

Telescope Archives

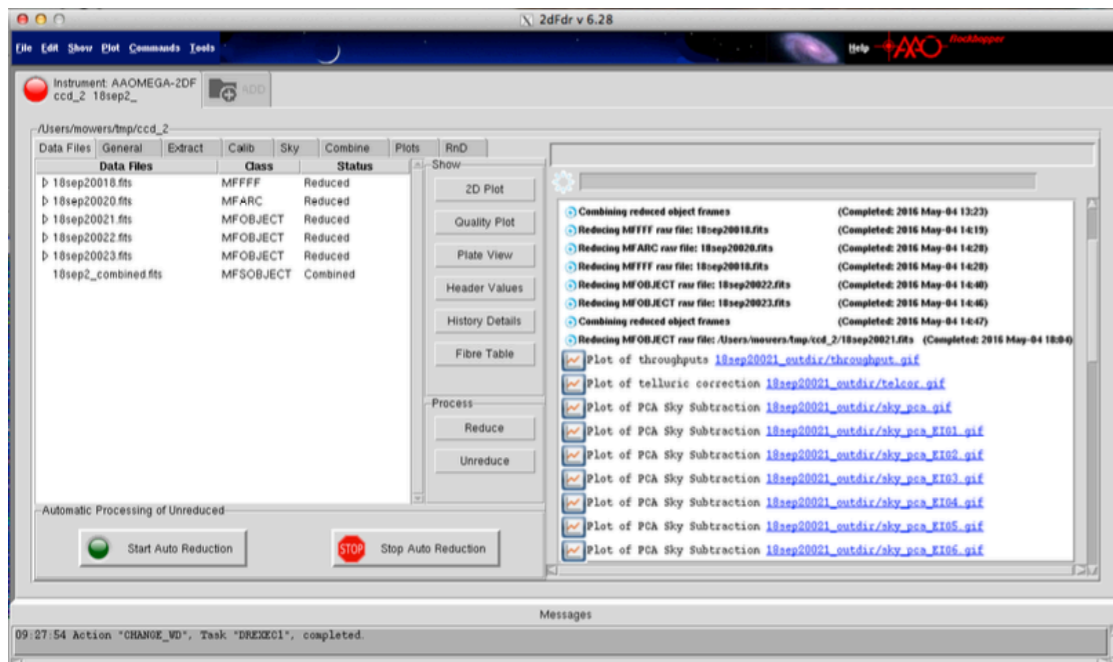
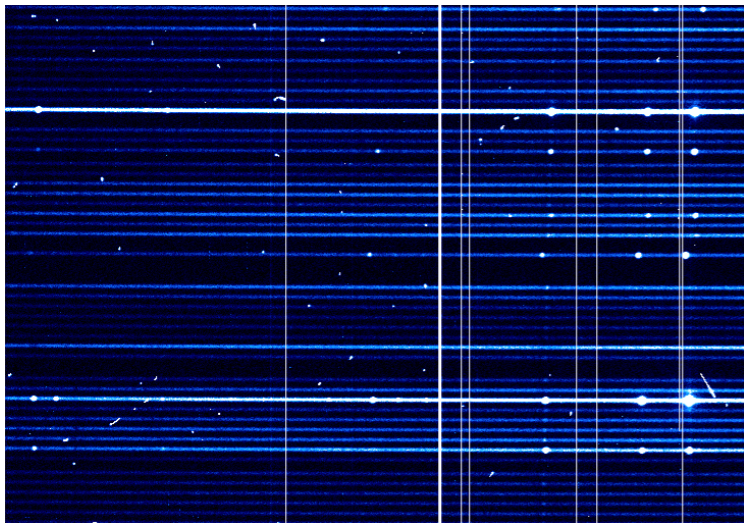
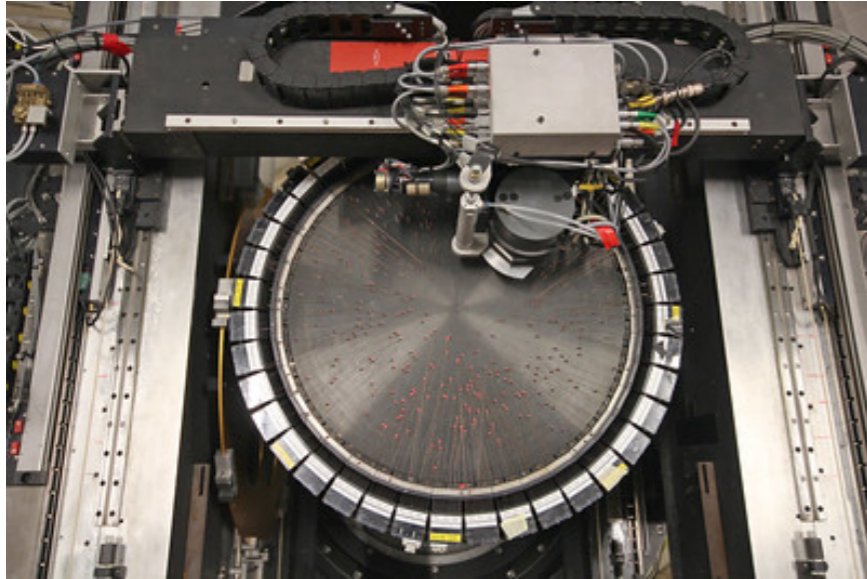
Dr Brent Miszalski

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Part I: PAWS



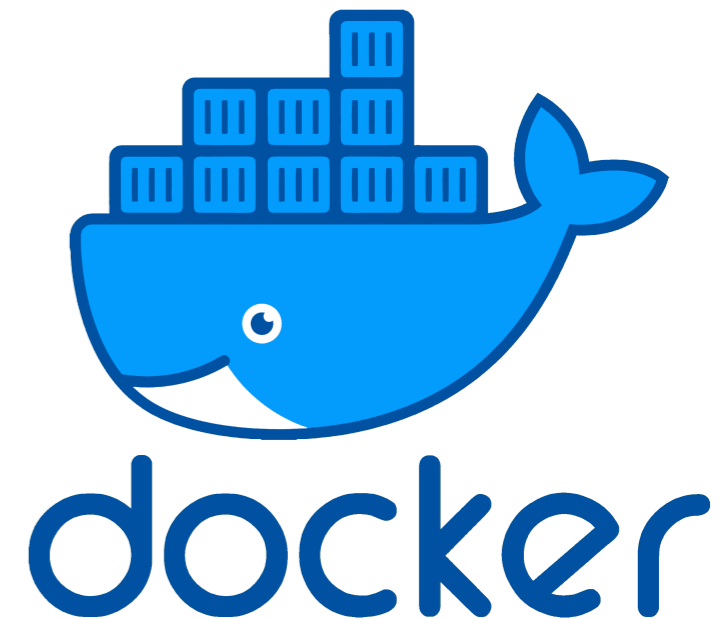
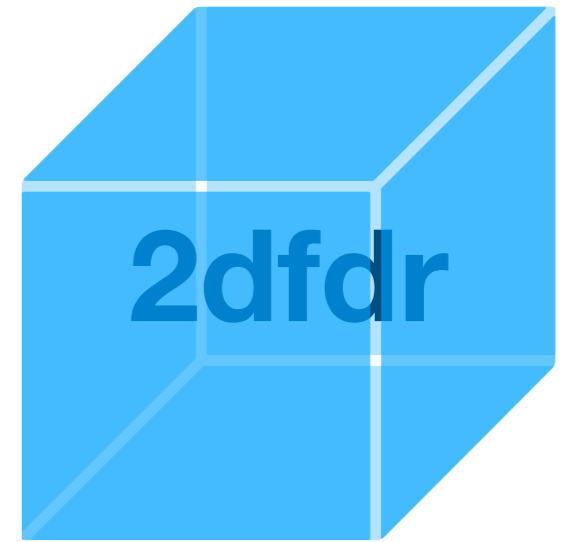
2dF data reduction



