LIneA: astronomical data access interfaces and products

TICAL
Comunidad y tecnología

Encuentro Latinoamericano
eCiencia
2018

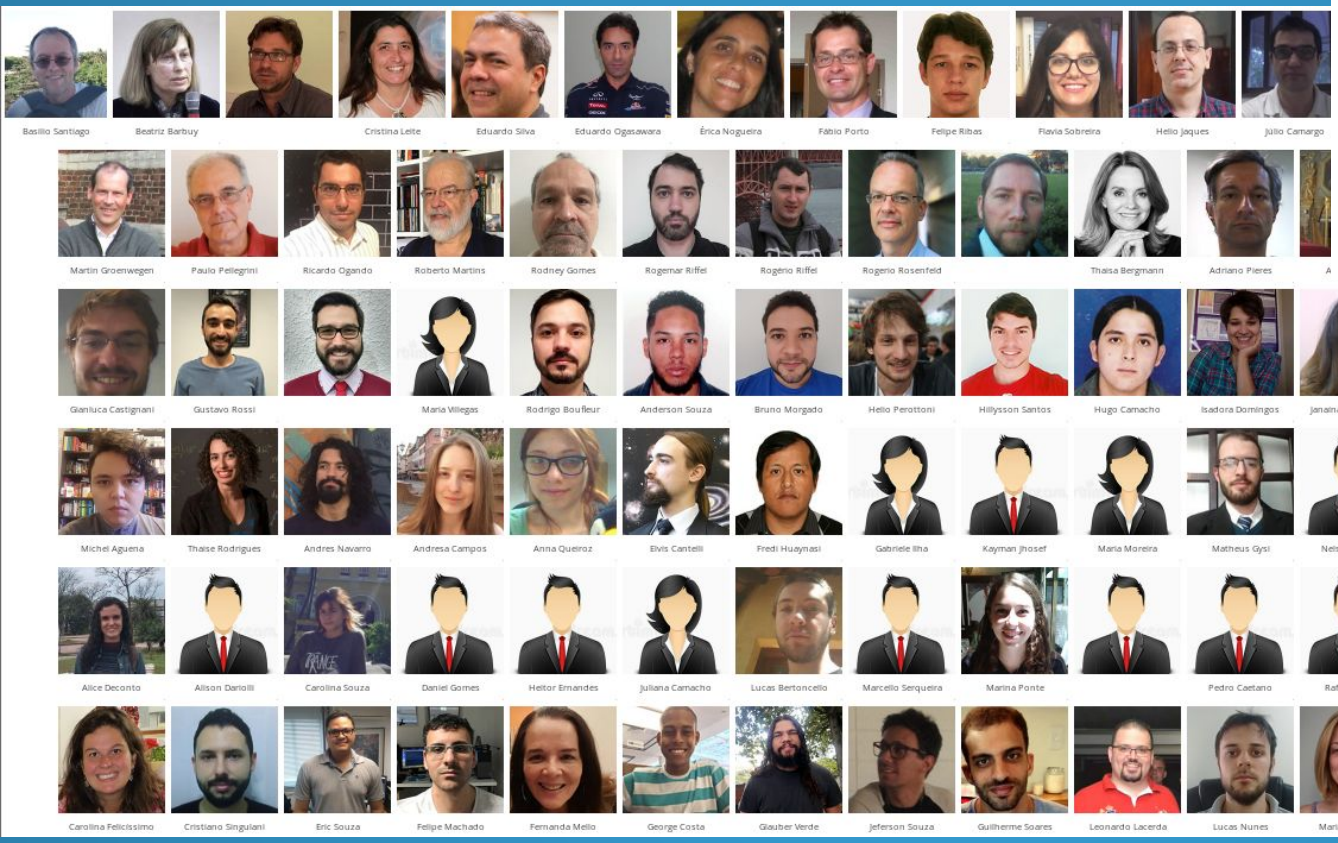
HELLO

Ricardo Ogando

I work at Observatório Nacional and Laboratório Interinstitucional de e-Astronomia (LIneA)

You can find me at 🐦 @thespacelink or ogando@linea.gov.br (see also Luiz Nicolaci da Costa at Ciberinfraestructura para la Ciencia)

LIneA team



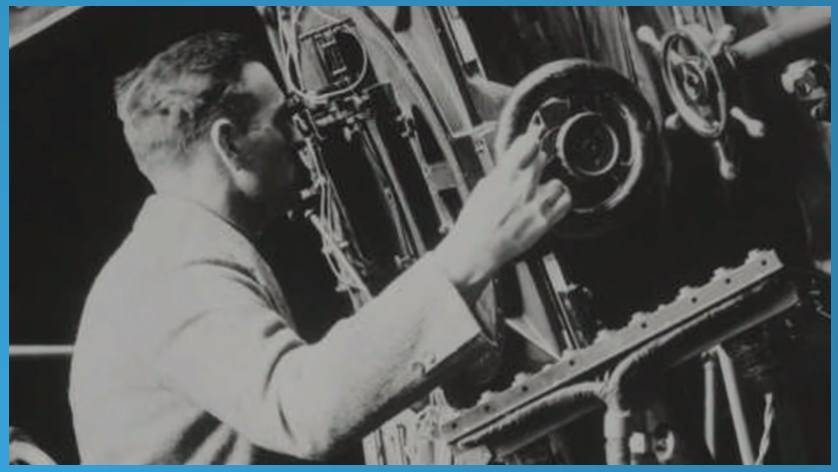
Luiz Nicolaci

Martin Huarca

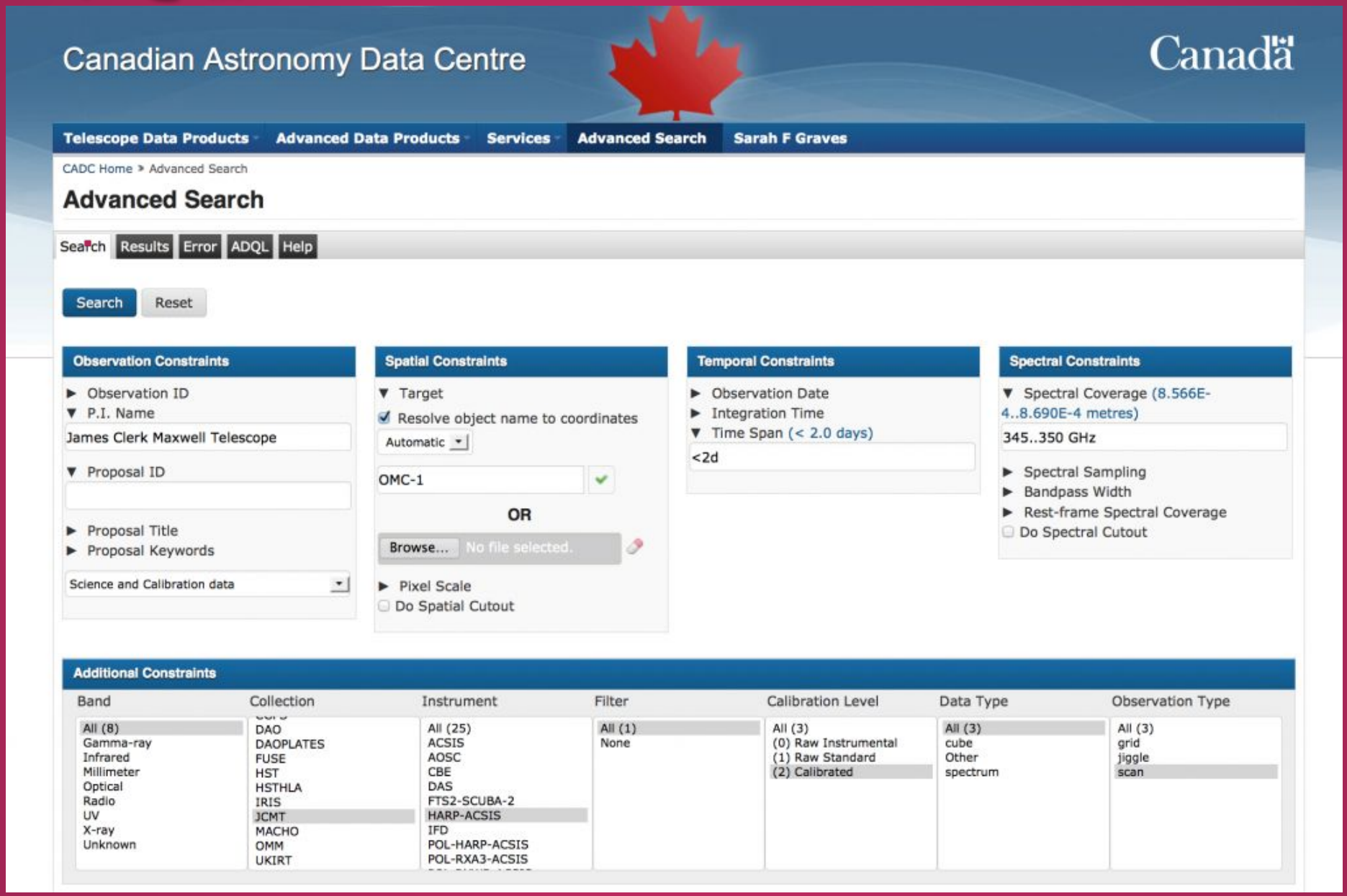
Multidisciplinary team spread over different parts of Brazil

Astronomy compels the soul to look upwards and leads us from this world to another - Plato.

