', 2 under '414268531', 3 under 'CCS', 4 under 'F0060000', 5 under 'CCAM01189', 6 under 'P3', and 7 under '.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 P3 when available → latest (P1 = auto, P2 = PDL analysis)
7. File type

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**
 - 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

Most people will just want the processed data

But raw data are also available

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-r

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

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

Master list

	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**

Site	V RMC Drive	W RMC POS	X Type of Obs	Y Comment spec	AC Heterogen	AD PDS?	AE Target Type	AF
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			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	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%

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	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 - /
v1/mslccm_1xxx/data/

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

6/7/2013 1:53 PM	<dir>	sol00010
6/7/2013 1:53 PM	<dir>	sol00012
11/15/2013 2:52 PM	<dir>	sol00013
11/15/2013 2:52 PM	<dir>	sol00014
11/15/2013 2:52 PM	<dir>	sol00015
11/15/2013 2:53 PM	<dir>	sol00019
11/15/2013 2:53 PM	<dir>	sol00022
11/15/2013 2:53 PM	<dir>	sol00027
6/7/2013 1:53 PM	<dir>	sol00030
11/15/2013 2:52 PM	<dir>	sol00032
11/15/2013 2:53 PM	<dir>	sol00033
6/7/2013 1:53 PM	<dir>	sol00034
6/7/2013 1:53 PM	<dir>	sol00040
11/15/2013 2:52 PM	<dir>	sol00043
11/15/2013 2:52 PM	<dir>	sol00045
6/7/2013 1:53 PM	<dir>	sol00047
11/15/2013 2:53 PM	<dir>	sol00048
11/15/2013 2:51 PM	<dir>	sol00049
11/15/2013 2:52 PM	<dir>	sol00050
11/15/2013 2:51 PM	<dir>	sol00055
6/7/2013 1:53 PM	<dir>	sol00056
11/15/2013 2:52 PM	<dir>	sol00057
11/15/2013 2:52 PM	<dir>	sol00059

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	c15_401928243ccs_f0042778ccam01050p3.csv	
7/31/2013	9:26 AM	27968	c15_401928245ccs_f0042778ccam01050p3.lbl	
[To Pa	11/6/2013	4:47 PM	1502	c15_401928245moc_f0042778ccam01050p3.csv
	11/6/2013	4:47 PM	22841	c15_401928245moc_f0042778ccam01050p3.lbl
6/6/2	5/17/2013	9:05 AM	2242425	c15_401928245rdr_f0042778ccam01050p3.csv
12/12/2	7/31/2013	9:34 AM	28160	c15_401928245rdr_f0042778ccam01050p3.lbl
6/7/2	5/17/2013	9:05 AM	3006883	c15_401928321ccs_f0042778ccam01050p3.csv
11/15/2	7/31/2013	9:26 AM	28005	c15_401928321ccs_f0042778ccam01050p3.lbl
12/12/2	11/6/2013	4:47 PM	1502	c15_401928321moc_f0042778ccam01050p3.csv
12/9/2	11/6/2013	4:47 PM	22878	c15_401928321moc_f0042778ccam01050p3.lbl
11/15/2	5/17/2013	9:05 AM	2241335	c15_401928321rdr_f0042778ccam01050p3.csv
4/10/2	7/31/2013	9:34 AM	28197	c15_401928321rdr_f0042778ccam01050p3.lbl
11/15/2	5/17/2013	9:05 AM	3007278	c15_401928397ccs_f0042778ccam01050p3.csv
3/27/2	7/31/2013	9:26 AM	28003	c15_401928397ccs_f0042778ccam01050p3.lbl
	11/6/2013	4:47 PM	1505	c15_401928397moc_f0042778ccam01050p3.csv
	11/6/2013	4:47 PM	22876	c15_401928397moc_f0042778ccam01050p3.lbl
	5/17/2013	9:05 AM	2241783	c15_401928397rdr_f0042778ccam01050p3.csv
	7/31/2013	9:34 AM	28195	c15_401928397rdr_f0042778ccam01050p3.lbl
16 Ma	5/17/2013	9:05 AM	3007045	c15_401928508ccs_f0042778ccam01050p3.csv