- Single 2dF exposure: ~400 spectra
- Data reduction traditionally involves 2 steps:
 - Copy data during observing run or download from AAT archive
 - Reduce data with 2dFdr software
- This approach can be problematic:
 - Difficulties installing 2dFdr (unusual dependencies)
 - Downloading and organising large numbers of observations
 - Scripting possible via command line (aaorun) commands, but these do not scale well for multiprocessing usage. Multiple concurrent 2dFdr processes can crash for obscure reasons.
- New AAT archive will offer On Demand reductions:
 - No need to download data
 - No need to install 2dFdr

2dFdr Pipeline as A Web Service (PAWS)

- 2dFdr installed inside Docker image.
- Run 2dFdr commands off Docker container using Python web service, docker-py and celery (asynchronous task manager).
- **Robust:** Problematic 2dFdr commands that fail are automatically restarted by celery.
- **Fast:** e.g. reduce 960 science exposures in 48 minutes.
- **Current status:** 2dF+AAOmega reductions (beta). Proprietary data reduction supported.
- **Future plans:** Support other 2dF modes (Hermes, KOALA, etc). Adapt PAWS system to ESO pipelines (e.g. FORS, UVES, X-shooter, etc).
- **Possible Future Plans:**
 - Retrospectively reduce archived 2dF observations and make available via SSA service
 - Live reductions of spectra as they are taken off the telescope.
 - Quick staging of reduced spectra (e.g. transient follow-up).



Workflow Overview

- Users do not have to select calibrations (ARC, FLAT, BIAS, DARK)
- Nearby calibrations queried: Use pandas to gather all info from AAT archive (indexed by date)
- Select calibrations closest in time to science observations
- Data grouped according to 2dF plate, grating, camera setup (camang+gratang), field (night + configure .fld name)
- Some basic 2dFdr parameters may be specified
- May still be bugs - please help test if you can at beta.datacentral.org.au

Workflow Overview

```
#start with an empty chain workflow
s = chain()
#do initial notifications (|= appends to the chain)
s |= make_setup.s(uid=uid)
#write the aorun version to the logfile log.2dfdr_aorun_version.txt
s |= echo_version.s(uid=uid,workdir=workdir)
#bias reductions
if(inc_bias):
    s |= make_status_update.s(uid=uid,status="Reducing BIAS frames...")
    s |= group(bias_workflows[i] for i in range(0,len(bias_workflows)))
#dark reductions
if(inc_dark):
    s |= make_status_update.s(uid=uid,status="Reducing DARK frames...")
    s |= group(dark_workflows[i] for i in range(0,len(dark_workflows)))
#science reductions
s |= make_status_update.s(uid=uid,status="Reducing SCIENCE frames...")
s |= group(sci_workflows[i] for i in range(0,len(sci_workflows)))
#splice results
if(len(splice_workflows) > 0):
    s |= make_status_update.s(uid=uid,status="Splicing spectra...")
    s |= chain(splice_workflows[i] for i in range(0,len(splice_workflows)))
#create tar archives
s |= make_status_update.s(uid=uid,status="Creating archives to download...")
s |= make_tarballs.s(uid=uid,config=data)
#do final notifications
s |= make_finish.s(uid=uid)
```

Science workflow

```
(make_tlm.s(uid=uid,workdir=workdir,flat=flat,grat=arcsetup,config=config)
| reduce_arc.s(uid=uid,workdir=workdir,flat=flat,arc=arc,grat=arcsetup,config=config)
| reduce_flat.s(uid=uid,workdir=workdir,arc=arc,flat=flat,grat=arcsetup,config=config)
| group(reduce_object.s(uid=uid,workdir=workdir,flat=flat,arc=arc,obj=objects[i],grat=arcsetup,config=config)
    for i in range(0,len(objects)))
| group(plot_reduced.s(uid=uid,workdir=workdir,fname=re.sub("[fF][iI]?[tT][sS]","red.fits",objects[i]),config=
    for i in range(0,len(objects)))
| combine_spectra.s(uid=uid,workdir=workdir,objs=objects,grat=arcsetup,combined='combined_red.fits')
| plot_reduced.s(uid=uid,workdir=workdir,fname='combined_red.fits',config=config)
```

**make_tlm | reduce_arc | reduce_flat |
reduce_object | plot_reduced |
combine_spectra | plot_reduced**

2dFdr PAWS Screenshots

New AAT archive query results

Request reductions
with 2dFdr PAWS!

1/60 selected.

Download Files

 Reduce With 2dFdr PAWS

||| COLUMNS ▾ FILTERS ≡ DENSITY ↓ EXPORT

fibre_table	ndf_class	targets	OBJECT	EXPOSED	obs_date
VIEW	MFFFF	VIEW	Fibre Flat Field - Quartz_20_2	4	2008-05-29
VIEW	MFARC	VIEW	ARC - FeAr_1 FeAr_2 CuAr_1 CuAr_2 CuHe_1 CuNe_1	30	2008-05-29
VIEW	MFOBJECT	VIEW	S18 MISZALSKI	1800	2008-05-29

Select your 2dFdr PAWS parameters

Request ID: 8e5bc086-911f-48b3-9e40-4f35dab7c4b9

A subset of 2dFdr parameters may be specified.

The default parameters are sufficient for most users.

Changing the defaults may increase the time needed to complete the reductions.

An email notification will be sent upon submission of this request and at completion.

BIAS Reduce BIAS frames in reductions
(instead of using overscan of science frames)

DARK Reduce DARK frames in reductions

COSMIC

Method of Cosmic Ray Rejection

SKYSCR Secondary wavelength calibration from skylines

PCASKY Use PCA after normal sky subtraction

TELCOR Correct for telluric absorption

RWSS Include spectra without sky subtraction in the rwss extension

Email

Notifications will be sent to this address

Make it so!

2dFdr Parameters

**Once reductions are
requested, user
redirected to this page**

**Custom reduction task
manager developed for
2dFdr PAWS**

Email notification

Data Central: 2dfdr PAWS reductions Inbox x



noreply@datacentral.org.au

Tue, 5 Apr, 10:19 (3 days ago)



to me ▾

Dear Brent Miszalski,

The 2dFdr Pipeline As a Web Service (PAWS) has started to reduce your data.

You may check the status of the reductions [here](#).

Another email will be sent to you upon completion.

Best regards,

Data Central and 2dFdr PAWS 🐾

Data Central, AAO North Ryde, Sydney,



Sent:
◆ **At job start**
◆ **At job completion**



noreply@datacentral.org.au

Tue, 5 Apr, 10:23 (3 days ago)



to me ▾

Dear Brent Miszalski,

The 2dFdr Pipeline As a Web Service (PAWS) has successfully reduced your data.

You may download the data products from [here](#).

Best regards,

Data Central and 2dFdr PAWS 🐾

Data Central, AAO North Ryde, Sydney, Australia



Users can keep track of the status of their 2dFdr requests

List of reduction jobs

The screenshot shows a web interface for 'data central'. The user is logged in as 'bmiszalski'. The navigation menu includes 'Requests', 'Docs', and 'Logout'. The main content area is titled 'Recent 2dFdr PAWS requests' and includes a sub-header: 'Brent Miszalski, you have 5 requests in the last 7 days.' Below this is a table with 5 rows of request data.