Astronomical data access

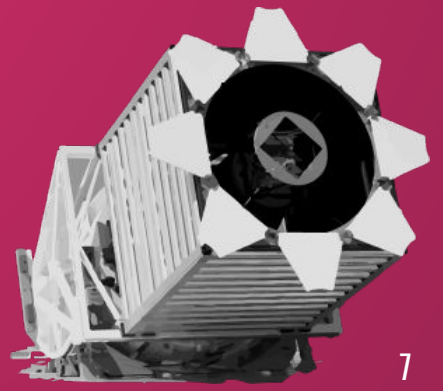


- Observations
- ~One year proprietary period
- Static data access interfaces
  - **Raw** products
  - Advanced products: article results, tables…
- CADC, CDS, IPAC


Canadian Astronomy Data Centre
Canada
Telescope Data Products
Advanced Data Products
Services
Advanced Search
Sarah F Graves
CADC Home » Advanced Search
Advanced Search
Search
Results
Error
ADQL
Help
Search
Reset
Observation Constraints
Observation ID
P.I. Name
James Clerk Maxwell Telescope
Proposal ID
Proposal Title
Proposal Keywords
Science and Calibration data
Spatial Constraints
Target
Resolve object name to coordinates
Automatic
OMC-1
OR
Browse...
No file selected.
Pixel Scale
Do Spatial Cutout
Temporal Constraints
Observation Date
Integration Time
Time Span (< 2.0 days)
<2d
Spectral Constraints
Spectral Coverage (8.566E-4..8.690E-4 metres)
345..350 GHz
Spectral Sampling
Bandpass Width
Rest-frame Spectral Coverage
Do Spectral Cutout
Additional Constraints
Band
All (8)
Gamma-ray
Infrared
Millimeter
Optical
Radio
UV
X-ray
Unknown
Collection
DAO
DAOPLATES
FUSE
HST
HSTHLA
IRIS
JCMT
MACHO
OMM
UKIRT
Instrument
All (25)
ACSIS
AOSC
CBE
DAS
FTS2-SCUBA-2
HARP-ACSIS
IFD
POL-HARP-ACSIS
POL-RXA3-ACSIS
Filter
All (1)
None
Calibration Level
All (3)
(0) Raw Instrumental
(1) Raw Standard
(2) Calibrated
Data Type
All (3)
cube
Other
spectrum
Observation Type
All (3)
grid
jiggle
scan

Sloan Digital Sky Survey

The most detailed three-dimensional maps of the Universe ever made



DR14

- Summary
- Explore
- Search
- Notes
  - Add to Notes
  - Show Notes
- Finding Chart
- Print
- **Help**
  - Tutorial
  - Examples

Powered by SciServer

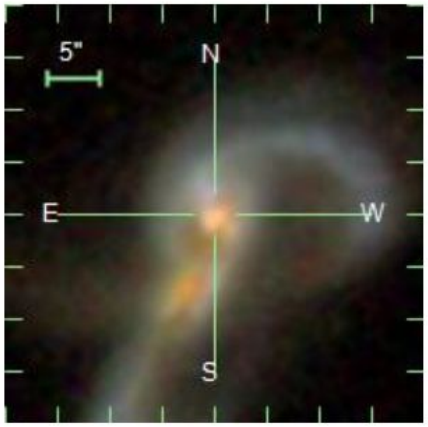
Summary data for: SDSS J151806.13+424445.0

Position Data (How do I find it?)

Object ID (objID):	Right ascension (ra):	Declination (dec):
1237662301903192106	229.525575753922	42.7458537608544

Image Data
(What does it look like?)

Preview image (click to go to Navigate tool)



Object Type (type): GALAXY

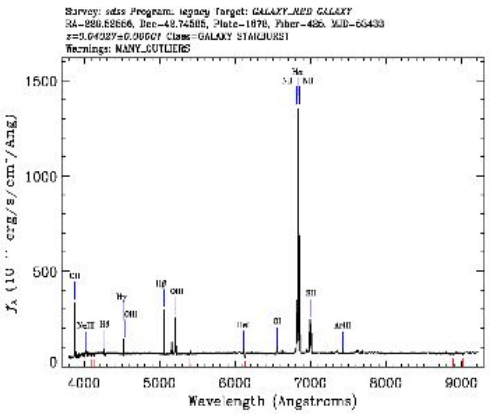
Magnitudes:

Ultraviolet (u):	16.27 ± 0.01
Green (g):	15.30 ± 0.00
Red (r):	14.76 ± 0.00
Infrared - 7600 Å (i):	14.32 ± 0.00
Infrared - 9100 Å (z):	14.02 ± 0.00

Caution: Magnitudes and other data for this object may be unreliable. See the **flags** in the Explore tool summary page for more information.

Spectrum Data
(What does its spectrum look like?)

Preview spectrum (click for a larger version)



Interactive spectrum

Spectral classification (Class): GALAXY

Redshift Data:

Redshift (z):	0.04027193

Get spectrum as CSV

Get spectrum as FITS

SDSS Query / CasJobs

Help Tools Query History MyDB Import Groups Output Schema Browser Profile Queues SkyServer Logout

Context **Table** (optional) **Task Name**

BESTDR14 | MyTable_4 | My Query

Samples | Recent | Clear

Basic SELECT FROM WHERE
Galaxies two criteria
Unclassified spectra
Galaxies multiple criteria
Spatial unit vectors
CVs using colors
Data subsample
Low z QSOs by colors
Velocities and errors
Using BETWEEN
Moving asteroids
Quasars in imaging
Object counts and logic
Galaxy star blends
Stars in specific fields
Using three tables
Objects close pairs
QSOs in spectroscopy
Errors using flags
Elliptical galaxies
Galaxies blue centers
Diameter limited galaxies
Extremely red galaxies
LRG sample
Galaxies by spectra
Galaxies by spectra2
Binary stars colors

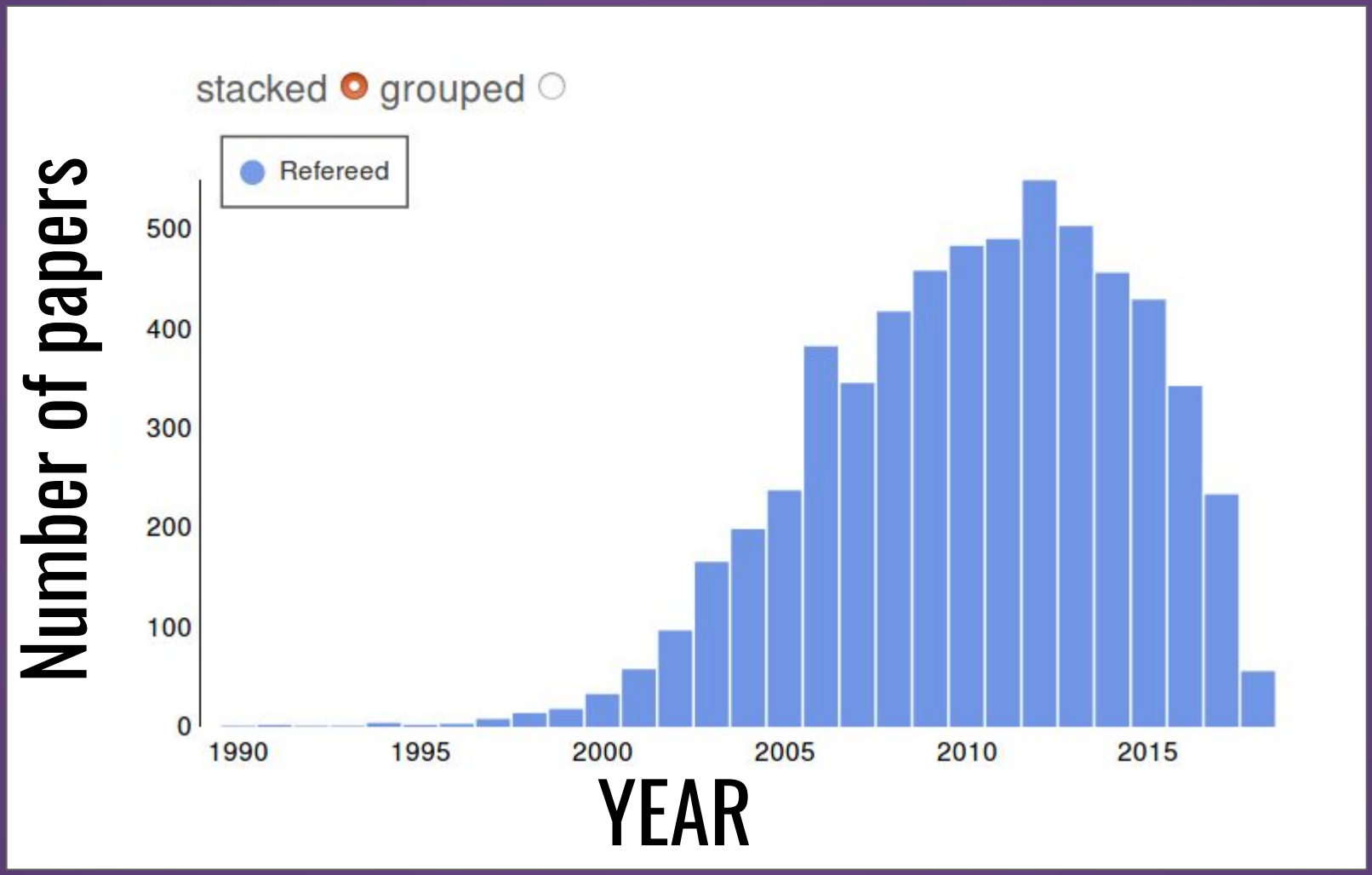
```
-- Galaxies meeting two simple criteria.
-- Find all galaxies brighter than r magnitude 17, where the local
-- extinction is > 0.275.  This is a simple query that uses a WHERE clause,
-- but now two conditions that must be met simultaneously.
--
-- Finds 6604 galaxies in under 10 mins on DR2, but beware that increasing
-- the limiting r magnitude will significantly add to the execution time.

SELECT objID
FROM Galaxy
WHERE
  r < 17                        -- r IS NOT deredenned
  and extinction_r > 0.275      -- extinction more than 0.175
```

