



RadLab: Advancing Databases and Graphical and Programming Interfaces for Space Radiation Data

Biological and Physical Sciences

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NASA Open Science Data Repository

Open Science Projects

Open Science Projects primary goals aim to increase collaborative scientific data sharing, analysis and more rapid scientific advancement.

GeneLab

GeneLab, an open science multi-omics repository, covering transcriptomics, metagenomics, epigenomics, proteomics, and metabolomics. Studies comprise of data from model organisms including microbes, plants, fruit flies, rodents and humans.

[Learn more GeneLab](#)



BSP

The NASA Space Biology Biospecimen Sharing Program (BSP) collects biospecimens to maximize the scientific return from biological spaceflight and associated ground investigations and to encourage and broaden participation from the scientific community in space biology-related research.

[Learn more about BSP](#)



ALSDA

Ames Life Sciences Data Archive (ALSDA) collects, curates, and makes available space-relevant higher-order phenotypic datasets. Datasets that enable scientists to perform retrospective analysis across missions, experiments, life science disciplines, research subjects, and species.

[Learn more about ALSDA](#)



NBISC

NASA Biological Institutional Scientific Collection (NBISC) is a biorepository of non-human samples collected from NASA-funded spaceflight investigations and correlative ground studies. The purpose of NBISC is to receive, store, document, preserve, and make the collection available to the scientific community.

[Learn more about NBISC](#)



FAIR data

"[...] all research objects should be
Findable, Accessible, Interoperable and Reusable (FAIR)
both for machines and for people."

Wilkinson, M., Dumontier, M., Aalbersberg, I. *et al.*

"The FAIR Guiding Principles for scientific data management and stewardship" (2016)

doi.org/10.1038/sdata.2016.18

OSDR: GeneLab and ALSDA

General Search Filters

Data Source

☒ GeneLab

☒ ALSDA

☐ NIH GEO

☐ EBI PRIDE

☐ ANL MG-RAST

Data Type

☒ Study

☐ Experiment

☐ Subject

☐ Biospecimen

☐ Payload

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Study Search Filters

Project Type

☐ Ground

☐ Spaceflight

☐ High Altitude

Assay Type

 Open Science for Life in Space

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Open Science Data Repository Search

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Study

OSD-678

Light has a principal role in the Arabidopsis transcriptomic response to the spaceflight environment

Organisms	Factors	Assay Types	Release Date	Description
Arabidopsis thaliana	Spaceflight Ecotype Treatment Genotype	transcription profiling	20-Dec-2024	The Characterizing Arabidopsis Root Attractions (CARA) spaceflight experiment provides comparative transcriptome analyses of plants grown in both light and dark conditions within the same spaceflight....

Highlights: *cgene*



Study

OSD-516

Modeling cellular responses to serum and vitamin D in microgravity using a human kidney microphysiological system

Organisms	Factors	Assay Types	Release Date	Description
Homo sapiens	Spaceflight Treatment Sex	transcription profiling	18-Jul-2024	The microgravity environment aboard the International Space Station (ISS) provides a unique stressor that can help understand underlying cellular and molecular drivers of pathological changes observed....

Highlights: *cgene*



Study

OSD-517

Characterization of the transcriptomic response to spaceflight in Arabidopsis thaliana roots

Organisms	Factors	Assay Types	Release Date	Description
Arabidopsis thaliana	Spaceflight Ecotype Treatment Genotype	transcription profiling	20-Dec-2024	The Characterizing Arabidopsis Root Attractions (CARA) spaceflight experiment provides comparative transcriptome analyses of plants grown in both light and dark conditions within the same spaceflight....

Highlights: *cgene*

"RadLab: DB, GUI, API for Space Radiation Data"

NASA ARC, BMSIS
NASA OSDR

NASA HRP IWS
2025-Jan-28

5/28

OSDR: FAIR data

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 Missions

 Protocols

 Samples

 Assays

 Publications

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 Visualization 

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Study Files Selected: 0

Search Files 

☐	 GLDS-48_proteomics_RR1_Liver_Basal_Vivarium_processed.tar.gz	1.85 GB	Tue Jun 06 2023
☐	 GLDS-48_proteomics_RR1-NASA.processed.tar.gz	8.36 GB	Tue Jun 06 2023
☐	 MD5 Checksums		
☐	 GeneLab Processed RNA-Seq Files		
☐	 Differential Expression Analysis Data		
☐	 GLDS-48_rna_seq_contrasts.csv	1.44 KB	Tue Jun 06 2023
☐	 GLDS-48_rna_seq_differential_expression.csv	33.64 MB	Tue Jun 06 2023
☐	 GLDS-48_rna_seq_SampleTable.csv	866.0 B	Tue Jun 06 2023
☐	 Processing Info		
☐	 ...		