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

11/15/2013 2:52 PM <dir> sol00058

Getting all Mars Level 2 data

Concatenated PLS compositions

ChemCam LIBS and RMI RDR → mslccm_1xxx → **extras**

← → ↻

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
v1/mslccm_1xxx/extras/**

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

4/10/2013 1:54 PM	754771	dn2engunits_lut.pdf
3/27/2013 10:27 AM	520	extrinfo.txt

Currently **NOT** in there! In the future, will include:

1. Location-averaged PLS compositions
2. Single-shot PLS compositions

In the meantime, email us to get the table.

Getting Mars quicklooks

When you DON'T know what you want

ChemCam LIBS and RMI RDR → mslccm_1xxx → **browse**

← → ↻

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 -
v1/mslccm_1xxx/browse/

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

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

Getting Mars quicklooks

When you DON'T know what you want

Ch pds-geosciences.wustl.edu - /msl/msl-m-chemse
v1/mslccm_1xxx/browse/sol00050/

← → ↻

pds-ge

[To Parent Directory]

6/6/2013 11/6/2013 4:18 PM 236131 [gchemcam_00050_libs1_401928245.jpg](#)
12/12/2013 11/6/2013 4:18 PM 1858 [gchemcam_00050_libs1_401928245.lbl](#)
6/7/2013 11/6/2013 4:18 PM 236676 [gchemcam_00050_libs1_401928321.jpg](#)
11/15/2013 11/6/2013 4:18 PM 1858 [gchemcam_00050_libs1_401928321.lbl](#)
12/12/2013 11/6/2013 4:18 PM 235140 [gchemcam_00050_libs1_401928397.jpg](#)
12/9/2013 11/6/2013 4:18 PM 1858 [gchemcam_00050_libs1_401928397.lbl](#)
11/15/2013 11/6/2013 4:18 PM 236793 [gchemcam_00050_libs1_401928508.jpg](#)
4/10/2013 11/6/2013 4:18 PM 1858 [gchemcam_00050_libs1_401928508.lbl](#)
11/15/2013 11/6/2013 4:18 PM 235815 [gchemcam_00050_libs1_401928583.jpg](#)
3/27/2013 11/6/2013 4:18 PM 1858 [gchemcam_00050_libs1_401928583.lbl](#)
11/6/2013 11/6/2013 4:18 PM 235776 [gchemcam_00050_libs1_401928761.jpg](#)
11/6/2013 11/6/2013 4:18 PM 1858 [gchemcam_00050_libs1_401928761.lbl](#)
11/6/2013 11/6/2013 4:18 PM 234071 [gchemcam_00050_libs1_401928872.jpg](#)
11/6/2013 11/6/2013 4:18 PM 1858 [gchemcam_00050_libs1_401928872.lbl](#)
11/6/2013 11/6/2013 4:18 PM 235947 [gchemcam_00050_libs1_401928948.jpg](#)
11/6/2013 11/6/2013 4:18 PM 1858 [gchemcam_00050_libs1_401928948.lbl](#)
11/6/2013 11/6/2013 4:18 PM 235449 [gchemcam_00050_libs1_401929025.jpg](#)
11/6/2013 11/6/2013 4:18 PM 1858 [gchemcam_00050_libs1_401929025.lbl](#)
11/6/2013 11/6/2013 4:18 PM 353423 [gchemcam_00050_libs2_401928245.jpg](#)
11/6/2013 11/6/2013 4:18 PM 1858 [gchemcam_00050_libs2_401928245.lbl](#)
11/6/2013 11/6/2013 4:18 PM 344743 [gchemcam_00050_libs2_401928321.jpg](#)
11/15/2013 2:49 PM <dir> sol00055
11/15/2013 2:48 PM <dir> sol00056