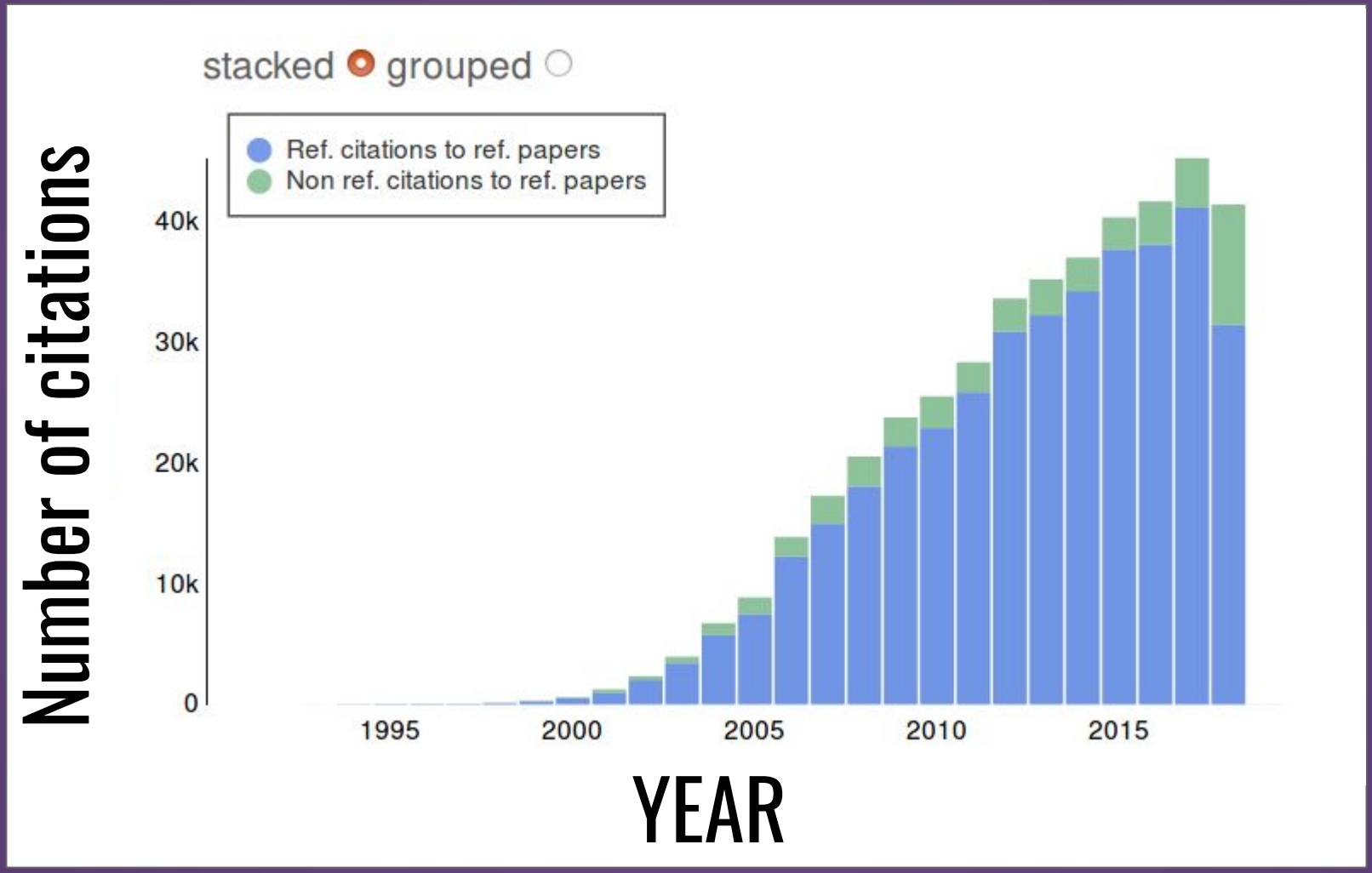
Gray's law
20 queries!

http://skyserver.linea.gov.br/dr14/en/home.aspx

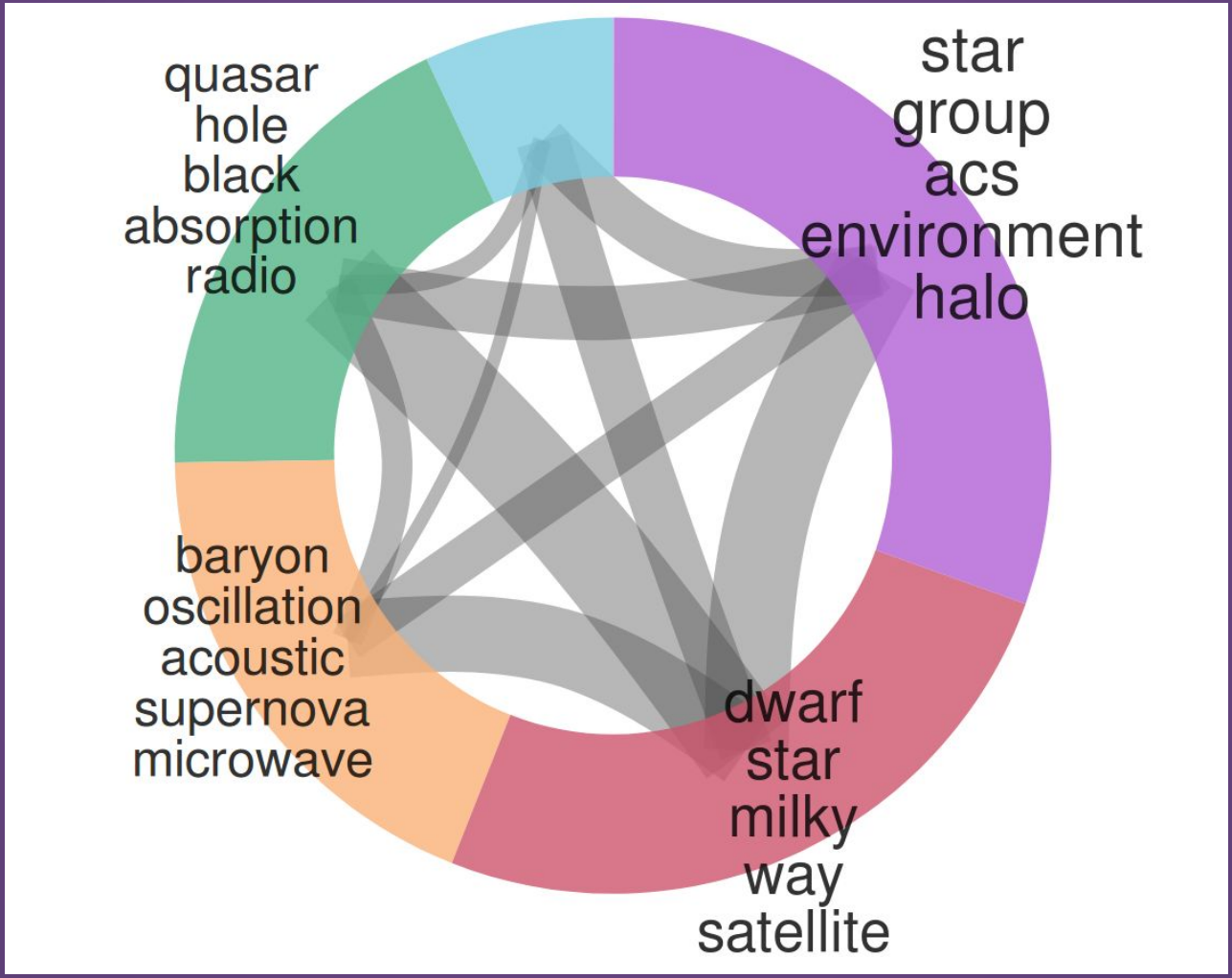
SDSS high impact: papers



SDSS high impact: citations



SDSS high impact: areas



Universe expansion is accelerated

- Dark Energy (1998)
- Stage 1: Discovery
- Stage 2: Ongoing (SDSS) (10M sources)
- Stage 3: Dark Energy Survey (DES) 2013-2018 (100M sources)
- Stage 4:
  - Large Synoptic Survey Telescope (LSST) 2021-2031 (1B sources)

We have to do better at producing tools to support the whole research cycle — from data capture and data curation to data analysis and data visualization. - Jim Gray, 2007