Request ID	Status	Nfiles	Requested (Sydney)
5594b0a8-1689-4e4b-b3da-6d3e1ae8baf0	✓ Finished	6	2022-04-05T10:18:40
374a25f4-9e5d-4628-ba01-7b09a8e51477	✓ Finished	1	2022-04-01T12:40:25
969d4942-c38b-4669-8080-56ea1d30e7cb	✓ Finished	1	2022-04-01T12:27:00
619b0075-7aa8-4a76-a064-a16690111517	✓ Finished	1	2022-04-01T10:12:47
8e5bc086-911f-48b3-9e40-4f35dab7c4b9	🐾 Initialised	1	2022-04-01T09:54:33

Custom reduction task manager developed for 2dFdr PAWS

Status page of request

data central bmiszalski Requests Docs Logout

Status of 2dFdr PAWS request

Request ID: 5594b0a8-1689-4e4b-b3da-6d3e1ae8baf0

Current status: Finished

Your data were successfully reduced.
You may interactively view the reduced spectra [via the 2dF Explorer.](#)

The following download options are available:

- Reduced files
- Reduced and raw files
- All files

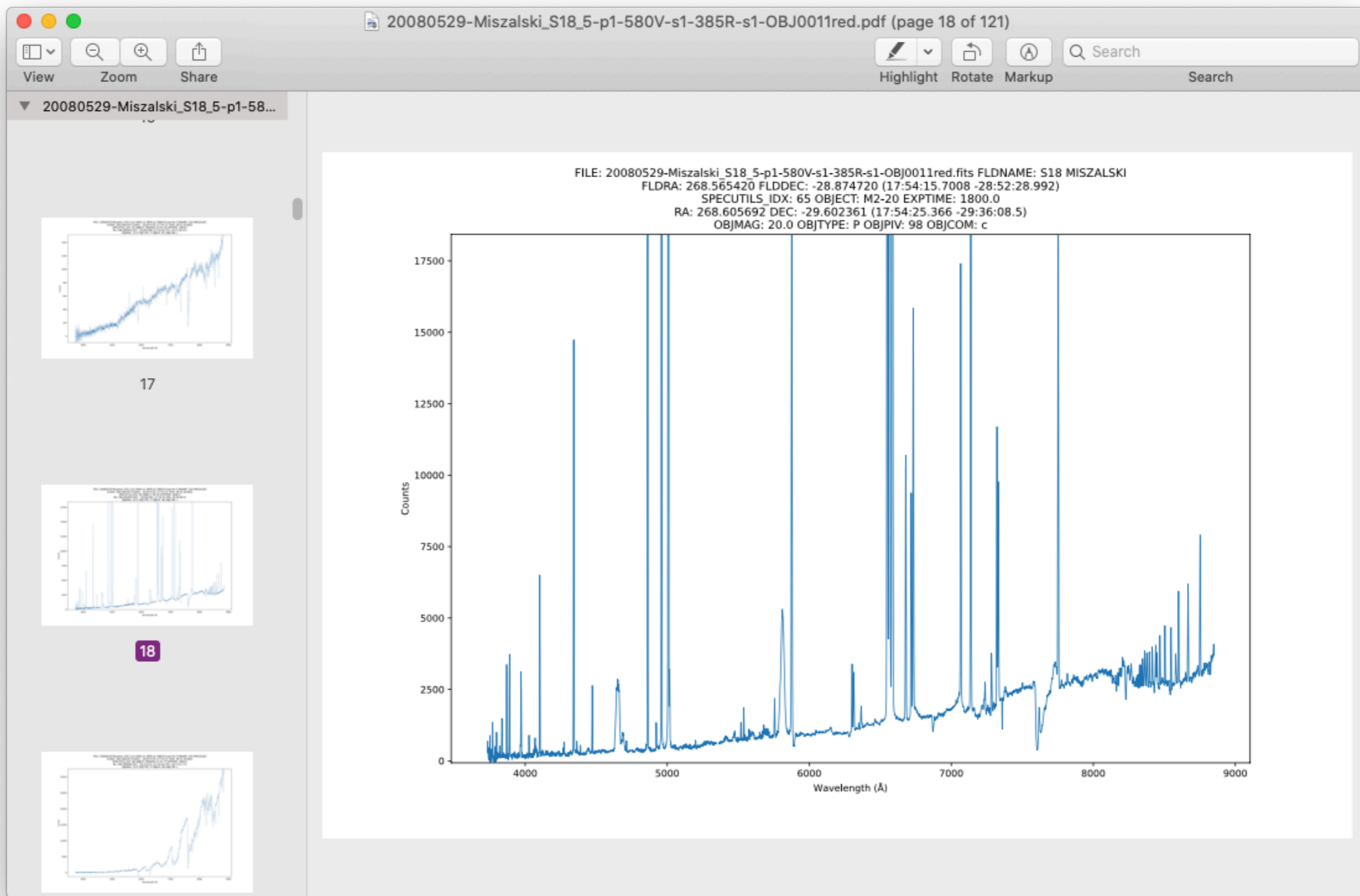
All of the above downloads include:

- Log file output of the executed 2dFdr (aaorun) commands.
- Generated pdf files that plot each spectrum of each data product.

- Users can download their data
 - Reduced files only
 - Reduced and raw files
 - Everything
- Log files and plots of spectra are included
- Users may also explore the data products interactively

**Custom reduction task
manager developed for
2dFdr PAWS**

Generated PDFs of all reduced spectra



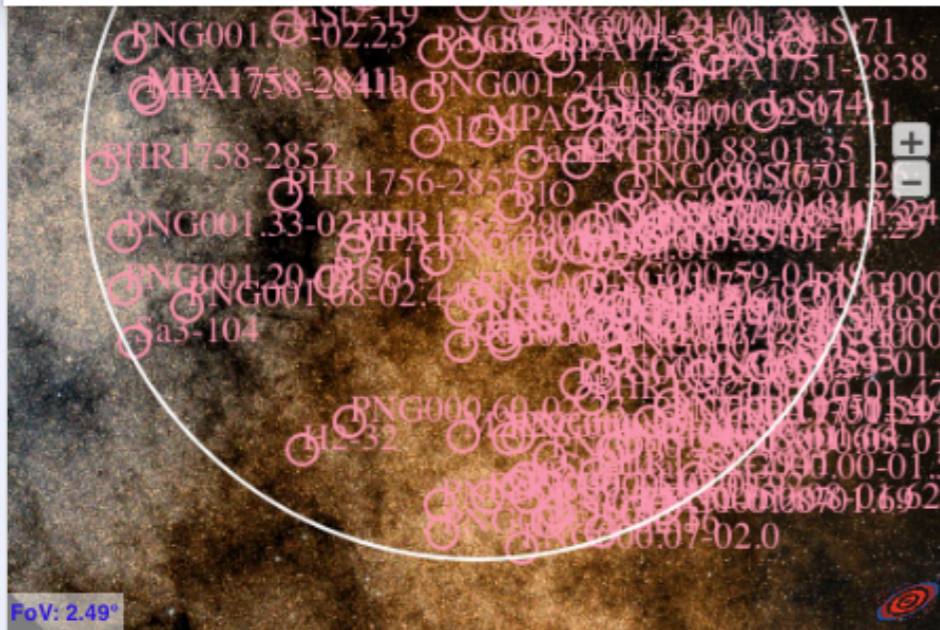
2dF Explorer

Explore 2dFdr data products

Request ID: 5594b0a8-1689-4e4b-b3da-6d3e1ae8baf0

Select a data product to explore

- ✓ 1/385R/s1/20080529-Miszalski_S18_5-p1/OBJ0011red.fits
- 1/385R/s1/20080529-Miszalski_S18_5-p1/OBJ0012red.fits
- 1/385R/s1/20080529-Miszalski_S18_5-p1/OBJ0013red.fits
- 1/385R/s1/20080529-Miszalski_S18_5-p1/combined_red.fits
- 1/580V/s1/20080529-Miszalski_S18_5-p1/OBJ0011red.fits
- 1/580V/s1/20080529-Miszalski_S18_5-p1/OBJ0012red.fits
- 1/580V/s1/20080529-Miszalski_S18_5-p1/OBJ0013red.fits
- 1/580V/s1/20080529-Miszalski_S18_5-p1/combined_red.fits
- 1/spliced/20080529-Miszalski_S18_5-p1-580V-s1-385R-s1-OBJ0011red.fits
- 1/spliced/20080529-Miszalski_S18_5-p1-580V-s1-385R-s1-OBJ0012red.fits
- 1/spliced/20080529-Miszalski_S18_5-p1-580V-s1-385R-s1-OBJ0013red.fits
- 1/spliced/20080529-Miszalski_S18_5-p1-580V-s1-385R-s1-combined_red.fits