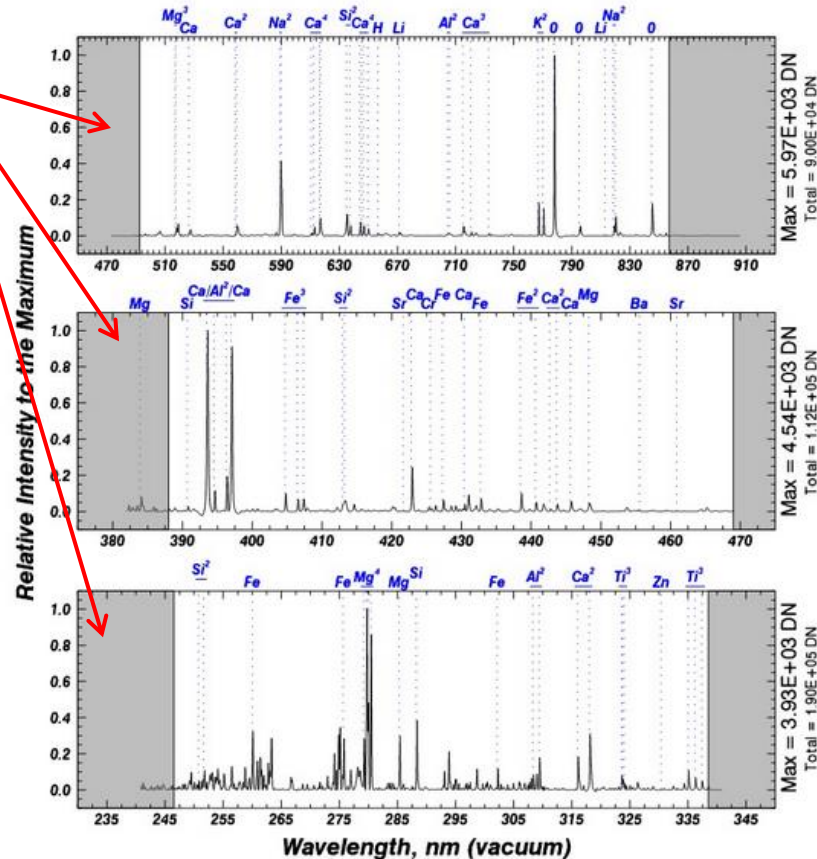
se
l.edu -
wse/
winfinfo.txt
000010
000012
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000015
000019
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000027
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000047
000048
000049
000050

16 Mar 201


LIBS1 quicklook

Averaged spectrum

Average spectrum of all shots (1 location)