LIneA interfaces and products

Science Portals

Interface for scientific analysis in Rio de Janeiro, Brazil

Quick Reduce

Quality control of DECam images on CTIO, Chile

Data Release Interface

Interactive maps and catalog query for DES data release at NCSA, USA

Quick Look Framework

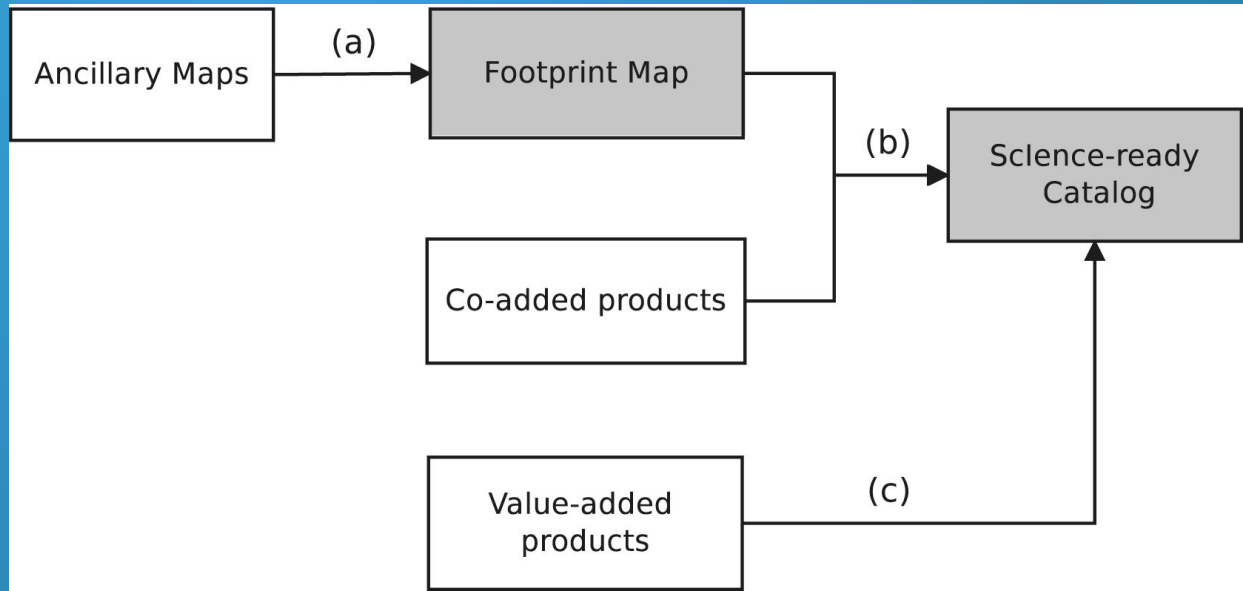
Quality control of DESI 15k spectra/exposure on Kitt Peak, USA

Science Portals

- Interface to cluster nodes
  - Powered by TurboGears
  - Home-made orchestration + condor
  - XML workflows
  - XML product logs
- Provenance: data and configuration
- Dashboard process management

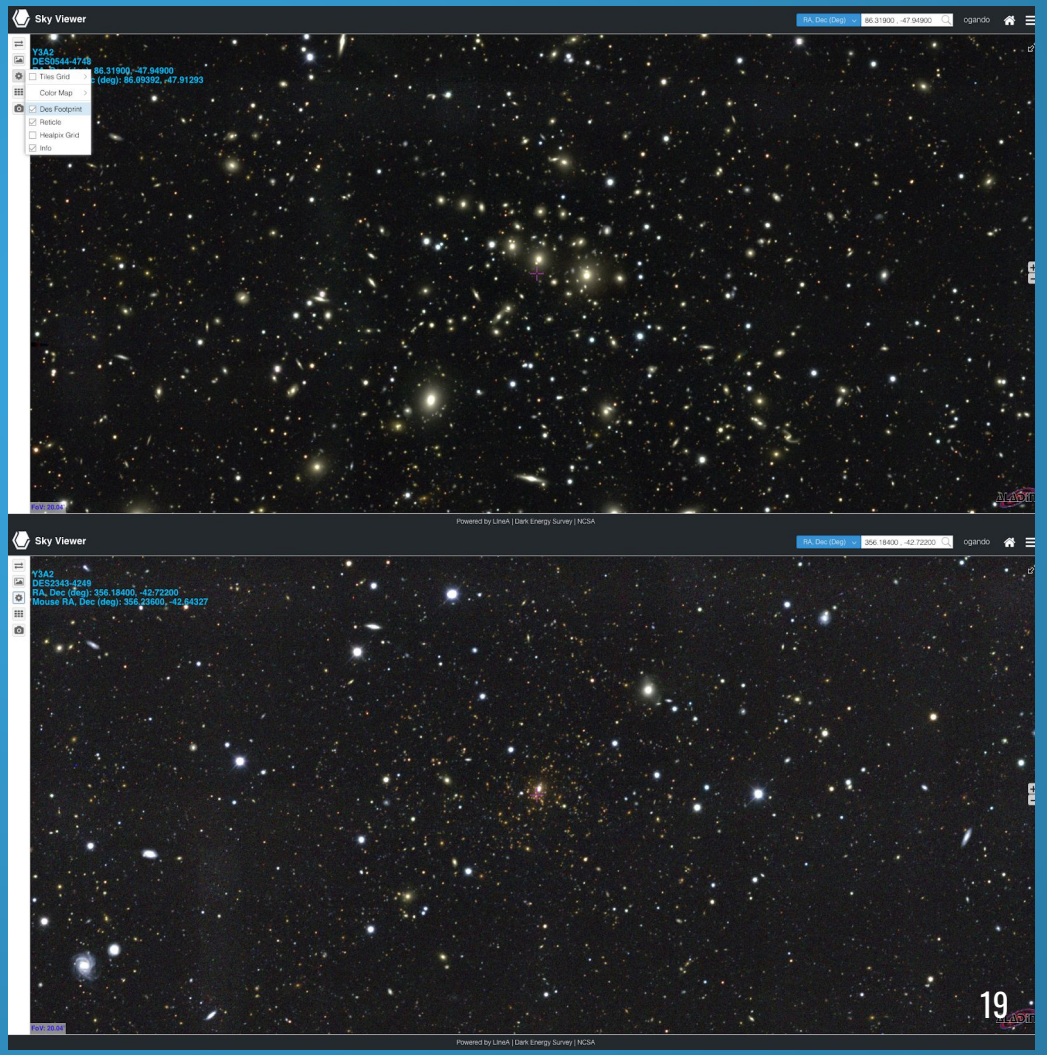
Science Portals

- End to end process
  - Maps of observational properties
  - Star/Galaxy classification
  - Photometric redshifts (Gschwend et al. 2018)
- Value-added catalogs (Fausti Neto et al. 2018)
- Query builder

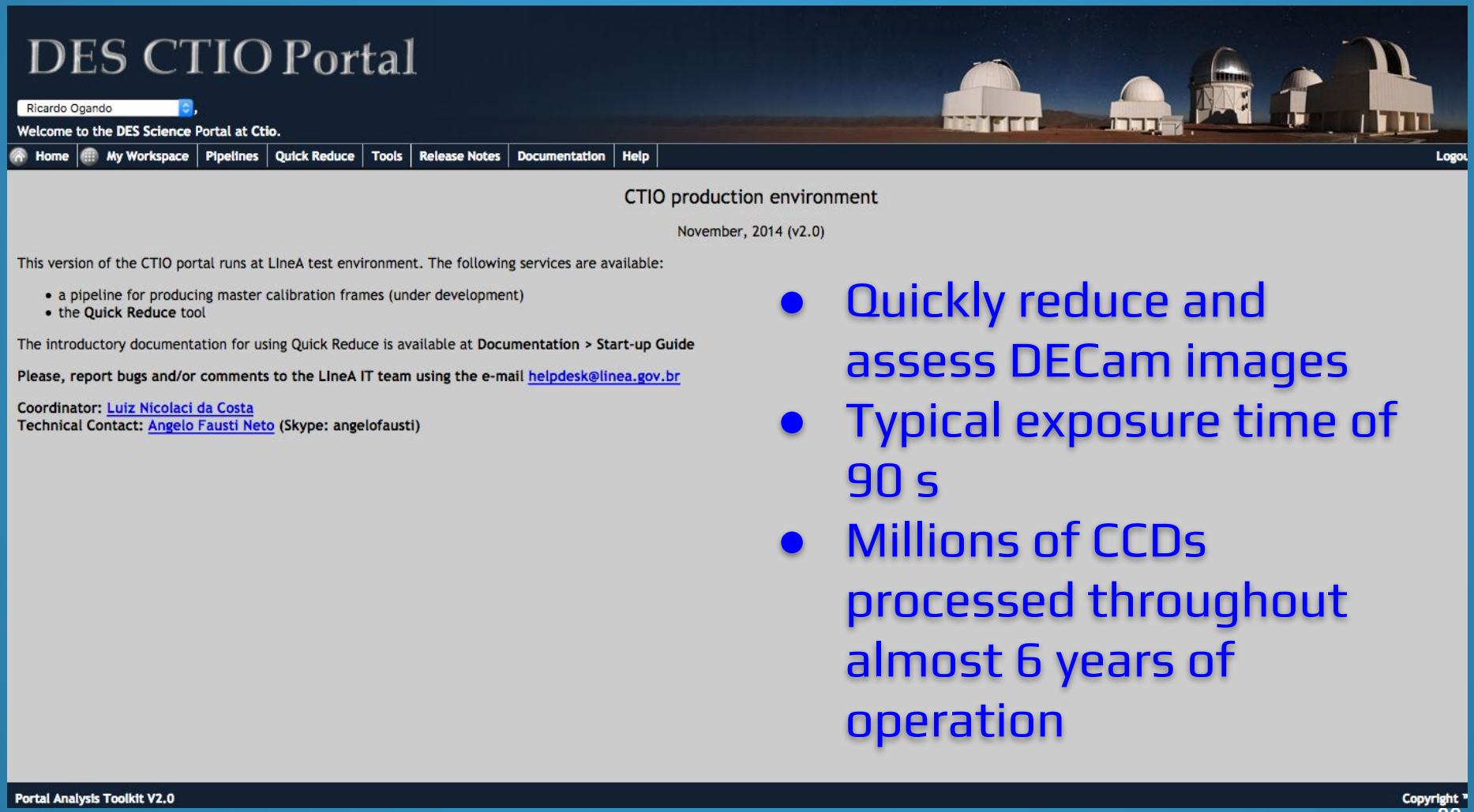


Science Portals

- Value-added catalogs feed several scientific pipelines
- Ex. cluster finding



Quick Reduce (QR)