Summary

Field: S18 MISZALSKI (17:54:15.7008 -28:52:28.992) **Exp:** 1800s 

Target: Click a target in Aladin lite to view its spectrum below

Users can select which data products they want to explore

2dF field position displayed in Aladin Lite

2dF Explorer

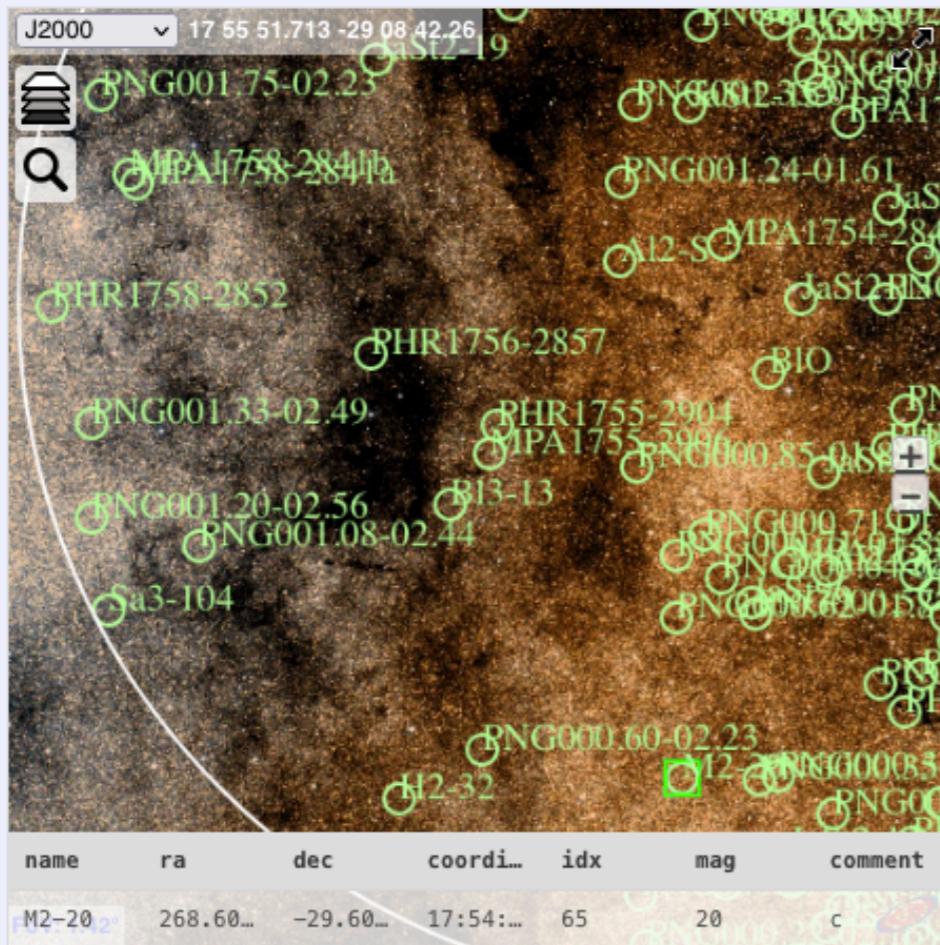
Explore 2dFdr data products

Request ID: 5594b0a8-1689-4e4b-b3da-6d3e1ae8baf0

Select a data product to explore

1/spliced/20080529-Miszalski_S18_5-p1-580V-s1-385R-s1-combined_re

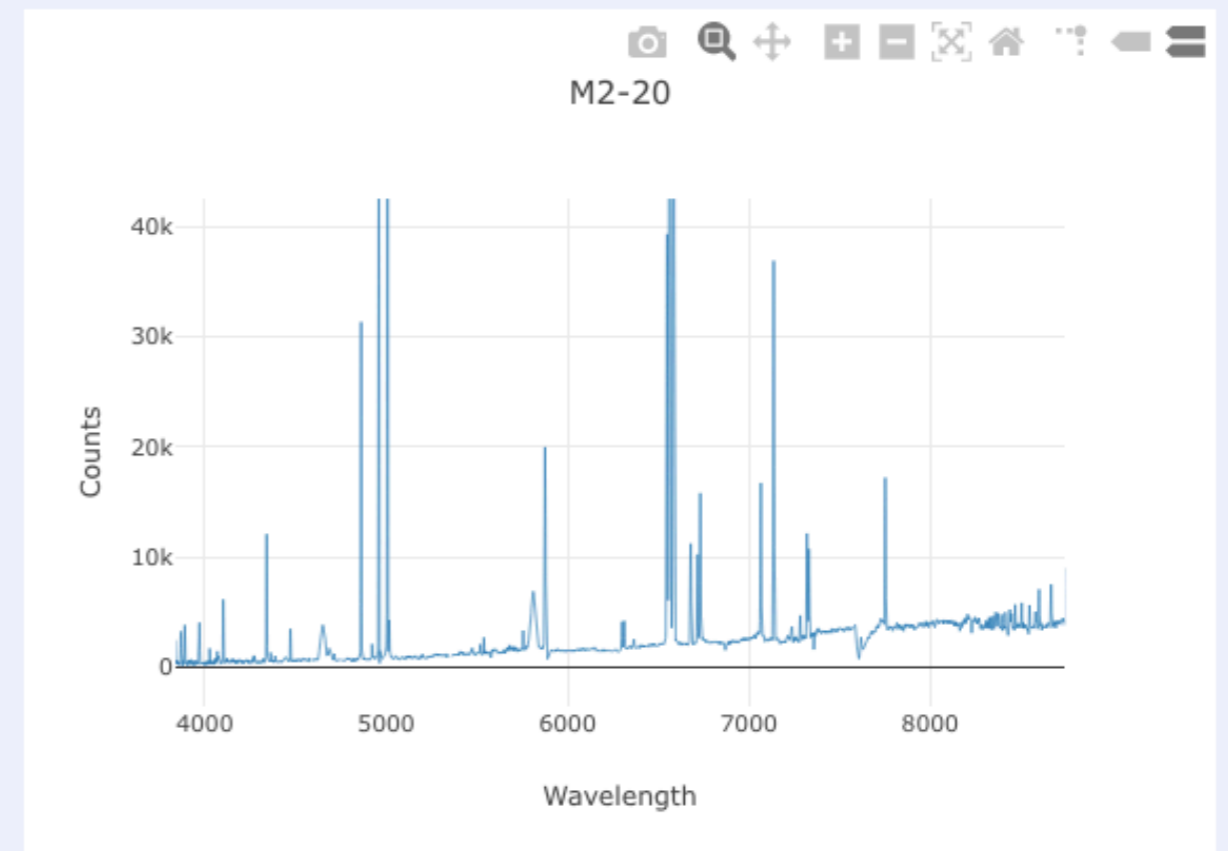
Show Labels



Interactive display of spectra with plotly.js (zoom, screenshot, etc)

Summary

Field: S18 MISZALSKI (17:54:15.7008 -28:52:28.992) Exp: 2100s
Target: M2-20 (17:54:25.366 -29:36:08.5) DAS: *
Magnitude: 20 Comment: c



Users can click on individual fibre positions to LOAD the observed spectra

Demo

<https://beta.datacentral.org.au/results/c0f52b0c-dcca-42e3-8132-5aae08397c3d>

Part II: Accessing Other Observatory Archives

Most archives now have some sort of
programmatic access
(Your Mileage May Vary)

(an incomplete list)
see also

<https://docs.datacentral.org.au/reference/services/data-aggregation-service/>

Gemini archive

Programmatic access via json API:
<https://archive.gemini.edu/help/api.html>

Gemini Observatory Archive

[Help](#) - [About](#) - [Misc Files](#)