Information about target, sol, number of shots, processing

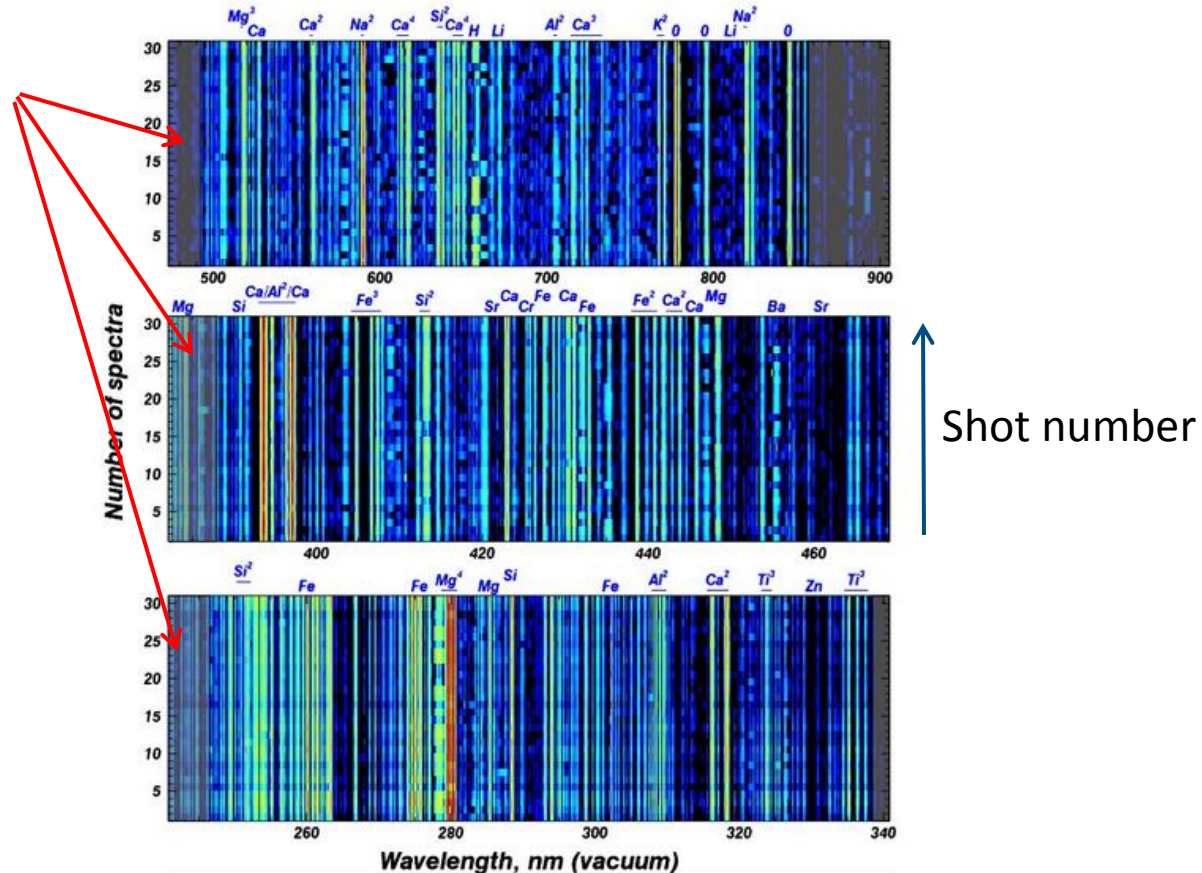
ChemCam LIBS Quicklook		<input type="checkbox"/> Sanity Check <input type="checkbox"/> Dark subtraction <input checked="" type="checkbox"/> Average <input checked="" type="checkbox"/> Denoise removal <input checked="" type="checkbox"/> Continuum subst. <input type="checkbox"/> Transmission <input checked="" type="checkbox"/> Wave calibration <input type="checkbox"/> Resampling <input type="checkbox"/> Wave calib: from Sol 00027	
Generated: Fri Aug 9 09:38:59 2013 QChemCam_00050_LIBS1_401928245 (from: CL5_401928245_DP_F0042790CAM01050M1.DAT)			
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)		
NASA/JPL-Caltech/LANL/IRAP - http://www.msl-chemcam.com			

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		
slck: 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

ChemCam RMI Quicklook		<input checked="" type="checkbox"/> Linearity correction <input checked="" type="checkbox"/> Dark subtraction <input checked="" type="checkbox"/> Smearing correction <input checked="" 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	
Generated: Wed Jun 26 05:09:16 2013 QChemCam_00187_RMI_414093565 (from: CR0_414093565EDR_F0090000CCAM02187M1.IMG)			
Target:seward_1 Sol: 187 LTST: 12:24:02 sclk: 414093565 SeqID: ccam02187	Distance, m: 2.311 Tel. temp, °C: -20.7 Exposure, ms: 13 Rov.mot. #: (R02)		
<small>NASA/JPL-Caltech/LANL/IRAP/IAS - http://www.msl-chemcam.com</small>			

Information about target, sol, exposure, processing



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 the GNU Wget website. At the top, there is a browser address bar with the URL <https://www.gnu.org/software/wget/>. Below the address bar, there is a navigation menu 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. Below the main content, there is a red navigation bar with links: [About GNU](#), [Philosophy](#), [Licenses](#), [Education](#), [Software](#), [Documentation](#), and [Help GNU](#). On the right side of this bar, there is a search box with the text "Why GNU/Linux?" and a "Search" button. Below the navigation bar, there is a blue header for "GNU Wget". The main content area below the header is titled "Introduction to GNU Wget" and contains the following text: "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." Below this text, there is a paragraph: "GNU Wget has many features to make retrieving large files or mirroring entire web or FTP sites easy, including:" followed by a list item: "• Can resume aborted downloads, using REST and RANGE".