- Quickly reduce and assess DECam images
- Typical exposure time of 90 s
- Millions of CCDs processed throughout almost 6 years of operation

Quick Reduce (QR)

CCD 12 (S24)

Image | General Properties | Requirements

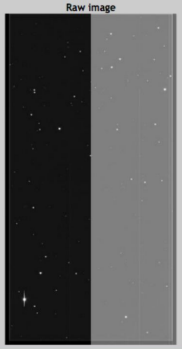
Quick Navigation
- CCDs
- Background

CCDs

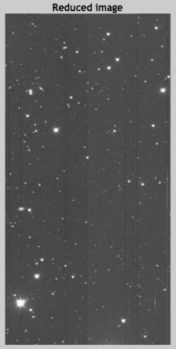
Parameter	Value
Bias corrected	Y
Flat corrected	Y
Filter	g
RA	08:05:42
Dec	+29:52:44
l (deg)	300.75
b (deg)	-27.08
Exposure time (s)	80.0
Extinction (mag)	--
HI Column (atoms cm^-2)	--

Custom python data reduction module

Raw Image



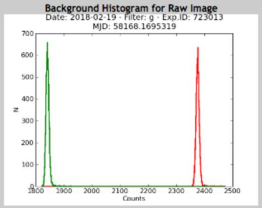
Reduced Image



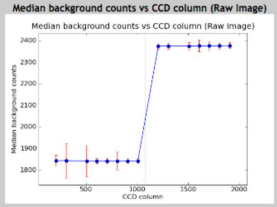
Background

Parameter (reduced image)	Value
Median of sky background (ADU)	96
RMS of sky background (ADU)	5
Skewness of sky background	0.06

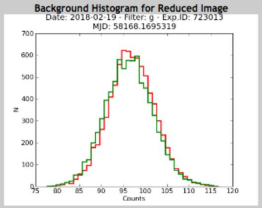
Background Histogram for Raw Image



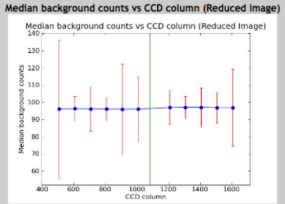
Median background counts vs CCD column (Raw Image)



Background Histogram for Reduced Image

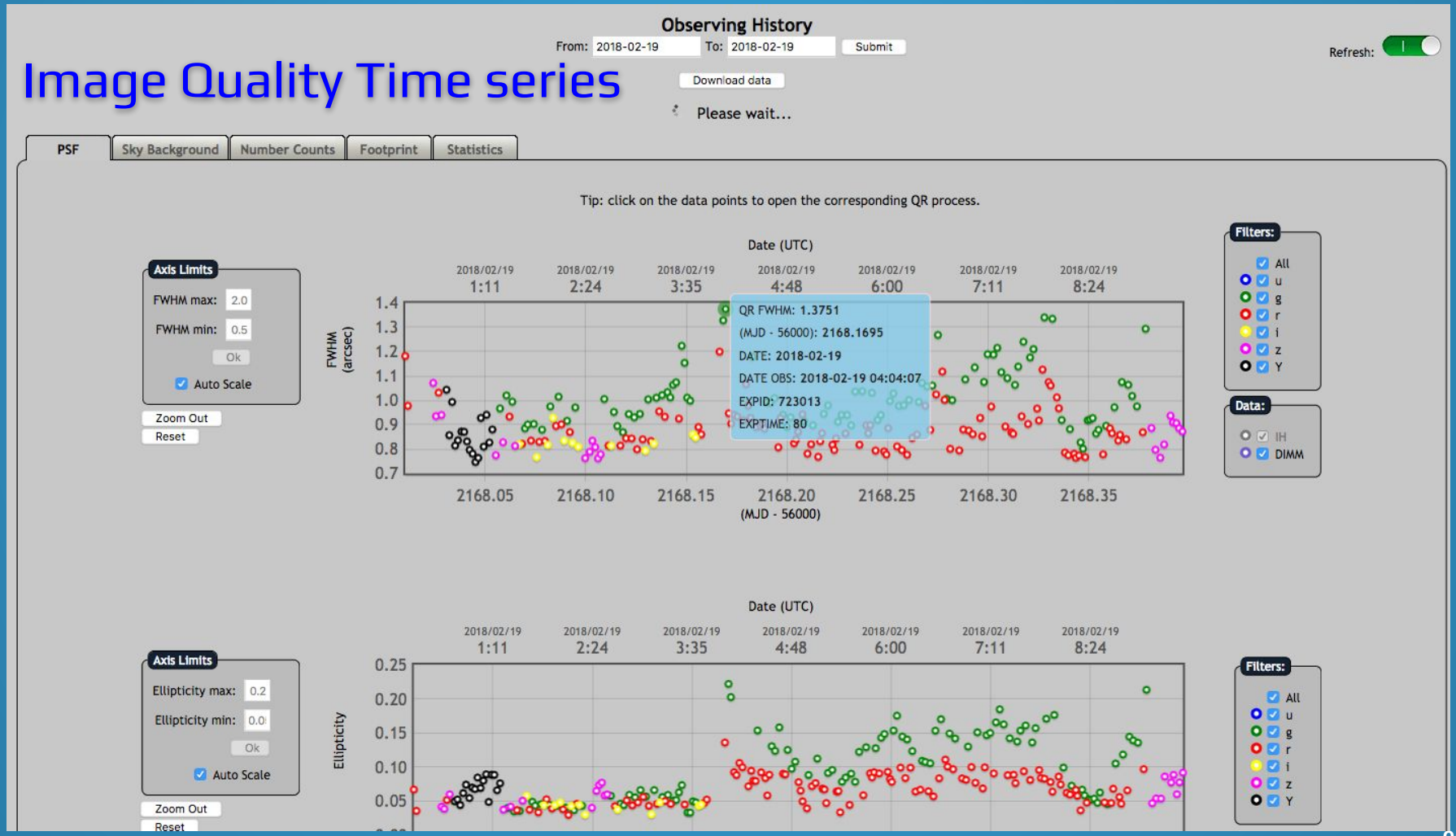


Median background counts vs CCD column (Reduced Image)

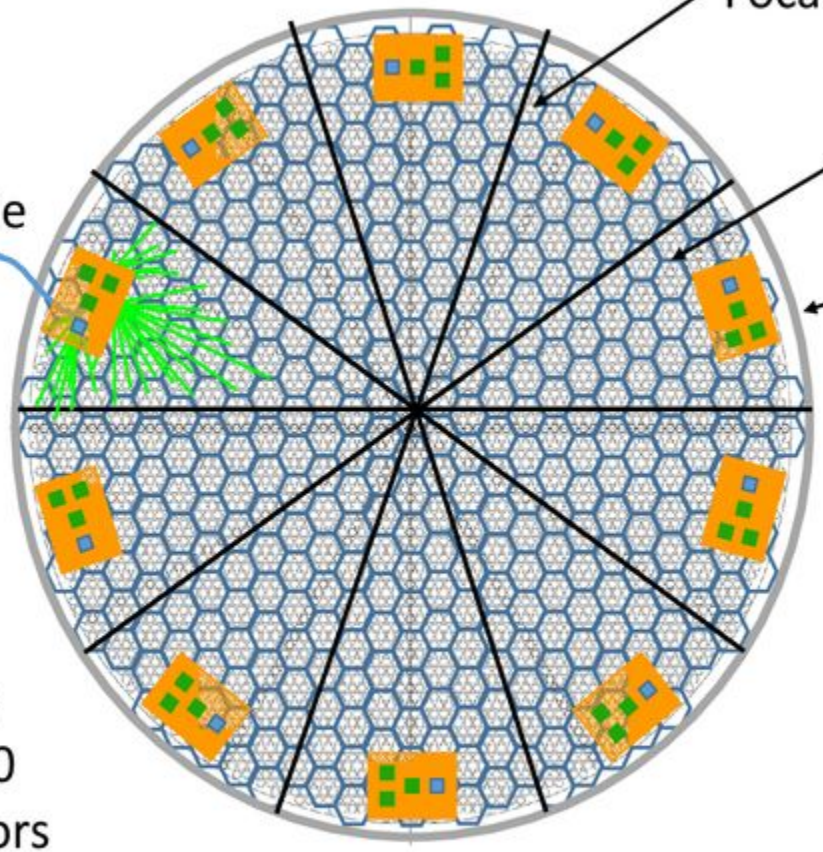


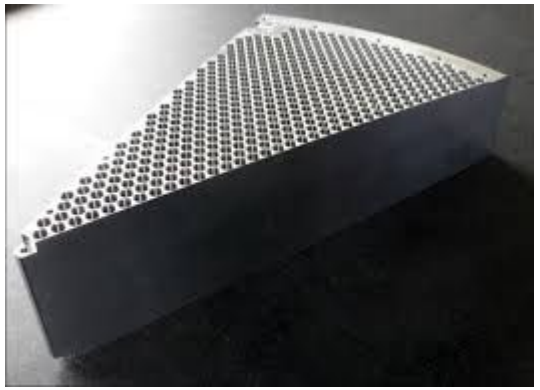
Quick Reduce (QR)