OSDR: FAIR data

[12,3] "Space Flight"				
id.accession	id.assay name	study.factor value.altered gravity	study.factor value.spaceflight	study.factor value.treatment
OSD-13	OSD-13.transcription-profiling_dna-microarray_Affymetrix	1G by centrifugation	Space Flight	Activated
OSD-13	OSD-13.transcription-profiling_dna-microarray_Affymetrix	1G by centrifugation	Space Flight	Activated
OSD-13	OSD-13.transcription-profiling_dna-microarray_Affymetrix	1G by centrifugation	Space Flight	Activated
OSD-13	OSD-13.transcription-profiling_dna-microarray_Affymetrix	uG	Space Flight	Activated
OSD-13	OSD-13.transcription-profiling_dna-microarray_Affymetrix	uG	Space Flight	Activated
OSD-13	OSD-13.transcription-profiling_dna-microarray_Affymetrix	uG	Space Flight	Activated
OSD-13	OSD-13.transcription-profiling_dna-microarray_Affymetrix	uG	Space Flight	Non-activated
OSD-13	OSD-13.transcription-profiling_dna-microarray_Affymetrix	uG	Space Flight	Non-activated
OSD-13	OSD-13.transcription-profiling_dna-microarray_Affymetrix	uG	Space Flight	Non-activated
OSD-29	OSD-29.transcription-profiling_dna-microarray_Affymetrix	1G with centrifugation	Space Flight	Not Osteo-induced
OSD-29	OSD-29.transcription-profiling_dna-microarray_Affymetrix	1G with centrifugation	Space Flight	Osteo-induced
OSD-29	OSD-29.transcription-profiling_dna-microarray_Affymetrix	uG	Space Flight	Not Osteo-induced
OSD-29	OSD-29.transcription-profiling_dna-microarray_Affymetrix	uG	Space Flight	Osteo-induced
OSD-29	OSD-29.transcription-profiling_dna-microarray_Affymetrix	1G on Earth	Ground Control	Not Osteo-induced
OSD-29	OSD-29.transcription-profiling_dna-microarray_Affymetrix	1G on Earth	Ground Control	Osteo-induced
OSD-29	OSD-29.transcription-profiling_dna-microarray_Affymetrix	1G on Earth	Vivarium Control	Not Osteo-induced
OSD-29	OSD-29.transcription-profiling_dna-microarray_Affymetrix	1G on Earth	Vivarium Control	Osteo-induced
OSD-35	OSD-35.transcription-profiling_dna-microarray_Affymetrix	uG	Space Flight	NaN
OSD-35	OSD-35.transcription-profiling_dna-microarray_Affymetrix	1G on Earth	Ground Control	NaN
OSD-35	OSD-35.transcription-profiling_dna-microarray_Affymetrix	3G with centrifugation	Ground Control	NaN
OSD-35	OSD-35.transcription-profiling_dna-microarray_Affymetrix	1G on Earth	Vivarium Control	NaN
OSD-35	OSD-35.transcription-profiling_dna-microarray_Affymetrix	uG with clinorotation	Ground Control	NaN
OSD-36	OSD-36.transcription-profiling_dna-microarray_Affymetrix	uG	Space Flight	cold treatment
OSD-36	OSD-36.transcription-profiling_dna-microarray_Affymetrix	1G on Earth	Ground Control	cold treatment
OSD-36	OSD-36.transcription-profiling_dna-microarray_Affymetrix	10G with centrifugation	Not Applicable	no cold treatment
OSD-36	OSD-36.transcription-profiling_dna-microarray_Affymetrix	uG with random positioning machine	Not Applicable	cold treatment
OSD-36	OSD-36.transcription-profiling_dna-microarray_Affymetrix	uG with random positioning machine	Not Applicable	no cold treatment
OSD-36	OSD-36.transcription-profiling_dna-microarray_Affymetrix	1G on Earth	Not Applicable	cold treatment
OSD-36	OSD-36.transcription-profiling_dna-microarray_Affymetrix	1G on Earth	Not Applicable	no cold treatment
OSD-63	OSD-63.transcription-profiling_dna-microarray_Affymetrix	1G on Earth	Not Applicable	NaN
OSD-63	OSD-63.transcription-profiling_dna-microarray_Affymetrix	2G by centrifugation	Not Applicable	NaN
OSD-63	OSD-63.transcription-profiling_dna-microarray_Affymetrix	uG	Space Flight	NaN
OSD-63	OSD-63.transcription-profiling_dna-microarray_Affymetrix	1G on Earth	Ground Control	NaN
OSD-63	OSD-63.transcription-profiling_dna-microarray_Affymetrix	1G on Earth	Vivarium Control	NaN