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**

← → ↻  pds-geosciences.wustl.edu/mssl/mssl-m-chemcam-libs-2-edr-v1/msslccm_0xxx/

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

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

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

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

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

6/7/2013 2:24 PM	<dir>	sol00000
6/7/2013 2:24 PM	<dir>	sol00010
6/7/2013 2:24 PM	<dir>	sol00012
8/28/2013 2:00 PM	<dir>	sol00013
8/28/2013 2:00 PM	<dir>	sol00014
8/28/2013 2:00 PM	<dir>	sol00015
8/28/2013 2:00 PM	<dir>	sol00019
8/28/2013 2:00 PM	<dir>	sol00022
8/28/2013 2:00 PM	<dir>	sol00027
6/7/2013 2:24 PM	<dir>	sol00030
8/28/2013 2:00 PM	<dir>	sol00032
8/28/2013 2:00 PM	<dir>	sol00033
6/7/2013 2:24 PM	<dir>	sol00034
6/7/2013 2:24 PM	<dir>	sol00036
8/28/2013 2:00 PM	<dir>	sol00040
8/28/2013 2:00 PM	<dir>	sol00043
8/28/2013 2:00 PM	<dir>	sol00045
6/7/2013 2:24 PM	<dir>	sol00046
6/7/2013 2:24 PM	<dir>	sol00047
8/28/2013 2:00 PM	<dir>	sol00048
8/28/2013 2:00 PM	<dir>	sol00049
8/28/2013 2:00 PM	<dir>	sol00050
8/28/2013 2:00 PM	<dir>	sol00055
8/28/2013 2:00 PM	<dir>	sol00056
8/28/2013 2:00 PM	<dir>	sol00057
8/28/2013 2:00 PM	<dir>	sol00059
8/28/2013 2:00 PM	<dir>	sol00061

Getting More raw data

pds-geosciences.wustl.edu - /msl/msl-m-chemcam-libs
v1/mslccm_0xxx/data/sol00033/

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

edr = experiment data record

.edu - /m

/



pds-geoscien

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

5/15/2013	10:04	AM
6/7/2013	2:23	PM
8/28/2013	2:00	PM
12/12/2013	11:29	AM
12/2/2013	5:05	PM
12/5/2013	12:24	PM
12/9/2013	11:46	AM
12/2/2013	4:34	PM
11/25/2013	2:45	PM
2/13/2013	10:00	AM