Image Quality Time series



Quick Look Framework (QLF)





5,000 fibers → 15,000 spectra

Quick Look Framework (QLF)

DESI Quick Look

Home | About Us | Help | Tutorials | Contact Us | Releases

Pipeline Monitor

Control and monitor the execution of the Quick Look pipeline

Processing History

List exposures that have been processed

Observing History

Display time series plots for QA metrics, list of exposures and observed targets for the current night of for a range of nights

Afternoon Planning

Browse QA results for exposures processed by the offline pipeline at NERSC

Trend Analysis

Simple plots using quantities stored in the database

Observing Conditions

Display observing conditions such as atmospheric transparency, seeing, and observing background from the GFA camera

Survey Reports

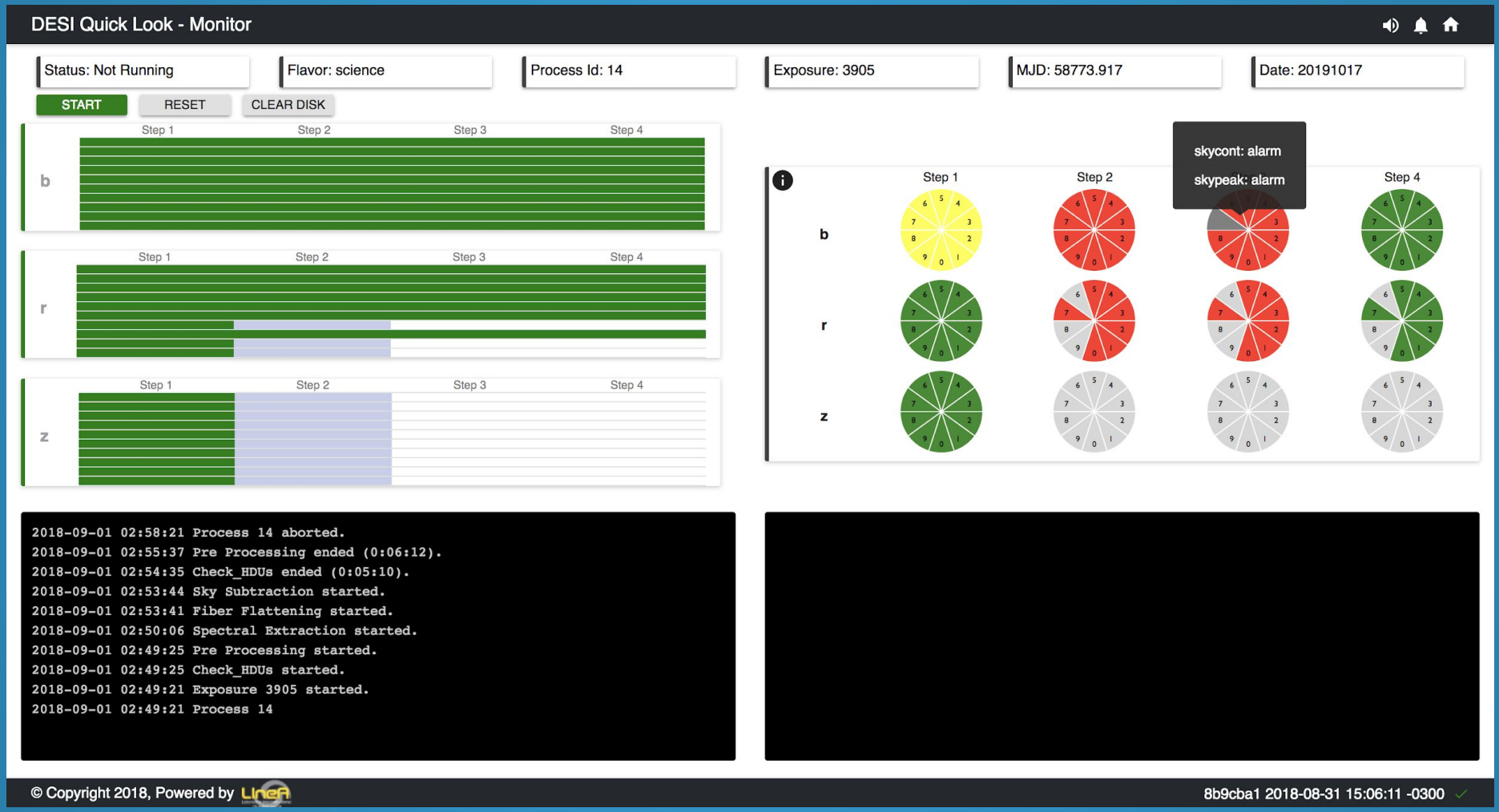
Show the overall progress and performance of survey

Configuration

Configuration of initial settings for execution

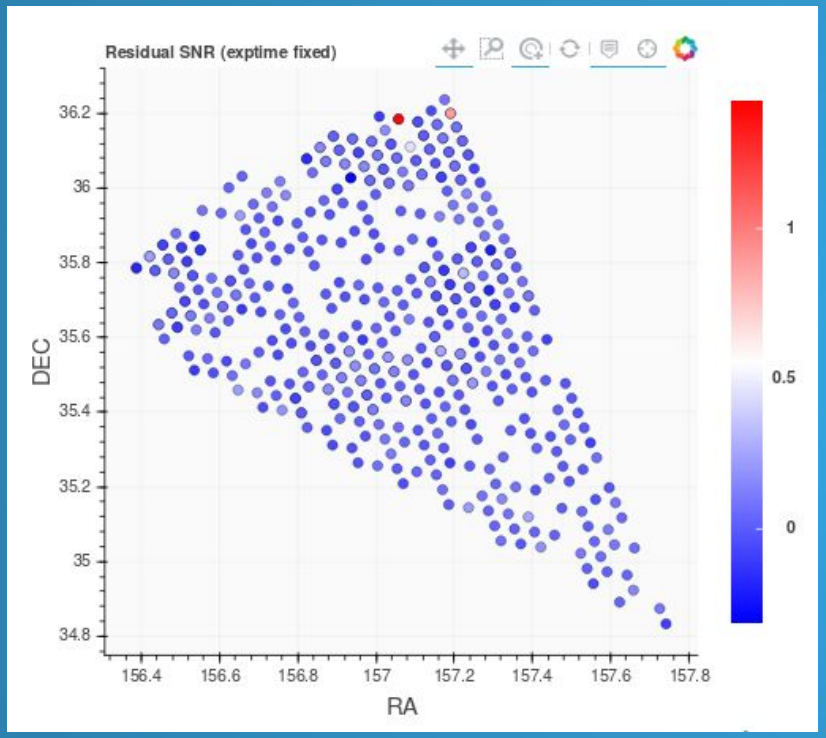
8b9cba1 2018-08-31 15:06:11 -0300

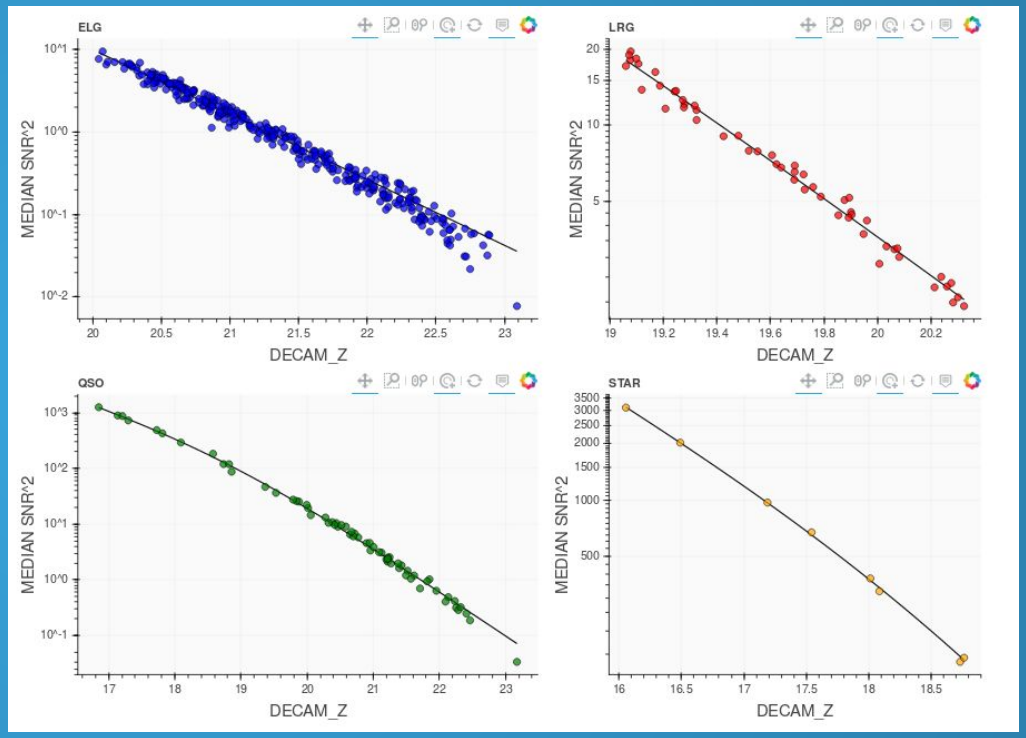
Quick Look Framework (QLF)