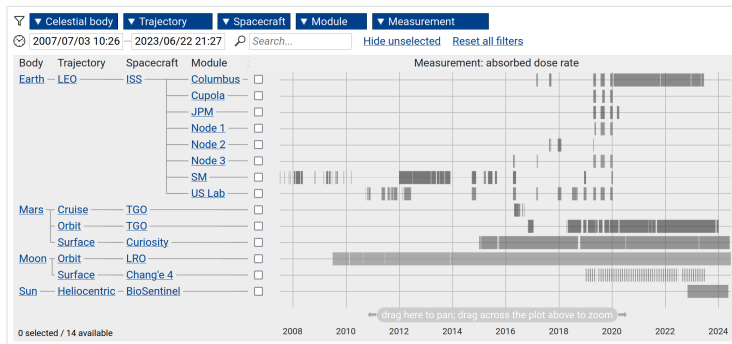
OSDR: FAIR data

[15, 2]	GO:0051641 GO:0033036 GO:0034613 GO:0006810 GO:0071705 GO:0015633 GO:0009987 GO:0045184 GO:0008104 GO:0051179 GO:0042886 GO:0071702 GO:0070727 GO:0051168 GO:0051234 GO:0006...	OSD-48 ~OSD-48_transcript... ~ENSEMBL	OSD-48 ~OSD-48_transcription-profiling_rna-sequencing-(rna-seq)_illumina ~GENENAME	OSD-48 ~OSD-48_transcription-profiling_rna-sequenc... ~COSMIC_IDS	OSD-48 ~OSD-48_transcription-profiling... ~Mmus_C57-6J_LVR_G0_1_Repl_M31	OSD-48 ~OSD-48_trans... ~Mmus_C57-6J...
ENSMUSG000000000001	guanine nucleotide binding protein (G protein), alpha inhibiting 3			GO:0051339 GO:0007188 GO:0010646 GO:0051716...	2450.13688856518	2389.559786176
ENSMUSG00000000028	cell division cycle 45			GO:0044085 GO:0000280 GO:0010467 GO:1903507...	28.6526881358503	33.82961571689
ENSMUSG00000000031	H19, imprinted maternally expressed transcript		NaN		10.5588958133492	3796.122210136
ENSMUSG00000000037	Scm polycomb group protein like 2		NaN		1.7193854310211	1.778112720319
ENSMUSG00000000049	apolipoprotein H		NaN		45421.4265727202	46534.14335752
ENSMUSG00000000056	nuclear prelamin A recognition factor			GO:0071840 GO:0022607 GO:0044085 GO:0006790...	781.554492826276	845.5620404107
ENSMUSG00000000058	caveolin 2			GO:0044085 GO:0043408 GO:0031399 GO:0051246...	114.448170029084	226.7024394541
ENSMUSG00000000078	Kruppel-like factor 6		NaN		398.10745387507	657.9002071837
ENSMUSG00000000085	sex comb on midleg homolog 1			GO:0010629 GO:0006725 GO:0031324 GO:2000113...	224.117468891416	204.7537286697
ENSMUSG00000000088	cytochrome c oxidase subunit 5A			GO:0009199 GO:0009141 GO:0006754 GO:1902600...	2605.95419439322	3657.559565535
ENSMUSG00000000093	T-box 2			GO:0006725 GO:0051171 GO:0016070 GO:0044260...	101.320834717567	106.8834914275
ENSMUSG00000000094	T-box 4			GO:0009799 GO:0051171 GO:0010467 GO:2001141...	5.20042849284993	7.680559652211
ENSMUSG00000000120	nerve growth factor receptor (TNFR superfamily, member 16)			GO:0050789 GO:0007264 GO:0050896 GO:0007165...	200.811035307446	190.3972852390
ENSMUSG00000000126	wingless-type MMTV integration site family, member 9A			GO:1905114 GO:0048869 GO:0051716 GO:0007165...	11.7781873486455	39.75292142997
ENSMUSG00000000127	fer (fms/tps related) protein kinase			GO:0043207 GO:0002764 GO:0051641 GO:0051640...	209.297276279945	148.4313094841
ENSMUSG00000000131	exportin 6			GO:0051641 GO:0033036 GO:0034613 GO:0006810...	729.202869200051	750.7611768339
ENSMUSG00000000134	transcription factor E3			GO:0006725 GO:0051171 GO:0016070 GO:0044260...	763.81858151224	583.8278269288
ENSMUSG00000000142	axin 2		NaN		231.20860547084	218.3883900141
ENSMUSG00000000148	BRCA1-associated ATM activator 1			GO:0051173 GO:0031399 GO:0019220 GO:0051246...	257.323085858097	192.9190841670
ENSMUSG00000000149	guanine nucleotide binding protein, alpha 12			GO:0051339 GO:0007188 GO:0010646 GO:0045761...	2209.69968870336	2103.811709011
ENSMUSG00000000154	solute carrier family 22 (organic cation transporter), member 18			GO:0022857 GO:0005215	1918.77861131579	1739.744385943
ENSMUSG00000000159	immunoglobulin superfamily, member 5		NaN		435.850967772864	378.7892197495
ENSMUSG00000000167	PI3K domain containing 2			GO:0006725 GO:0022607 GO:0046483 GO:0044085...	11.1639867542554	5.655197864039
ENSMUSG00000000168	dihydrolipoamide S-acetyltransferase (E2 component of pyruvate de...		NaN		1661.69610099969	2176.939572560
ENSMUSG00000000171	succinate dehydrogenase complex, subunit D, integral membrane pro...			GO:0009199 GO:0009141 GO:0006754 GO:1902600...	3811.54474307907	4403.415205196
ENSMUSG00000000183	fibroblast growth factor 6			GO:0010628 GO:0031399 GO:0051246 GO:0051171...	1	20.38709476711
ENSMUSG00000000184	cyclin D2			GO:0031399 GO:0051246 GO:0051171 GO:0000280...	456.561414996354	453.6693194546
ENSMUSG00000000194	G protein-coupled receptor 107			GO:0051179 GO:0071840 GO:0006900 GO:0051234...	353.979352465345	382.0157915351
ENSMUSG00000000197	sodium leak channel, non-selective		NaN		1	1.465764415052
ENSMUSG00000000204	schlafen 4		NaN		9.04671466479752	2.484579107502
ENSMUSG00000000214	tyrosine hydroxylase			GO:1901615 GO:0006725 GO:0043436 GO:0006570...	1	3.683444857318
ENSMUSG00000000223	dystrophin related protein 2			GO:0095536 GO:0007154 GO:0009987 GO:0023052...	1	23.09013124349
ENSMUSG00000000244	tetraspanin 32			GO:0031224 GO:0005887 GO:0031226 GO:0110165...	19.4800406201126	11.96845158522