Not logged in

PI/Col Name:	<input type="text" value="(leave empty for Any)"/>	<i>(no punctuation; separate with spaces)</i>	Program Title:	<input type="text" value="(leave empty for Any)"/>	<i>(no punctuation; separate with spaces)</i>
Program ID:	<input type="text" value="(leave empty for Any)"/>	<i>(or Obs. ID / Data Label. Exact Match)</i>	Target Name:	<input type="text" value="(leave blank for Any)"/>	<i>(Name of Target)</i>
UTC Date:	<input type="text" value="(leave empty for Any)"/>	<i>(YYYYMMDD or start - end)</i>	Resolver:	<input type="button" value="None"/> <input type="button" value="Resolve"/>	<i>(Name Resolver)</i>
Instrument:	<input type="button" value="Any"/>	<i>(Select GMOS for GMOS-N and GMOS-S)</i>	RA:	<input type="text" value="(leave blank for Any)"/>	<i>(HH:MM:SS.ss or decimal degrees)</i>
Obs. Class:	<input type="button" value="Any"/>	<i>(help)</i>	Dec:	<input type="text" value="(leave blank for Any)"/>	<i>([+/-]DD:MM:SS.ss or decimal degrees)</i>
Obs. Type:	<input type="button" value="Any"/>	<i>(help)</i>	Search radius:	<input type="text" value="(leave blank for 180 arcsec)"/>	<i>(arcsecs or decimal degrees)</i>
Mode:	<input type="button" value="Any"/>	<i>(Imaging / Spectroscopy etc)</i>	Raw / Reduced:	<input type="button" value="Any"/>	<i>(Select data by processing state)</i>
Adaptive Optics:	<input type="button" value="Any"/>	<i>(help)</i>	Publication:	<input type="text" value="(leave empty for Any)"/>	<i>(bibliography code of related publication)</i>

Advanced Options **Column Selection**

(help on buttons)

Set at least one of the search criteria above to search for data. Mouse over the (text in brackets) to see more help for each item.

Example: json API accessed via Python and pandas:

```
url = "https://archive.gemini.edu/jsonsummary/sr=60/dec=-7.08834222636/imaging/ra=307.888365097/canonical/present"
data_json = requests.get(url).json()
df = pd.DataFrame.from_dict(data_json).drop(columns=['types', 'path', 'file_md5', 'data_md5', 'lastmod', 'mdready', 'entrytime', 'md5', 'detector_welldepth_setting', 'detector_readmode_setting'])
print(df)
for idx, row in df.iterrows():
    access_url = "https://archive.gemini.edu/file/" + row['name']
    print(row['object'], row['filter_name'], row['program_id'], row['exposure_time'], access_url)
```

	name	filename	compressed	file_size	data_size	size	program_id	...
0	S20090423S0090.fits	S20090423S0090.fits.bz2	True	1428508	4887360	1428508	GS-2009A-Q-35	...
1	S20090423S0091.fits	S20090423S0091.fits.bz2	True	1387996	4887360	1387996	GS-2009A-Q-35	...
2	S20090423S0092.fits	S20090423S0092.fits.bz2	True	1251783	4887360	1251783	GS-2009A-Q-35	...
3	S20090423S0093.fits	S20090423S0093.fits.bz2	True	1318765	4887360	1318765	GS-2009A-Q-35	...
4	S20090423S0094.fits	S20090423S0094.fits.bz2	True	48944	221760	48944	GS-2009A-Q-35	...
5	S20090423S0095.fits	S20090423S0095.fits.bz2	True	49303	221760	49303	GS-2009A-Q-35	...
6	S20090423S0096.fits	S20090423S0096.fits.bz2	True	49094	221760	49094	GS-2009A-Q-35	...

[7 rows x 56 columns]

```
A70 Ha GS-2009A-Q-35 60.4983 https://archive.gemini.edu/file/S20090423S0090.fits
A70 HaC GS-2009A-Q-35 60.4985 https://archive.gemini.edu/file/S20090423S0091.fits
A70 OIII GS-2009A-Q-35 60.4983 https://archive.gemini.edu/file/S20090423S0092.fits
A70 OIIIC GS-2009A-Q-35 60.4981 https://archive.gemini.edu/file/S20090423S0093.fits
```

ESO archive (TAP)

- In recent years, ESO have added several VO services

- <http://archive.eso.org/cms/eso-data/programmatic-access.html>

- Can access ESO archive via TAP_OBS tables.

- Authenticated access via token: see <http://archive.eso.org/cms/eso-data/programmatic-access/authentication-and-authorisation.html>

SCIENCE ARCHIVE FACILITY **Observational Raw Data Query Form**

How to use? Instrument-specific Interfaces ESO Archive Overview Archive FAQ Archive Facility HOME ESO HOME

This query interface allows to search and to request raw observational data taken by telescopes of the La Silla Paranal Observatory.
New features 9 November 2020:

- You can now limit your queries to either optical or infrared instruments using the MarkOptical and MarkInfrared buttons in the instrument blue panel
- When looking for images in a certain bandpass, constraints can now be provided using wavelengths in nm, or standard bandpass name (see [help page](#))
- At request time, you can decide whether to download any of the following:
 - the selected raw data,
 - the raw or processed calibrations needed to process the selected raw data,
 - the pipeline-processed data generated out of the selected raw data (if they exist)

Read more...

Search Reset Output preferences: html table Return max 200 rows. All Fields Syntax Help

Target, Program, and Scheduling Information

Target Name Resolved by SIMBAD Night (YYYY MM(M) DD)
RA DEC J2000 Otherwise give a query range using the following start/end dates:
Search Box 00 10 00 Input RA(h) DEC(deg) Start 12 hrs [UT] End 12 hrs [UT]
Output Sexagesimal (h, deg) Program ID Program Type Any
PI CoI SV Any
Title
List of Targets Browse... No file selected.

Observing Information

MarkOptical MarkInfrared

Imaging	Spectroscopy	Interferometry	Other
<input type="checkbox"/> EFOSC2/LaSilla	<input type="checkbox"/> CES/LaSilla	<input type="checkbox"/> AMBER/VLTI	<input type="checkbox"/> APICAM/Paranal
<input type="checkbox"/> EMMI/LaSilla	<input type="checkbox"/> CRIRES/VLT	<input type="checkbox"/> GRAVITY/VLTI	<input type="checkbox"/> BOL/APEX
<input type="checkbox"/> FORS1/VLT	<input type="checkbox"/> EFOSC2/LaSilla	<input type="checkbox"/> MATISSE/VLTI	<input type="checkbox"/> HET/APEX
<input type="checkbox"/> FORS2/VLT	<input type="checkbox"/> EMMI/LaSilla	<input type="checkbox"/> MIDI/VLTI	<input type="checkbox"/> LGSF/VLT
<input type="checkbox"/> HAWKI/VLT	<input type="checkbox"/> ESPRESSO/VLT	<input type="checkbox"/> PIONIER/VLTI	<input type="checkbox"/> MAD/VLT
<input type="checkbox"/> GROND/LaSilla	<input type="checkbox"/> FEROS/LaSilla	<input type="checkbox"/> VINCI/VLTI	<input type="checkbox"/> MASCOT/Paranal
<input type="checkbox"/> ISAAC/VLT	<input type="checkbox"/> FORS1/VLT	<input type="checkbox"/> WFCAM/UKIRT	
<input type="checkbox"/> NACO/VLT	<input type="checkbox"/> FORS2/VLT		
<input type="checkbox"/> OMEGACAM/VST	<input type="checkbox"/> GIRAFFE/VLT	Polarimetry	
<input type="checkbox"/> SOFI/LaSilla	<input type="checkbox"/> HARPS/LaSilla	<input type="checkbox"/> ALL NONE	
<input type="checkbox"/> SPHERE/VLT	<input type="checkbox"/> ISAAC/VLT	<input type="checkbox"/> EFOSC2/LaSilla	Sparse Aperture Mask
<input type="checkbox"/> SUSI2/LaSilla	<input type="checkbox"/> KMOS/VLT	<input type="checkbox"/> FORS1/VLT	<input type="checkbox"/> ALL NONE
		<input type="checkbox"/> FORS2/VLT	<input type="checkbox"/> NACO/VLT
		<input type="checkbox"/> SPHERE/VLT	<input type="checkbox"/> SPHERE/VLT