React interface+ SMU QL software

Quick Look Framework (QLF)





Bokeh for interactive drill-down plots

THE ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES, 232:15 (28pp), 2017 September

THE ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES, 232:15 (28pp), 2017 September https://doi.org/10.3847/1538-4365/aa8667

The DES Bright Arcs Survey: Hundreds of Candidate Strongly Lensed Galaxy Systems from the Dark Energy Survey Science Verification and Year 1 Observations

H. T. Diehl[1], E. J. Buckley-Geer[1], K. A. Lindgren[1], B. Nord[1], H. Gaitsch[1], S. Gaitsch[1], H. Lin[1], S. Allam[1], T. E. Collett[2], C. Furlanetto[3], M. S. S. Gill[4], A. More[5], J. Nightingale[3], C. Odden[1,6], A. Pellico[1], D. L. Tucker[1], L. N. da Costa[7,8], A. Fausti Neto[7], N. Kuropatkin[1], M. Soares-Santos[1], B. Welch[9], Y. Zhang[1], J. A. Frieman[1,9], F. B. Abdalla[10,11], J. Annis[1], A. Benoit-Lévy[10,12,13], E. Bertin[12,13], D. Brooks[10], D. L. Burke[4,14], A. Carnero Rosell[7,8], M. Carrasco Kind[15,16], J. Carretero[17], C. E. Cunha[14], C. B. D'Andrea[18], S. Desai[19], J. P. Dietrich[20,21], A. Drlica-Wagner[1], A. E. Evrard[22,23], D. A. Finley[1], B. Flaugher[1], J. García-Bellido[24], D. W. Gerdes[22,23], D. A. Goldstein[25,26], D. Gruen[4,14], R. A. Gruendl[15,16], J. Gschwend[7,8], G. Gutierrez[1], D. J. James[27,28], K. Kuehn[29], S. Kuhlmann[30], O. Lahav[10], T. S. Li[1], M. Lima[7,31], M. A. G. Maia[7,8], J. L. Marshall[32], F. Menanteau[15,16], R. Miquel[17,33], R. C. Nichol[2], P. Nugent[26], R. L. C. Ogando[7,8], A. A. Plazas[34], K. Reil[4], A. K. Romer[35], M. Sako[18], E. Sanchez[36], B. Santiago[7,37], V. Scarpine[1], R. Schindler[4], M. Schubnell[23], I. Sevilla-Noarbe[36], E. Sheldon[7,38], M. Smith[39], F. Sobreira[7,40], E. Suchyta[41], M. E. C. Swanson[16], G. Tarle[23], D. Thomas[2], and A. R. Walker[28]
(DES Collaboration)

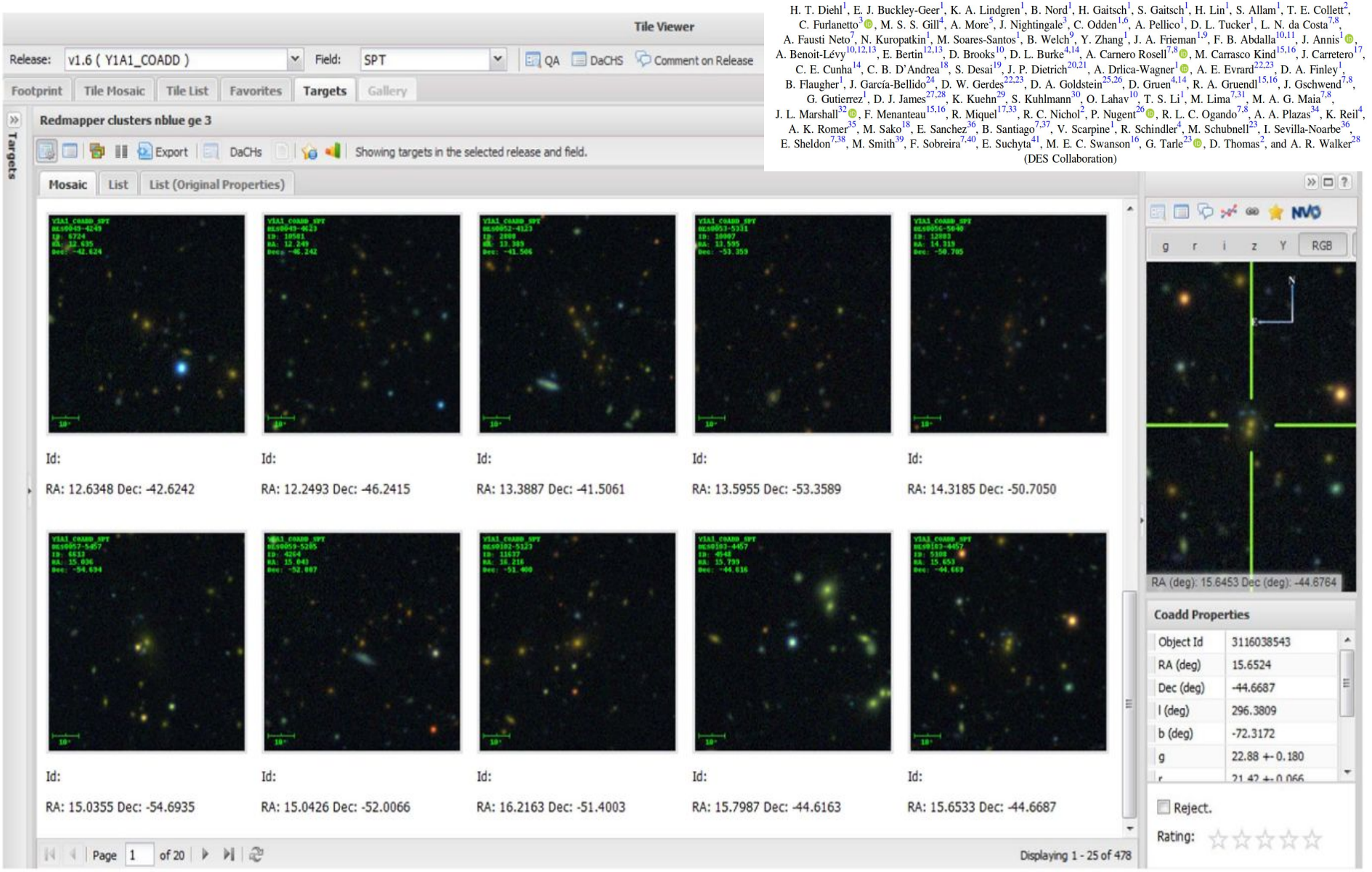
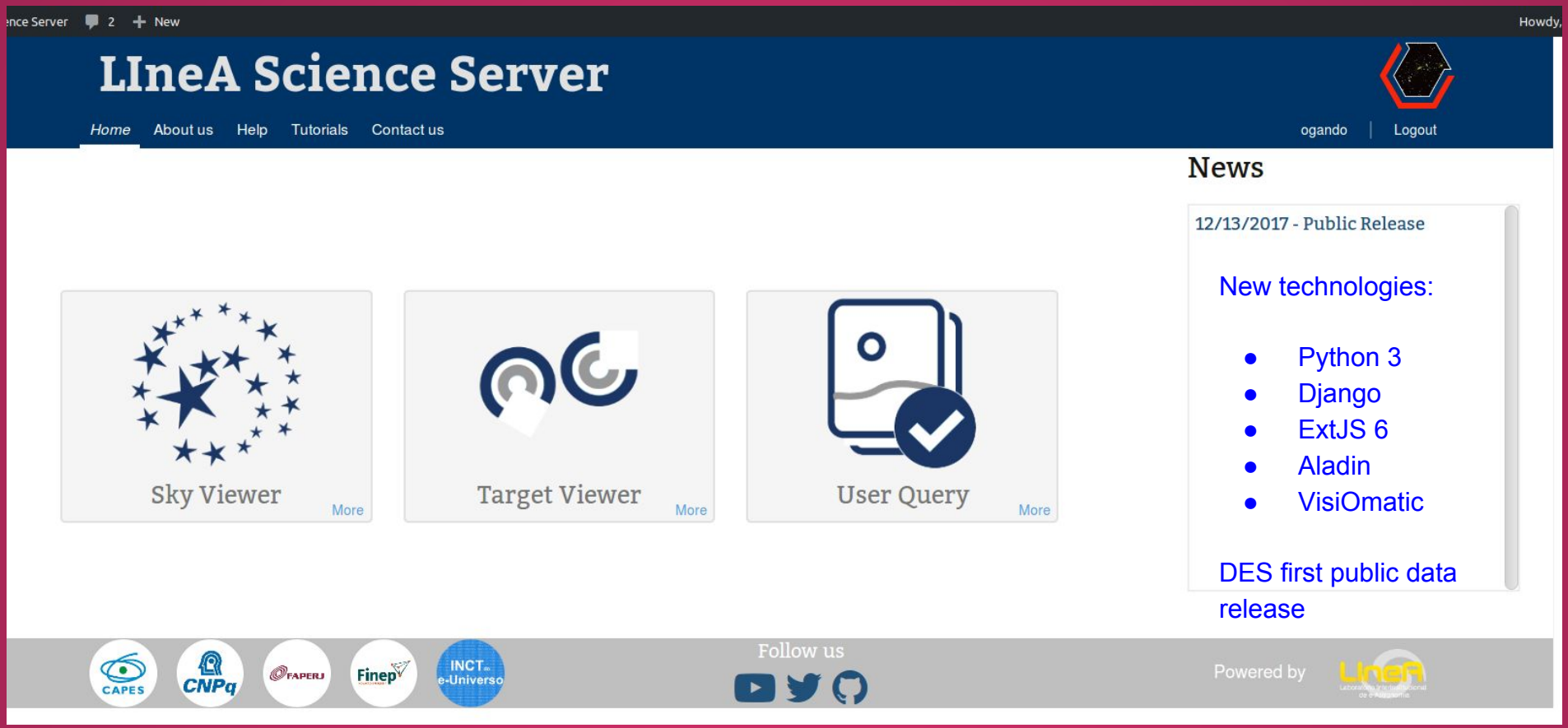