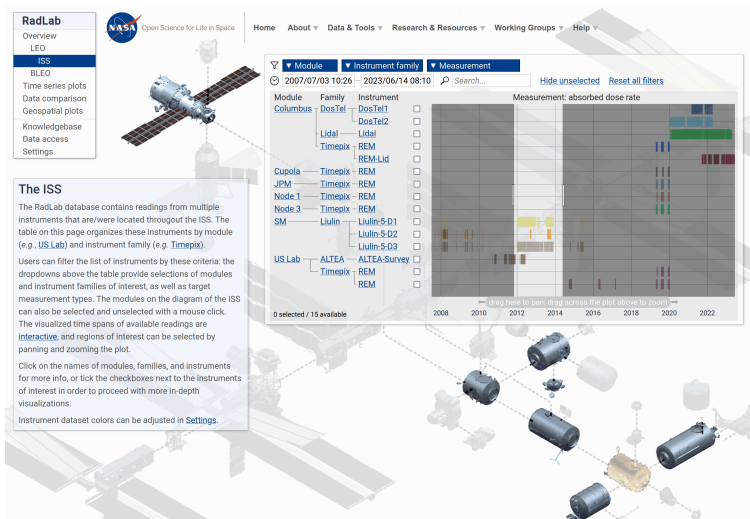
OSDR: FAIR data

[5,3] 49649					
index	Mmus_C57-6J_LVR_FLT_C_Rep1_M25	Mmus_C57-6J_LVR_FLT_C_Rep2_M26	Mmus_C57-6J_LVR_FLT_C_Rep3_M27	Mmus_C57-6J_LVR_FLT_C_Rep4_M28	Mmus_C57-6J_LVR_FLT_C_Rep5_M29
ENSMUSG000000000001	1255	1297	1636	1263	1153
ENSMUSG000000000003	0	0	0	0	0
ENSMUSG000000000028	12	11	14	14	16
ENSMUSG000000000031	10	19	18	8	3
ENSMUSG000000000037	0	0	2	3	3
ENSMUSG000000000049	32753	31585	49649	38397	35106
ENSMUSG000000000056	377	166	285	292	376
ENSMUSG000000000058	40	55	40	27	19
ENSMUSG000000000078	317	398	340	398	252
ENSMUSG000000000085	137	152	141	199	147
ENSMUSG000000000088	2506.52	2432	4282.6	2803.71	2485
ENSMUSG000000000093	136	95	88	153	102
ENSMUSG000000000094	1	0	0	0	2
ENSMUSG000000000103	0	0	0	0	0
ENSMUSG000000000120	66	43	53	41	20
ENSMUSG000000000125	0	0	0	0	0
ENSMUSG000000000126	11	3	6	3	7
ENSMUSG000000000127	96	115	114	100	98
ENSMUSG000000000131	563	615	562	900	675
ENSMUSG000000000134	396	536	473	555	373
ENSMUSG000000000142	94	252	236	330	186
ENSMUSG000000000148	129	143	149	179	138
ENSMUSG000000000149	662	498	694	538	644
ENSMUSG000000000154	1489	1723	1717	1724	1717
ENSMUSG000000000157	0	0	1	2	0
ENSMUSG000000000159	398	281	380	286	329
ENSMUSG000000000167	13	17	8	11	6
ENSMUSG000000000168	639	828	1000	989	794
ENSMUSG000000000171	2741	2675	4323	2885	2497
ENSMUSG000000000182	0	0	0	0	0
ENSMUSG000000000183	0	0	0	0	0
ENSMUSG000000000184	227	392	294	337	156
ENSMUSG000000000194	237	294	268	328	267
ENSMUSG000000000197	0	0	0	1	0

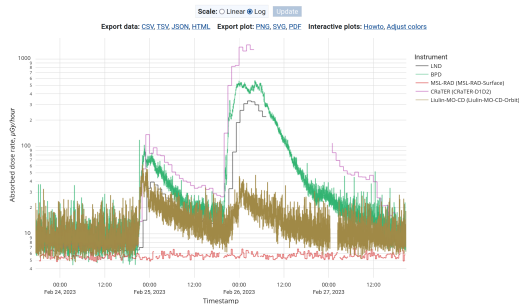
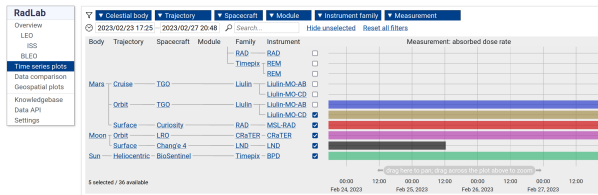
RadLab: Data



RadLab: GUI

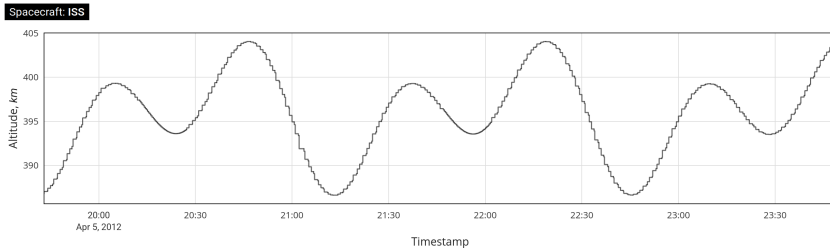
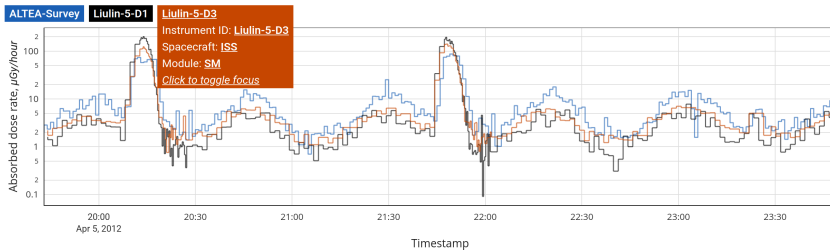