5/15/2013	10:15	AM	12336	cc0_400420271epw_f0040000ccam00033m1.dat
5/15/2013	10:15	AM	10304	cc0_400420271epw_f0040000ccam00033m1.lbl
5/15/2013	10:15	AM	20560	cc0_400420273edr_f0040000ccam00033m1.dat
5/15/2013	10:15	AM	17229	cc0_400420273edr_f0040000ccam00033m1.lbl
5/15/2013	10:15	AM	12336	cc0_400420278ewu_f0040000ccam00033m1.dat
5/15/2013	10:15	AM	10302	cc0_400420278ewu_f0040000ccam00033m1.lbl
5/15/2013	10:15	AM	20560	cc0_400420280edr_f0040000ccam00033m1.dat
5/15/2013	10:15	AM	17230	cc0_400420280edr_f0040000ccam00033m1.lbl
5/15/2013	10:15	AM	12336	cc0_400420706ewu_f0040000ccam00033m1.dat
5/15/2013	10:15	AM	10299	cc0_400420706ewu_f0040000ccam00033m1.lbl
5/15/2013	10:15	AM	20560	cc0_400420708edr_f0040000ccam00033m1.dat
5/15/2013	10:15	AM	17226	cc0_400420708edr_f0040000ccam00033m1.lbl
5/15/2013	10:15	AM	30840	cc0_400422892epo_f0040000ccam15003m1.dat
5/15/2013	10:15	AM	28837	cc0_400422892epo_f0040000ccam15003m1.lbl
5/15/2013	10:15	AM	39064	c11_400420738edr_f0040000ccam01033m1.dat
5/15/2013	10:15	AM	24476	c11_400420738edr_f0040000ccam01033m1.lbl
5/15/2013	10:15	AM	90464	c11_400421189edr_f0040000ccam02033m1.dat
5/15/2013	10:15	AM	24492	c11_400421189edr_f0040000ccam02033m1.lbl
5/15/2013	10:15	AM	90464	c11_400421450edr_f0040000ccam02033m1.dat
5/15/2013	10:15	AM	24450	c11_400421450edr_f0040000ccam02033m1.lbl
5/15/2013	10:15	AM	90464	c11_400421682edr_f0040000ccam02033m1.dat
5/15/2013	10:15	AM	24492	c11_400421682edr_f0040000ccam02033m1.lbl
5/15/2013	10:15	AM	39064	c11_400421927edr_f0040000ccam03033m1.dat
5/15/2013	10:15	AM	24450	c11_400421927edr_f0040000ccam03033m1.lbl
5/15/2013	10:15	AM	90464	c11_400421951edr_f0040000ccam03033m1.dat
5/15/2013	10:15	AM	24532	c11_400421951edr_f0040000ccam03033m1.lbl
5/15/2013	10:15	AM	39064	c11_400422031edr_f0040000ccam04033m1.dat
5/15/2013	10:15	AM	24440	c11_400422031edr_f0040000ccam04033m1.lbl
7/26/2013	7:25	AM	674368	c15_400422236edr_f0040000ccam04033m1.dat
7/26/2013	7:25	AM	26633	c15_400422236edr_f0040000ccam04033m1.lbl
7/26/2013	7:25	AM	674368	c15_400422333edr_f0040000ccam04033m1.dat
7/26/2013	7:25	AM	26666	c15_400422333edr_f0040000ccam04033m1.lbl
7/26/2013	7:25	AM	674368	c15_400422430edr_f0040000ccam04033m1.dat
7/26/2013	7:25	AM	26668	c15_400422430edr_f0040000ccam04033m1.lbl
7/26/2013	7:25	AM	674368	c15_400422527edr_f0040000ccam04033m1.dat
7/26/2013	7:25	AM	26633	c15_400422527edr_f0040000ccam04033m1.lbl
7/26/2013	7:25	AM	674368	c15_400422624edr_f0040000ccam04033m1.dat
7/26/2013	7:25	AM	26672	c15_400422624edr_f0040000ccam04033m1.lbl
5/15/2013	10:15	AM	117192	c19_400421231edr_f0040000ccam02033m1.dat
5/15/2013	10:15	AM	24828	c19_400421231edr_f0040000ccam02033m1.lbl

00000
00010
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00059

.dat files
(binary file)

.lbl file of same
name describes
.dat file

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)

PDS backup slides

PDS archive volume directory structure

ChemCam RDR data are stored in an archive volume having the directory structure illustrated below. Raw ChemCam data products (EDRs) are stored in a separate archive volume not described here.

MSLCCM 1XXX

```

|
| - AAREADME.TXT      Introduction to the archive (this file)
| - ERRATA.TXT         Release notes and errata for the archive
| - VOLDESC.CAT       Description of the contents of the archive
|
| - BROWSE
|   |
|   | - BROWINFO.TXT   Description of the BROWSE directory
|   |
|   | - SOLnnnnn       Directory of browse data for sol nnnnn
|   |
|   |   |
|   |   | - QCHEMCAM_nnnnn_type_sclk.JPG, .LBL
|   |   |           Browse version of product acquired on sol
|   |   |           nnnnn, with inst LIBS1, LIBS2 or RMI, at
|   |   |           spacecraft clock time sclk
|   |
|