Category SCIENCE CALIB ACQUISITION

Data Product Info

Type Any
User defined input:
Mode Any
User defined input:
Dataset ID
Orig Name
Release Date
OB Name
OB ID
TPL START
Instrumental Setup

http://archive.eso.org/eso/eso_archive_main.html



TOPCAT

Menu item: VO->TAP Query

Table Access Protocol (TAP) Query

Select Service Use Service Resume Job Running Jobs

Locate TAP Service

By Table Properties By Service Properties

Keywords: And

Match Fields: Table Name Table Description Service

Cancel Find Services

Selected TAP services (21/118)

- ▶ TAPVizieR (74/49957) - ivo://cds.vizieer/tap
- ▶ VSA TAP (39/2764) - ivo://wfau.roe.ac.uk/vsa-tap
- ▶ WFAU OSA TAP (17/799) - ivo://wfau.roe.ac.uk/osa-tap
- ▶ ESO TAP_CAT (17/90) - ivo://eso.org/tap_cat
- ▶ GAVO DC TAP (6/206) - ivo://org.gavo.dc/tap
- ▶ **ESO TAP_OBS (6/21)** - ivo://eso.org/tap_obs
- ▶ HEASARC (5/1009) - ivo://nasa.heasarc/services/xamin
- ▶ VVV DR5 - VISTA Variables in the Via Lactea survey (2/133) - ivo://wfau.roe.ac.uk/vvdr5-dsa
- ▶ ATLAS DR1 - VST ATLAS Survey (2/63) - ivo://wfau.roe.ac.uk/atlasdr1-dsa
- ▶ VHS DR4 - VISTA Hemisphere Survey Data Release 4 (2/60) - ivo://wfau.roe.ac.uk/vhsdr4-dsa
- ▶ WSA TAP (1/2100) - ivo://wfau.roe.ac.uk/wsa-tap
- ▶ SSA (1/652) - ivo://wfau.roe.ac.uk/ssa-tap
- ▶ SkyMapper TAP (1/67) - ivo://nci.org.au/skymapper/tap
- ▶ AIP GAVO TAP (1/41) - ivo://aip.gavo.org/tap
- ▶ PADCC TAP (1/32) - ivo://purx/tap
- ▶ HESS DL3 DR1 (1/23) - ivo://vopdc.obspm/luth/hess-dr
- ▶ PADCC TAP (1/23) - ivo://padc.obspm.astro/tap

Selected TAP Service

TAP URL: ⌵

Use Service

Run Query

Metadata

Find:

Name Descrip Or

- TAP_SCHEMA.keys
- TAP_SCHEMA.schemas
- TAP_SCHEMA.tables
- asm (11)
 - asm.ambient_lasilla
 - asm.dimm_paranal
 - asm.historical_ambient_p
 - asm.lhatpros_paranal
 - asm.lhatpros_paranal_irt
 - asm.lhatpros_paranal_pro
 - asm.mass_paranal
 - asm.mass_paranal
 - asm.meteo_apex
 - asm.meteo_lasilla
 - asm.meteo_paranal
 - asm.slodar_paranal
- dbo (2)
 - dbo.raw**
 - dbo.ssa
- ivoa (1)
 - ivoa.ObsCore
- phase3v2 (2)
 - phase3v2.files
 - phase3v2.provenance

Service Schema Table Columns FKeys Hints

Name	Type	Unit	Indexed	Description	UCD
access_url	char(*)		<input type="checkbox"/>	A URL that can be used to download the raw file; the value is...	meta.ref.url
datalink_url	char(*)		<input type="checkbox"/>	A URL that can be used to find the access points of the raw fi...	meta.ref.url
date_obs	char(32*)		<input checked="" type="checkbox"/>	The content of the DATE_OBS keyword exposed as a string a...	time.start;obs.exposure
dec	double	deg	<input checked="" type="checkbox"/>	Declination FK5 J2000	pos.eq.dec;meta.main
dec_pnt	double	deg	<input type="checkbox"/>	Pointing Declination FK5 J2000 of the telescope	pos.eq.dec;instr.tel
det_chip1id	char(7*)		<input type="checkbox"/>	Detector chip identification. Read from keyword DET CHIP1 I...	
det_chop_ncycles	short		<input type="checkbox"/>	Number of cycles for chopping. Read from keyword DET CH...	
det_dit	float	s	<input type="checkbox"/>	Detector Integration Time (Infrared instruments).	
det_expid	short		<input type="checkbox"/>	Unique exposure ID number. Read from keyword DET EXP I...	
det_ndit	short		<input type="checkbox"/>	Number of exposures, each with det_dit integration time (Infr...	
dp_cat	char(10*)		<input type="checkbox"/>	Observation category: SCIENCE,CALIB,ACQUISITION,TECHNIC...	meta.code.class;obs
dp_id	char(30*)		<input checked="" type="checkbox"/>	The main unique ESO archive file identifier	meta.id;meta.dataset
dp_tech	char(30*)		<input type="checkbox"/>	Mode/technique used for the observation	meta.code.class;instr.setup
dp_type	char(30*)		<input type="checkbox"/>	Type of observation/exposure	meta.code.class;obs
ecl_lat	double	deg	<input checked="" type="checkbox"/>	Ecliptic latitude of the observation.	pos.ecliptic.lat
ecl_lon	double	deg	<input checked="" type="checkbox"/>	Ecliptic longitude of the observation.	pos.ecliptic.lon
exp_start	char(*)		<input checked="" type="checkbox"/>	The start time of the observation (format: ISO-8601).	time.start;obs.exposure
exposure	float	s	<input checked="" type="checkbox"/>	Total exposure time on target.	time.duration;obs.exposure
filter_path	char(255*)		<input checked="" type="checkbox"/>	All filters. The string is in the format <value>,<value>,... w...	instr.setup;instr.filter
gal_lat	double	deg	<input checked="" type="checkbox"/>	Galactic latitude of the observation.	pos.galactic.lat
gal_lon	double	deg	<input checked="" type="checkbox"/>	Galactic longitude of the observation.	pos.galactic.lon
grat_path	char(255*)		<input checked="" type="checkbox"/>	All gratings. The string is in the format <value>,<value>,... ..	instr.setup
gris_path	char(255*)		<input checked="" type="checkbox"/>	All grisms. The string is in the format <value>,<value>,... ..	instr.setup
ins_mode	char(30*)		<input checked="" type="checkbox"/>	Instrument mode	instr.setup
instrument	char(20*)		<input checked="" type="checkbox"/>	Instrument name	meta.id;instr
last_mod_date	char(*)		<input checked="" type="checkbox"/>	The last modification date of this record (format: ISO-8601).	time
mjd_obs	float	d	<input checked="" type="checkbox"/>	Modified Julian Date (JD - 2400000.5) of the start of the obs...	time.start;obs
ob_id	int		<input checked="" type="checkbox"/>	The identifier of the ESO Observation Block, a unique numeri...	meta.id;obs;meta.main

Service Capabilities

Query Language: Max Rows: Uploads:

ADQL Text

Mode:



1

```
SELECT * FROM dbo.raw WHERE ra >=307.888365097-0.1 and ra <=307.888365097+0.1 and dec >=-7.08834222636-0.1 and dec <=-7.08834222636+0.1 and instrument='FORS2'
```