RadLab: Visualizations

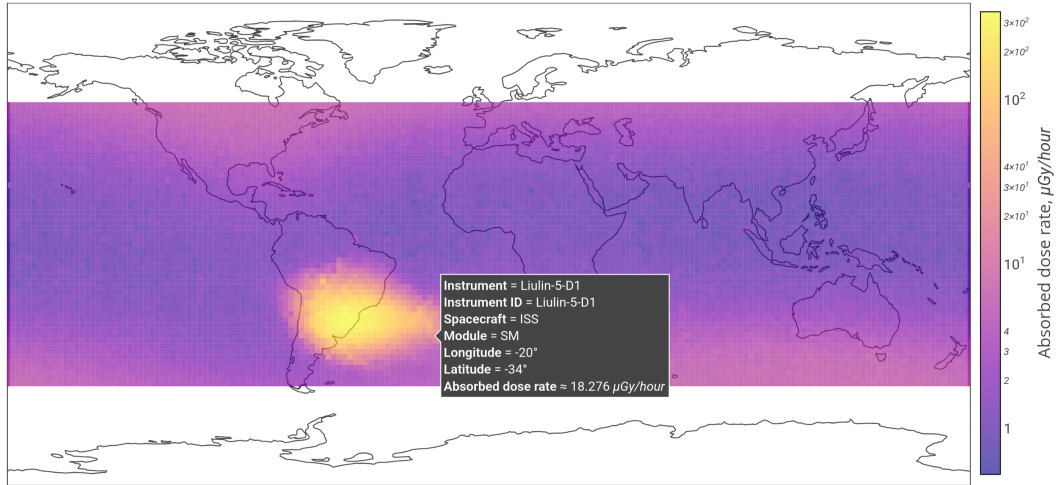


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API syntax

The data can be retrieved programmatically with queries sent as a GET request to <https://visualization.osdr.nasa.gov/radlab/api>.

Queries can be constructed using one of two approaches: either as **key-value pairs** (a simple approach, but with limited complexity with regard to nesting logical expressions), or as **boolean expressions** (which allow combining AND, OR, NOT, and comparison operators with optional parentheses).

These two approaches are mutually exclusive: see [notes](#).

Click on the field names in the table below for more information.

Several [example requests](#) are provided at the bottom of this guide.

Key-value pair syntax; data fields

Key	Type	Description	Unit	Value format	Examples
celestial_body	string	A celestial body that an instrument of interest is associated with, or another identifier (e.g. "deep space") if none		empty: Request the field without applying filters to its values =value: Match value =value1 value2: Match value1 or value2 Note: special characters ([], %, spaces) may need to be URL-encoded (see notes and examples below).	<code>celestial_body</code> <code>celestial_body=Earth</code> <code>celestial_body=Moon Sun</code>
trajectory	resolved string	Name or type of trajectory; can be an exact identifier (e.g. "LEO") or one of "Orbit", "Surface", "BLEO", etc. For example, "BLEO" will resolve to "Moon surface", "Heliocentric orbit at 1 AU" and anything else outside of LEO.			<code>trajectory</code> <code>trajectory=Orbit</code> <code>trajectory=LEO Heliocentric</code>
spacecraft	string	Name of spacecraft			<code>spacecraft</code> <code>spacecraft=ISS</code>
module	string (Note: may become resolved string in the future)	Module within the spacecraft; currently only applicable for the ISS and is blank (NA) for others			<code>module</code> <code>module=US%20Lab</code> <code>module=Cupola JPM</code>
instrument_family	string	Instrument family, which is a loosely defined			<code>instrument_family</code> <code>instrument_family=TEPC</code>

RadLab: API

RadLab Overview LEO ISS BLEO Time series plots Data comparison Geospatial plots Knowledgebase Data API Settings	instrument_id	string	Note: case-sensitive. A specific ID of an instrument, detector, or configuration; this is guaranteed to be unique in the database. E.g.: REM-Lid , the REM instrument affixed to the lid of Lidaj and included in the DORELL project; or Liulin-5-D2 , the second detector of the Liulin-5 instrument. Note: is always returned, even when not explicitly requested. The ID can be used to look up the specifics of the instrument and the dataset in the knowledgebase .		<pre>instrument_id instrument_id=ALTEA-Survey instrument_id=DosTel1 DosTel2</pre>
	timestamp	ISO-formatted string (or Unix timestamp)	Timestamp of recorded value(s). Note: case-sensitive if passed as an ISO-formatted string.	<code>empty</code>: Request the field without applying filters to its values <code><value</code>: Match any less than value <code><=value</code>: Match any less or equal to value <code>=value</code>: Match value <code>>=value</code>: Match any greater or equal to value <code>>value</code>: Match any greater than value <i>Note: can be used more than once in a single query</i>	<pre>timestamp timestamp=2021-01-01T15:25 timestamp>=2022-01-01&timestamp<2023-01-01 timestamp>1683786900</pre>
	absorbed_dose_rate	number	Absorbed radiation dose rate	μGy/hour	<pre>absorbed_dose_rate absorbed_dose_rate>=2</pre>
	dose_equivalent_rate	number	Dose equivalent rate	μSv/hour	<pre>dose_equivalent_rate dose_equivalent_rate<=20</pre>
	flux	number	Particle flux	cm ⁻² sr ⁻¹ s ⁻¹	<pre>flux flux<1</pre>
	latitude	number	Latitude of a spacecraft at given timestamp, where available. This and the values below are currently only tracked for the ISS and are blank (NA) for others.	deg	<pre>latitude latitude<-10</pre>