```

PDS backup slides

PDS archive volume directory structure

```

|- CALIB
| |
| | - CALINFO.TXT      Description of the CALIBRATION directory
| | - MSL\_CCAM\_LIBS\_CALIB.CSV LIBS Calibration Data
| | - MSL\_CCAM\_LIBS\_CALIB.LBL PDS label describing
| |   MSL_CCAM_LIBS_CALIB.CSV
| | - environment      Environment data collected from
| |   |                ie. CLEANROOM,TVAC, etc
| |   | - std          Standard or Sample
| |   |
| |   | - *CCS.CSV     Clean Calibrated Spectra
| |   |               coma seperated values
| |   | - *CCS.LBL     PDS labels for CCS.CSV file
|

```

PDS backup slides

PDS archive volume directory structure

- | - [CATALOG](#)
- | |
- | | - [CATINFO.TXT](#) Description of the CATALOG directory
- | | - [CCAM_LIBS_INST.CAT](#) ChemCam LIBS instrument description
- | | - [CCAM_LIBS_RDR_DS.CAT](#) ChemCam LIBS RDR data set description
- | | - [CCAM_PERSON.CAT](#) Relevant ChemCam personnel
- | | - [CCAM_REF.CAT](#) References mentioned in CCAM*.CAT files
- | | - [CCAM_RMI_INST.CAT](#) ChemCam RMI instrument description
- | | - [CCAM_RMI_RDR_DS.CAT](#) ChemCam RMI RDR data set description
- | | - [MSL_INSTHOST.CAT](#) MSL rover description
- | | - [MSL_MISSION.CAT](#) MSL mission description
- | | - [MSL_REF.CAT](#) References mentioned in MSL*.CAT files
- |



PDS backup slides

PDS archive volume directory structure

```
| - DATA
|   |
|   | - SOLnnnnn      Directory of data acquired on sol nnnnn
|   |
|   |   |
|   |   | - *.CSV     ChemCam LIBS data products
|   |   | - *.TIF     ChemCam RMI data products
|   |   | - *.LBL     PDS labels describing data products
|   |
|
```

PDS backup slides

PDS archive volume directory structure

- | - [DOCUMENT](#)
- | |
- | | - [DOCINFO.TXT](#) Description of the DOCUMENT directory
- | | - [GEOMETRIC_CM.TXT](#) Description of MSL geometric camera model.
- | | - [MSL_CAMERA_SIS.PDF](#) ChemCam Software Interface Specification
- | | - [MSL_CAMERA_SIS.LBL](#) PDS label for CAMERA_SIS.*
- | | - [CHEMCAM_ARCHSIS.PDF](#) ChemCam RDR Archive SIS
- | | - [CHEMCAM_ARCHSIS.LBL](#) PDS label for CHEMCAM_ARCHSIS.*
- | | - [PDSDD.FUL](#) PDS Data Dictionary
- | | - [PDSDD.LBL](#) PDS label for PDSDD.FUL
- | | - [MSL_CCAM_OBS.CSV](#) Summary information for ChemCam products
| | in a comma-delimited ASCII table.
- | | - [MSL_CCAM_OBS.LBL](#) PDS label for MSL_CCAM_OBS.CSV
- |

PDS backup slides

PDS archive volume directory structure

| - [EXTRAS](#)

| |

| | - [EXTRINFO.TXT](#) Description of the EXTRAS directory

| | - [DN2ENGUNITS_LUT.PDF](#) Lookup tables for the conversion
| | of ChemCam data numbers to physical values.

|

| - [INDEX](#)

|

| - [INDXINFO.TXT](#) Description of the INDEX directory

| - [LIBSINDEX.TAB](#) Table of LIBS data products in the archive

| - [LIBSINDEX.LBL](#) PDS label describing LIBSINDEX.TAB

| - [RMIINDEX.TAB](#) Table of RMI data products in the archive

| - [RMIINDEX.LBL](#) PDS label describing RMIINDEX.TAB