Examples



Info

Run Query

Query results

TOPCAT(3): Table Browser

dp_tech	dp_type	ecl_lat	ecl_lon	exp_start	exposure	filter_path	gal_lat	gal_lon	grat_path	gris_path	ins_mode	instrum...	last_mod_date	mjd_obs	ob_id
SPECTRUM	SKY	11.43854	231.54711	2012-07-08T09:27:20.667Z	899.962		-25.46732	38.12341		GRIS_1200G	LSS	FORS2	2017-05-18T11:45:27.153Z	56116.	20023518
SPECTRUM	SKY	11.43296	231.55743	2009-07-14T09:35:31.933Z	2399.9		-25.46338	38.11138		GRIS_1200G	LSS	FORS2	2017-05-18T11:40:01.677Z	55026.	20018980
IMAGE	SLIT	11.43853	231.54709	2012-07-08T09:24:26.770Z	20.008	I_BESS	-25.46738	38.12332			LSS	FORS2	2012-07-08T12:31:15.490Z	56116.	20023518
SPECTRUM	SKY	11.43296	231.55743	2009-07-14T09:35:31.933Z	2399.9		-25.46338	38.11138		GRIS_1200G	LSS	FORS2	2017-05-18T11:40:11.667Z	55026.	20018980
IMAGE	SLIT	11.43853	231.54709	2012-07-08T09:24:26.770Z	20.008	I_BESS	-25.46738	38.12332			LSS	FORS2	2012-07-08T12:31:12.423Z	56116.	20023518
IMAGE	SLIT	11.43296	231.55743	2009-07-14T09:34:08.587Z	30.001	OIII/3000	-25.46341	38.11127			LSS	FORS2	2011-07-15T02:04:57.087Z	55026.	20018980
IMAGE	SLIT	11.43648	231.5629	2010-06-17T09:44:49.800Z	30.002	OIII/3000	-25.45706	38.11031			LSS	FORS2	2011-07-15T13:36:50.260Z	55364.	20020407
IMAGE	SKY	11.42871	231.54971	2012-07-08T09:20:29.700Z	60.005	H_ALPHA	-25.47191	38.11324			LSS	FORS2	2012-07-08T12:31:11.427Z	56116.	20023518
IMAGE	SLIT	11.43854	231.54711	2012-07-08T09:25:47.817Z	9.999	I_BESS	-25.46735	38.1233			LSS	FORS2	2012-07-08T12:31:16.083Z	56116.	20023518
IMAGE	OBJECT	11.43838	231.55382	2009-07-14T09:28:41.303Z	119.994	OIII	-25.46251	38.11837			IMG	FORS2	2011-07-15T02:04:52.170Z	55026.	20018980
IMAGE	SLIT	11.43296	231.55743	2009-07-14T09:34:08.587Z	30.001	OIII/3000	-25.46341	38.11127			LSS	FORS2	2011-07-15T02:04:52.377Z	55026.	20018980
IMAGE	SKY	11.43312	231.55724	2010-06-17T09:41:29.113Z	30.001	OIII/3000	-25.46345	38.11154			LSS	FORS2	2011-07-15T13:36:47.053Z	55364.	20020407
IMAGE	OBJECT	11.43838	231.55382	2009-07-14T09:28:41.303Z	119.994	OIII	-25.46251	38.11837			IMG	FORS2	2011-07-15T02:04:53.197Z	55026.	20018980
IMAGE	SLIT	11.43648	231.5629	2010-06-17T09:44:49.800Z	30.002	OIII/3000	-25.45706	38.11031			LSS	FORS2	2011-07-15T13:36:45.027Z	55364.	20020407
IMAGE	SKY	11.43226	231.55509	2010-06-19T09:35:26.227Z	29.989	OIII/3000	-25.4656	38.11237			LSS	FORS2	2011-07-15T13:38:13.253Z	55366.	20020417
IMAGE	SLIT	11.43505	231.57	2010-06-19T09:38:44.293Z	30.001	OIII/3000	-25.45276	38.10404			LSS	FORS2	2011-07-15T13:38:11.963Z	55366.	20020417
SPECTRUM	SKY	11.43505	231.57	2010-06-19T09:40:14.190Z	1799.93		-25.45273	38.10415		GRIS_1200G	LSS	FORS2	2017-05-18T11:41:16.243Z	55366.	20020417
SPECTRUM	SKY	11.43854	231.54711	2012-07-08T09:44:41.150Z	1199.95		-25.46732	38.12341		GRIS_1200G	LSS	FORS2	2017-05-18T11:45:48.993Z	56116.	20023518
IMAGE	SKY	11.43854	231.54711	2012-07-08T10:07:27.210Z	299.992	H_ALPHA	-25.46735	38.1233			LSS	FORS2	2012-07-08T13:01:24.073Z	56116.	20023518
IMAGE	SLIT	11.43174	231.55333	2010-06-19T09:37:28.167Z	30.002	OIII/3000	-25.46724	38.11318			LSS	FORS2	2011-07-15T13:38:19.743Z	55366.	20020417
SPECTRUM	SKY	11.43505	231.57	2010-06-19T09:40:14.190Z	1799.93		-25.45273	38.10415		GRIS_1200G	LSS	FORS2	2017-05-18T11:41:10.170Z	55366.	20020417
SPECTRUM	SKY	11.43648	231.5629	2010-06-17T09:46:28.517Z	1799.93		-25.45702	38.11042		GRIS_1200G	LSS	FORS2	2017-05-18T11:41:41.830Z	55364.	20020407
SPECTRUM	SKY	11.43648	231.5629	2010-06-17T09:46:28.517Z	1799.93		-25.45702	38.11042		GRIS_1200G	LSS	FORS2	2017-05-18T11:41:24.257Z	55364.	20020407
IMAGE	SLIT	11.43853	231.54704	2012-07-08T09:23:05.873Z	26.001	I_BESS	-25.46741	38.12334			LSS	FORS2	2012-07-08T12:31:11.767Z	56116.	20023518
IMAGE	SLIT	11.43853	231.54704	2012-07-08T09:23:05.873Z	26.001	I_BESS	-25.46741	38.12334			LSS	FORS2	2012-07-08T12:31:15.690Z	56116.	20023518
SPECTRUM	SKY	11.43854	231.54711	2012-07-08T09:27:20.667Z	899.962		-25.46732	38.12341		GRIS_1200G	LSS	FORS2	2017-05-18T11:45:20.553Z	56116.	20023518
IMAGE	SKY	11.43226	231.55509	2010-06-19T09:35:26.227Z	29.989	OIII/3000	-25.4656	38.11237			LSS	FORS2	2011-07-15T13:38:14.290Z	55366.	20020417
IMAGE	SLIT	11.43505	231.57	2010-06-19T09:38:44.293Z	30.001	OIII/3000	-25.45276	38.10404			LSS	FORS2	2011-07-15T13:38:19.063Z	55366.	20020417
IMAGE	SKY	11.42871	231.54971	2012-07-08T09:20:29.700Z	60.005	H_ALPHA	-25.47191	38.11324			LSS	FORS2	2012-07-08T12:31:13.687Z	56116.	20023518
SPECTRUM	SKY	11.43854	231.54711	2012-07-08T09:44:41.150Z	1199.95		-25.46732	38.12341		GRIS_1200G	LSS	FORS2	2017-05-18T11:45:41.997Z	56116.	20023518
IMAGE	SKY	11.43838	231.55382	2009-07-14T09:31:27.223Z	59.989	OIII/3000	-25.46251	38.11837			LSS	FORS2	2011-07-15T02:04:57.007Z	55026.	20018980
IMAGE	SKY	11.43312	231.55724	2010-06-17T09:41:29.113Z	30.001	OIII/3000	-25.46345	38.11154			LSS	FORS2	2011-07-15T13:36:50.017Z	55364.	20020407
IMAGE	SKY	11.43854	231.54711	2012-07-08T10:07:27.210Z	299.992	H_ALPHA	-25.46735	38.1233			LSS	FORS2	2012-07-08T13:01:24.457Z	56116.	20023518
IMAGE	SKY	11.43838	231.55382	2009-07-14T09:31:27.223Z	59.989	OIII/3000	-25.46251	38.11837			LSS	FORS2	2011-07-15T02:04:52.670Z	55026.	20018980
IMAGE	SLIT	11.43201	231.55573	2010-06-17T09:43:35.343Z	30.002	OIII/3000	-25.46529	38.1117			LSS	FORS2	2011-07-15T13:36:50.330Z	55364.	20020407
IMAGE	SLIT	11.43854	231.54711	2012-07-08T09:25:47.817Z	9.999	I_BESS	-25.46735	38.1233			LSS	FORS2	2012-07-08T12:31:14.970Z	56116.	20023518
IMAGE	SLIT	11.43201	231.55573	2010-06-17T09:43:35.343Z	30.002	OIII/3000	-25.46529	38.1117			LSS	FORS2	2011-07-15T13:36:49.737Z	55364.	20020407
IMAGE	SLIT	11.43174	231.55333	2010-06-19T09:37:28.167Z	30.002	OIII/3000	-25.46724	38.11318			LSS	FORS2	2011-07-15T13:38:17.053Z	55366.	20020417

access_url => Link to download each file

Note: Some files may be compressed: can use <https://github.com/scivision/unlzw3> to uncompress in Python