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Examples

• Key-value pair syntax

- Dose rate and flux readings from DosTel-type instruments on the ISS between 11 PM on 01 Apr 2022, inclusive, and 1:05 AM on 02 Apr 2022, non-inclusive, only where the dose rate is above 2 $\mu\text{Gy}/\text{hour}$, together with the spatial and magnetic coordinates of the ISS, formatted as HTML:

- Conceptually:

```
https://visualization.osdr.nasa.gov/radlab/api/  
?spacecraft=ISS  
&instrument=DosTel  
&timestamp=>2022-04-01T23:00  
&timestamp<2022-04-02T01:05  
&absorbed_dose_rate>2  
&flux  
&latitude  
&longitude  
&altitude  
&b  
&l  
&format=html
```

- URL-encoded (may not be necessary):

```
https://visualization.osdr.nasa.gov/radlab/api/  
?spacecraft=ISS  
&instrument=DosTel  
&timestamp%3E=2022-04-01T23%3A00  
&timestamp%3C2022-04-02T01%3A05  
&absorbed_dose_rate%3E2  
&flux  
&latitude  
&longitude  
&altitude  
&b  
&l  
&format=html
```

- Full URL: https://visualization.osdr.nasa.gov/radlab/api/?spacecraft=ISS&instrument=DosTel×tamp%3E=2022-04-01T23%3A00×tamp%3C2022-04-02T01%3A05&absorbed_dose_rate%3E2&flux&latitude&longitude&altitude&b&l&format=html

- Full URL without encoding (should work in most browsers, Python, ...): https://visualization.osdr.nasa.gov/radlab/api/?spacecraft=ISS&instrument=DosTel×tamp=>2022-04-01T23:00×tamp<2022-04-02T01:05&absorbed_dose_rate>2&flux&latitude&longitude&altitude&b&l&format=html

• Boolean expression syntax

- Dose rate readings from all detectors in either the Cupola or JPM modules, between 5 Dec 2019 inclusive and 25 Dec 2019, non-inclusive; also retrieve the value of "Instrument_family" for each reading and format the output as TSV:

RadLab: API

timestamp	instrument_id	absorbed_dose_rate	altitude	b	flux	l	latitude	longitude	module	spacecraft
2022-04-01T00:00:00	REM-Lid	0.9107814	416.851987	32511.1	0.0731268...	1.09344	-8.324694	162.94325	Columbus	ISS
2022-04-01T00:00:00	DosTel2	2.368557	416.851987	32511.1	0.1394459...	1.09344	-8.324694	162.94325	Columbus	ISS
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2022-04-01T00:00:00	LidAl	2.2391858088147	416.851987	32511.1	0.0982921...	1.09344	-8.324694	162.94325	Columbus	ISS
2022-04-01T00:05:00	REM-Lid	2.0818824	415.176415	27547.8	0.1663191...	1.02651	6.951546	173.790418	Columbus	ISS
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2022-04-01T00:05:00	DosTel1	1.87163492307692	415.176415	27547.8	0.1053458...	1.02651	6.951546	173.790418	Columbus	ISS
2022-04-01T00:05:00	LidAl	2.0517677736311	415.176415	27547.8	0.0981521...	1.02651	6.951546	173.790418	Columbus	ISS
2022-04-01T00:10:00	REM-Lid	2.291432	416.22943	28879	0.1320885...	1.15888	21.89461	-174.5494...	Columbus	ISS
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2022-04-01T00:15:00	REM-Lid	3.86292	419.150222	34088	0.2971092...	1.52678	35.576278	-160.0008...	Columbus	ISS
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2022-04-01T00:20:00	DosTel1	7.80761766666667	422.420509	40921.5	0.3730812...	2.36792	46.397315	-139.8094...	Columbus	ISS
2022-04-01T00:20:00	LidAl	6.11440798239105	422.420509	40921.5	0.2980769...	2.36792	46.397315	-139.8094...	Columbus	ISS
2022-04-01T00:25:00	REM-Lid	11.048988	424.567687	45611.9	0.5415207...	3.89651	51.663254	-112.4683...	Columbus	ISS
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2022-04-01T00:25:00	LidAl	6.96877643785163	424.567687	45611.9	0.3478796...	3.89651	51.663254	-112.4683...	Columbus	ISS
2022-04-01T00:30:00	REM-Lid	11.574072	424.812496	45307.7	0.5625323...	3.85842	49.120498	-83.450832	Columbus	ISS
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2022-04-01T00:30:00	DosTel1	10.82385166666667	424.812496	45307.7	0.5084686...	3.85842	49.120498	-83.450832	Columbus	ISS
2022-04-01T00:30:00	LidAl	6.38013989877022	424.812496	45307.7	0.3076296...	3.85842	49.120498	-83.450832	Columbus	ISS
2022-04-01T00:35:00	REM-Lid	7.364856	423.385667	39608.2	0.3250669...	2.25814	39.968035	-60.605414	Columbus	ISS
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2022-04-01T00:35:00	DosTel1	6.70494814102564	423.385667	39608.2	0.3208913...	2.25814	39.968035	-60.605414	Columbus	ISS

GeneLab/ALSDA Applications: OSDR and EDA*

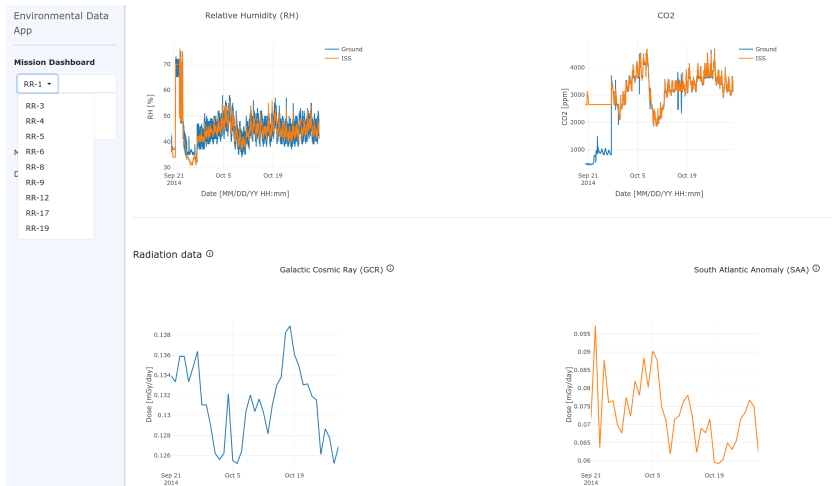
The screenshot displays the NASA GeneLab/ALSDA web application. The top navigation bar includes the NASA logo, the text "Open Science for Life in Space", and links for Home, About, Data & Tools, Research & Resources, Working Groups, and Help. A search bar is located on the left side of the header. Below the header, a sidebar on the left contains a search bar and a list of navigation options: Description (selected), Missions, Experiments, Studies, Hardware, Subjects/Biospecimens, and Files. The main content area features a header for "RR-1 Rodent Research 1" with a "Payload" button and a share icon. Below this is a "Description" section with a sub-header "Description". The text describes the NASA's Rodent Research Hardware System, its development at Ames Research Center, and its use on the International Space Station (ISS) for long-duration rodent experiments. It mentions the maiden voyage of the system, Rodent Research-1 (RR-1), launched on SpaceX-4 CRS-4 on September 21, 2014, and returned on October 25, 2014. The text also notes that RR-1 was the longest duration spaceflight rodent study to date conducted in a NASA facility. The primary goal is for NASA to validate hardware and demonstrate critical research operations, while supporting the Center for the Advancement of Science in Space (CASIS) in sponsoring the first commercial research study. Ten mice were flown to the ISS and transferred into habitat. Five mice were wild type (WT) and identified by an ear notch and the remaining mice, called "Knockouts" had no ear notches. Ten mice were used as ground controls.

PI: Novartis Pharmaceuticals
The mission objectives of the validation flight:

- The addition of the rodent research system expands the utilization of ISS for research on the effects of microgravity on rodents.
- The demonstration of the hardware capability to support rodent research for long-duration missions on ISS is accomplished.
- A validation of the operational capabilities of the hardware to support rodent research provides valuable information applicable to future long-term space missions.
- Validate that the Rodent Research Hardware can deliver and maintain healthy animals.
- Validate that on-orbit activities to support hardware operations can be performed.

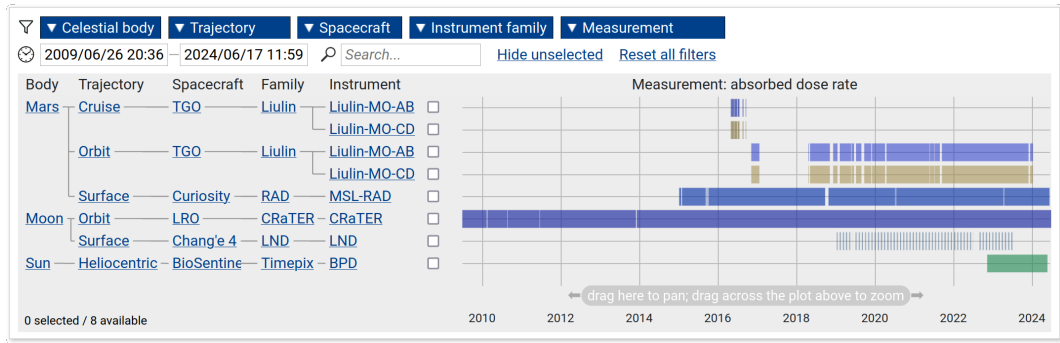
*EDA == the Environmental Data Application

GeneLab/ALSDA Applications: OSDR and EDA*



*EDA == the Environmental Data Application; visualization.osdr.nasa.gov/eda

Modeling Applications



Modeling Applications

Frontier Development Labs: FDL-X Heliolab 2024 Challenge

"Forecasting Radiation Exposure for Human Space Flight"

Team: Elena Massara, Xiaomei Song, Rutuja Gurav, Kimberly Sinclair

Faculty: Matt Kusner, Atılım Güneş Baydin, Bala Poduval

Advisors: Sylvain Costes, Jack Miller, Kirill Grigorev

Resources used: GOES, SDO, RadLab (BioSentinel + CRaTER)

Training an early warning model

frontierdevelopmentlab.org/fdl2024

youtube.com/watch?v=VYe9wpX8PXQ

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ALTEA

ALTEA is a detector on the [ISS](#) which has been deployed in the [US Lab](#) in the [ALTEA-Survey \(ALTEA-30\)](#) configuration, and in the [Columbus](#) module in the [ALTEA-Shield \(ALTEA-Fig\)](#) configuration.