Can also access calibration data via ESO TAP_OBS for some instruments

Accessing ESO archive via TAP and Python

```
endpoint = 'https://archive.eso.org/tap_obs/'
ra=307.888365097
dec=-7.08834222636
adql = r"""SELECT * FROM dbo.raw WHERE ra >=%s-0.1 and ra <=%s+0.1 and dec >=%s-0.1 and dec <=%s+0.1 and
instrument='FOR2'""" % (ra,ra,dec,dec)
url=endpoint+'sync?REQUEST=doQuery&lang=ADQL&FORMAT=votable&QUERY=' + quote(adql)
print (url)
df = parse_single_table(BytesIO(requests.get(url).content)).to_table(use_names_over_ids=True).to_pandas()
print (df)
```

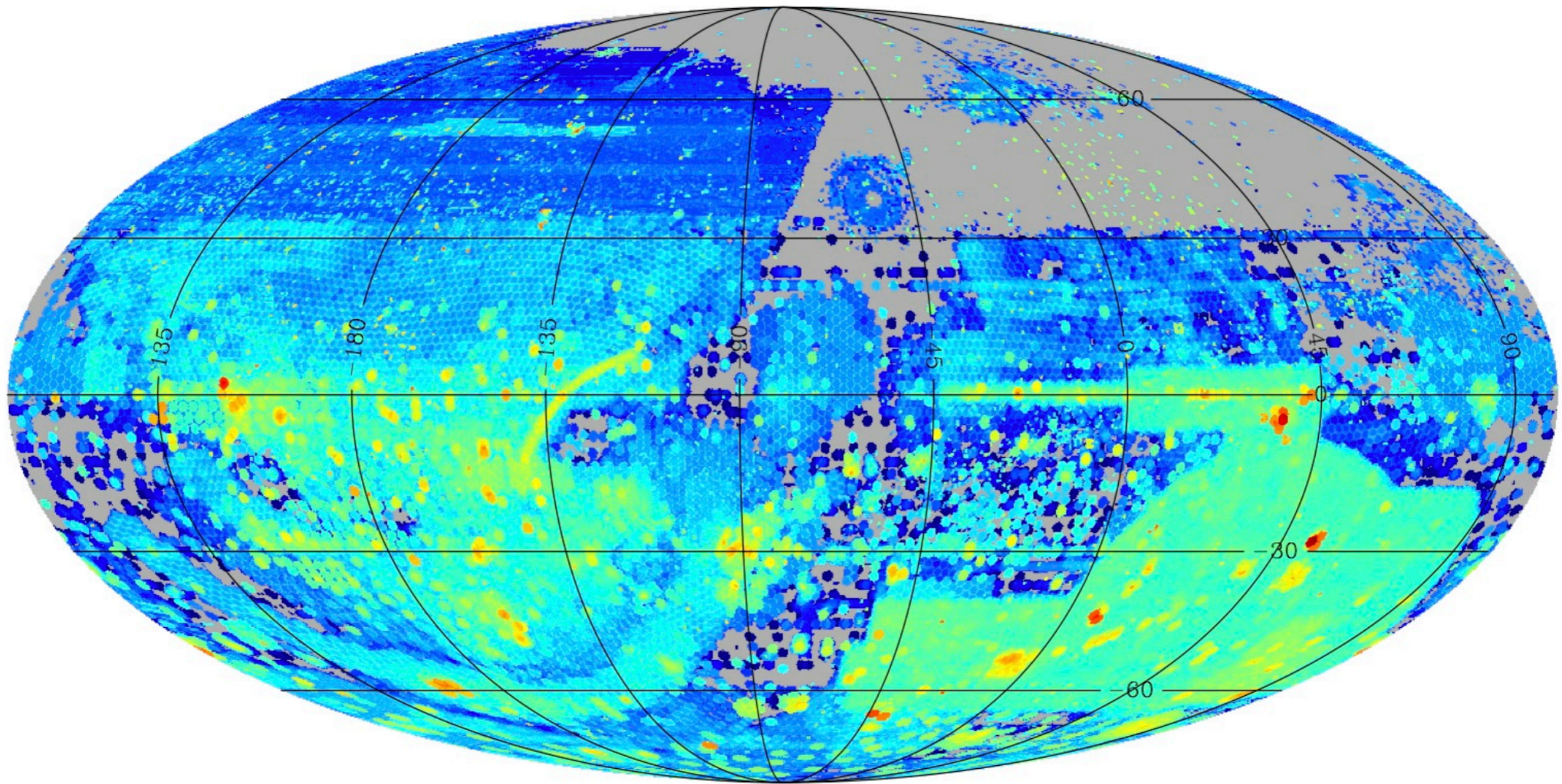
```
for idx, row in df.iterrows():
    print (row['object'],row['exposure'],row['prog_id'],row['ra'],row['dec'],row['filter_path'])
```

```
A70 899.9619750976562 089.D-0453(A) 307.89463111 -7.08651
A70 20.007999420166016 089.D-0453(A) 307.89465888 -7.08651 I_BEES
A70 2399.903076171875 083.D-0654(A) 307.88616111 -7.09444
A70 119.99400329589844 083.D-0654(A) 307.88825388 -7.08831 OIII
A70 30.00200080871582 085.D-0629(A) 307.88004611 -7.09236 OIII/3000
A70 29.98900032043457 085.D-0629(A) 307.88857805 -7.09454 OIII/3000
A70 30.000999450683594 085.D-0629(A) 307.87361805 -7.09548 OIII/3000
A70 1799.9300537109375 085.D-0629(A) 307.87361805 -7.09548
A70 9.99899959564209 089.D-0453(A) 307.89463111 -7.08651 I_BEES
A70 119.99400329589844 083.D-0654(A) 307.88825388 -7.08831 OIII
A70 30.000999450683594 083.D-0654(A) 307.88616111 -7.09444 OIII/3000
A70 30.000999450683594 085.D-0629(A) 307.886305 -7.09424 OIII/3000
A70 1799.9300537109375 085.D-0629(A) 307.88004611 -7.09236
A70 1799.9300537109375 085.D-0629(A) 307.88004611 -7.09236
```

Download file via row['access_url']

About NSF's NOIRLab Astro Data Lab science platform

Lots of DECam +
other data



<https://datalab.noirlab.edu/survey.php>

Noirlab: TAP + SIA

- TAP service: <https://datalab.noirlab.edu/tap>
- SIA v1.0: image cutouts
- Dark Energy Survey (DES) DR2
 - TAP table: **des_dr2.main**
 - SIA: https://datalab.noirlab.edu/sia/des_dr2
- DECam Legacy Survey (LS) DR9:
 - TAP table: **ls_dr9.tractor**
 - SIA: https://datalab.noirlab.edu/sia/ls_dr9
- Other surveys available: SMASH, DECAPS, DELVE, etc.
- Other cutouts available from <https://www.legacysurvey.org/viewer/urls> (e.g. FITS format)
- <https://www.legacysurvey.org/viewer/jpeg-cutout?ra=334.8017&dec=-43.8099&zoom=16&layer=ls-dr9>



CASDA

- Access ASKAP data - lots of VO services available!
- <https://research.csiro.au/casda/>
- TAP service at https://casda.csiro.au/casda_vo_tools/tap
- See also <https://astroquery.readthedocs.io/en/latest/casda/casda.html>



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Questions?