Attributes

Trajectory: [LEO](#)

Spacecraft: [ISS](#)

Modules: [US Lab](#), [Columbus](#)

Time resolution of the currently available data: 60 seconds

References

1. Nariel, L., Casolino, M., Di Fino, L., Larosa, M., Picozza, P., & Zaccante, V. (2015). **Radiation survey in the international space station**. *Journal of Space Weather and Space Climate*, 5, A37. <https://doi.org/10.1002/swsc.2015037>
2. Nariel, L., Berger, T., Burmeister, S., Di Fino, L., Rizzo, A., Matthä, D., & Reitz, G. (2017). **Exploiting different active silicon detectors in the International Space Station: ALTEA and DOSTEL galactic cosmic radiation (GCR) measurements**. *Journal of Space Weather and Space Climate*, 7, A18. <https://doi.org/10.1002/swsc.2017018>
3. Zeffin, C., Nariel, L., Rios, R. R., Rizzo, A., Stoffe, N., Hessler, D. M., ... & Spence, H. E. (2019). **Comparisons of high-linear energy transfer spectra on the ISS and in deep space**. *Space Weather*, 17(3), 396-418. <https://doi.org/10.1029/2018SW002150>

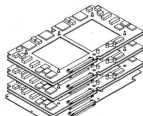
Overview

ALTEA is a detector system composed of six identical silicon strip telescopes, each able to measure the energy loss of all ions most relevant for radiation protection in space ($Z > 1$ to 26). For protons and helium ions, respectively, the energy ranges are 25-45 MeV and 25-250 MeV/n. ALTEA also measures the trajectory of each ion, while using a statistical method to estimate the incident ion charge and energy. Typically [flux](#), LET (Linear Energy Transfer) rate, [absorbed dose rate](#), Q (quality factor), [dose equivalent rate](#) with a time resolution of better than 1 second can be provided. Particle by particle data is also available, as well as LET spectra. In conjunction with orbital data, separation among the important geographical or magnetic regions can be made.

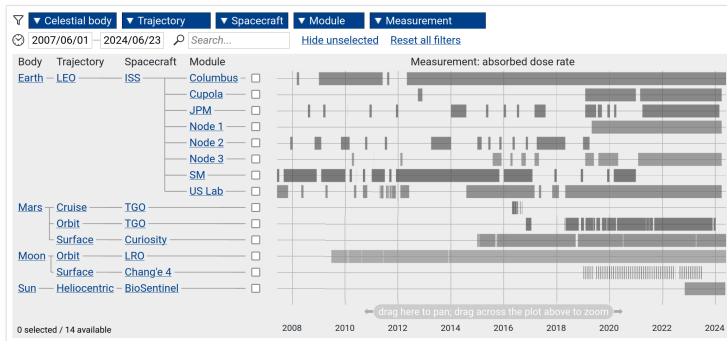
Detector configuration

The ALTEA system is composed of 6 identical Silicon Detector Units (SDU), and one electronic Data Acquisition Unit (DAU). Each SDU is a six-plane particle telescope, with each plane composed of two 8x4 cm² silicon wafers, 389 µm thick, placed side by side on an aluminum support and spaced 5.5 mm apart, for a total surface of 8x16.55 cm². Each silicon wafer is divided into 32 strips, with a pitch of 2.5 mm. Plane orientation alternates between X and Y directions. The distance between an X plane and the adjacent Y plane is 3.75 mm, while the distance between each XY pair is 37.5 mm. The hits in two consecutive planes provide the position of the particle in the X-Y plane, while hits in pairs of planes provide the Z. The outer box of each SDU is made of 1.3 mm thick aluminum and the whole structure results in a double-ended geometrical factor of 230 cm² sr. The field of view reaches 66.8° on the diagonal.

The front-end electronics are located around each double wafer, while at the bottom of the silicon planes, a 7th parallel plane with the same dimensions hosts the Read-Out Electronics board (ROE). (The figure shows the six double wafers plus electronics and—at the bottom—the ROE). The average equivalent thickness of the ROE is estimated to be 0.8 µm of glass + 0.8 µm of copper + 1 µm of silicon.



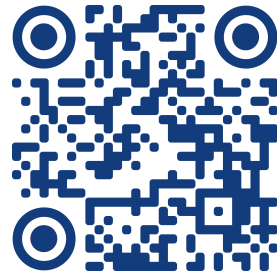
Goals



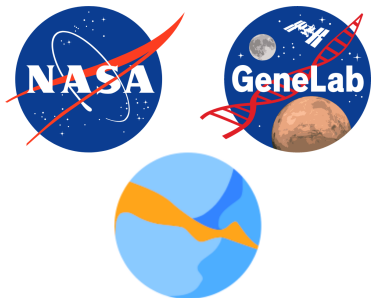
- + Known historical SPE annotations (in both the API and the GUI)
- + Federated GOES and POES data
- + Integration with other resources (e.g. *Space Radiation Intelligence System a.k.a. SPRINTS*)

The RadLab Working Group (RLWG)

- ▶ Integration of new and historical datasets
- ▶ Development of standards (data harmonization, etc.)
- ▶ Guiding the development of the platform
- ▶ Establishing the use of RadLab in radiation and biology research
- ▶ **Collaborative projects** (AWGs)



Acknowledgments



- ▶ People (*alphabetically!*)
 - ▶ Jamie Bales
 - ▶ Sylvain Costes
 - ▶ Samrawit Gebre
 - ▶ Danielle Lopez
 - ▶ Jack Miller
 - ▶ Livio Narici
 - ▶ Lauren Sanders
 - ▶ Amanda Saravia-Butler
 - ▶ Ryan Scott
 - ▶ Ana Uriarte Acuna
 - ▶ *and many more*
- ▶ All collaborators / data providers
- ▶ Compute
 - ▶ NASA Science Managed Compute Environment
- ▶ Support
 - ▶ NASA Space Biology Program
 - ▶ NASA Human Research Program
 - ▶ NASA Biological and Physical Sciences Division

visualization.osdr.nasa.gov/radlab

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