Figure 2. Typical page of cutouts as viewed on the Science Portal. The cutouts are 55″ on a side. The Portal displayed 25 cutouts on each page. These were viewed on a computer screen large enough to visualize the details in each system.

New Science Server @ NCSA*



https://desportal2.cosmology.illinois.edu/dri/apps/home/

Sky Viewer

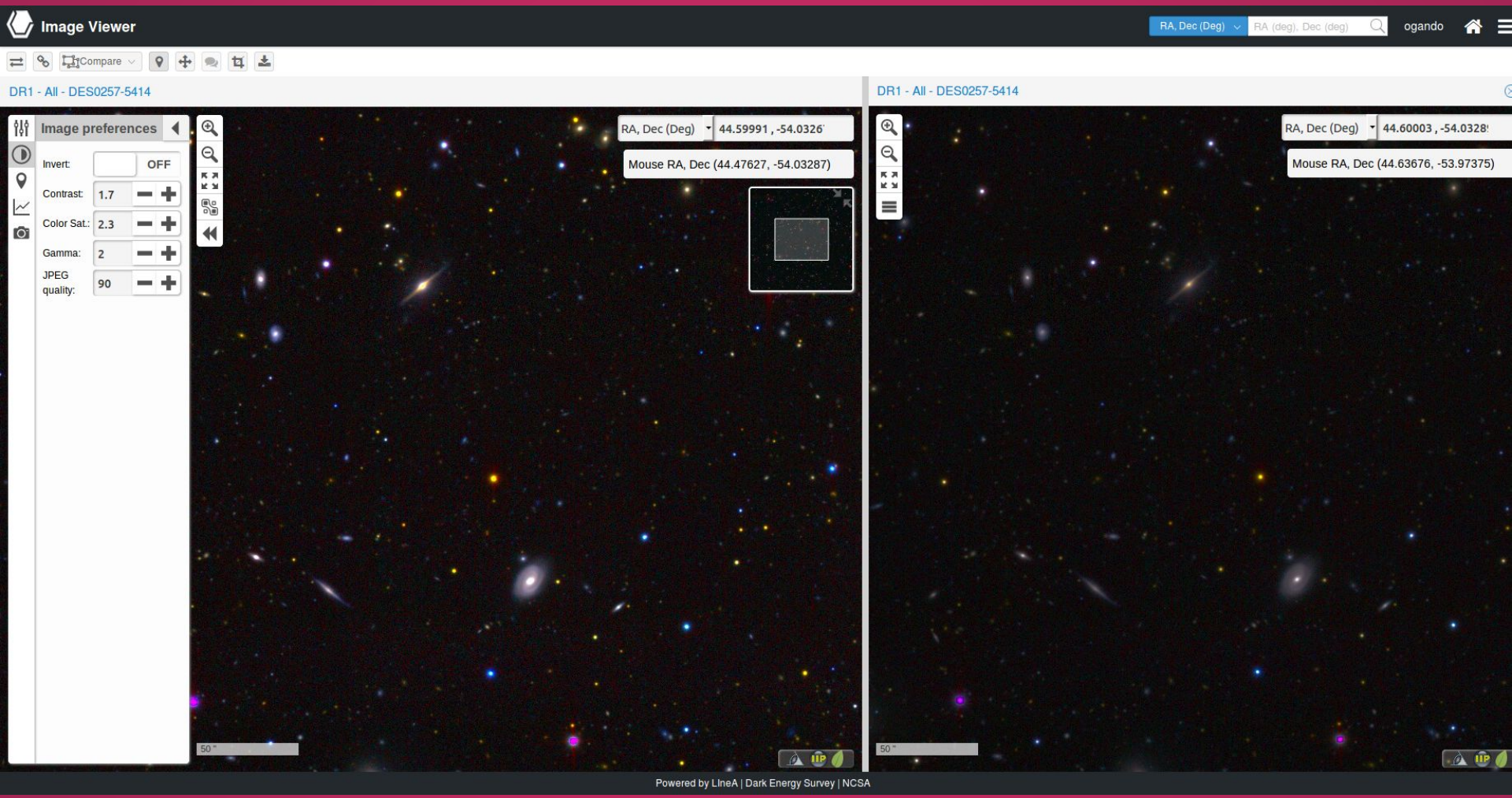
DES images exploration and validation

Sky Viewer

DES images exploration and validation

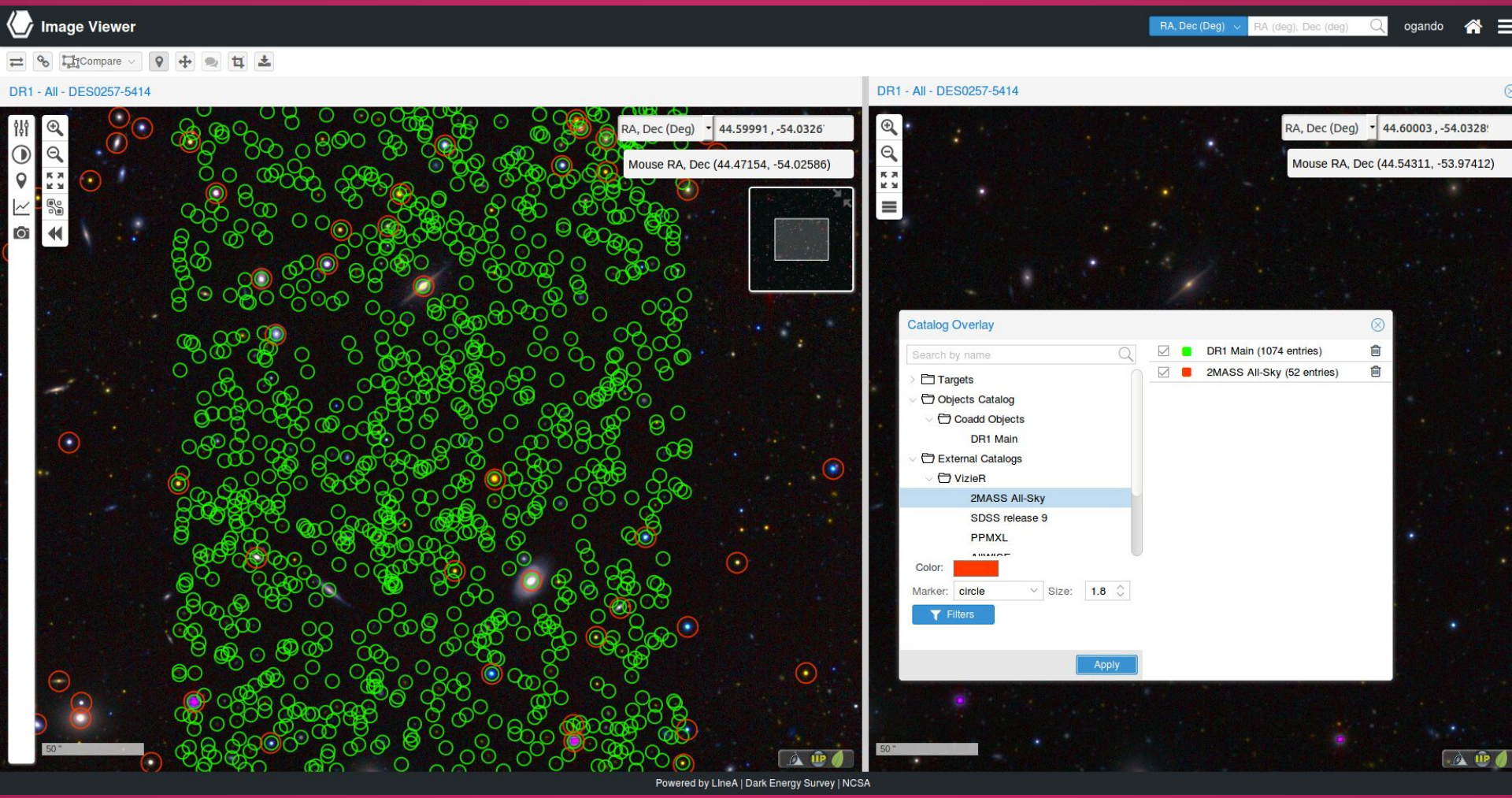
Online image visualization

Image comparison



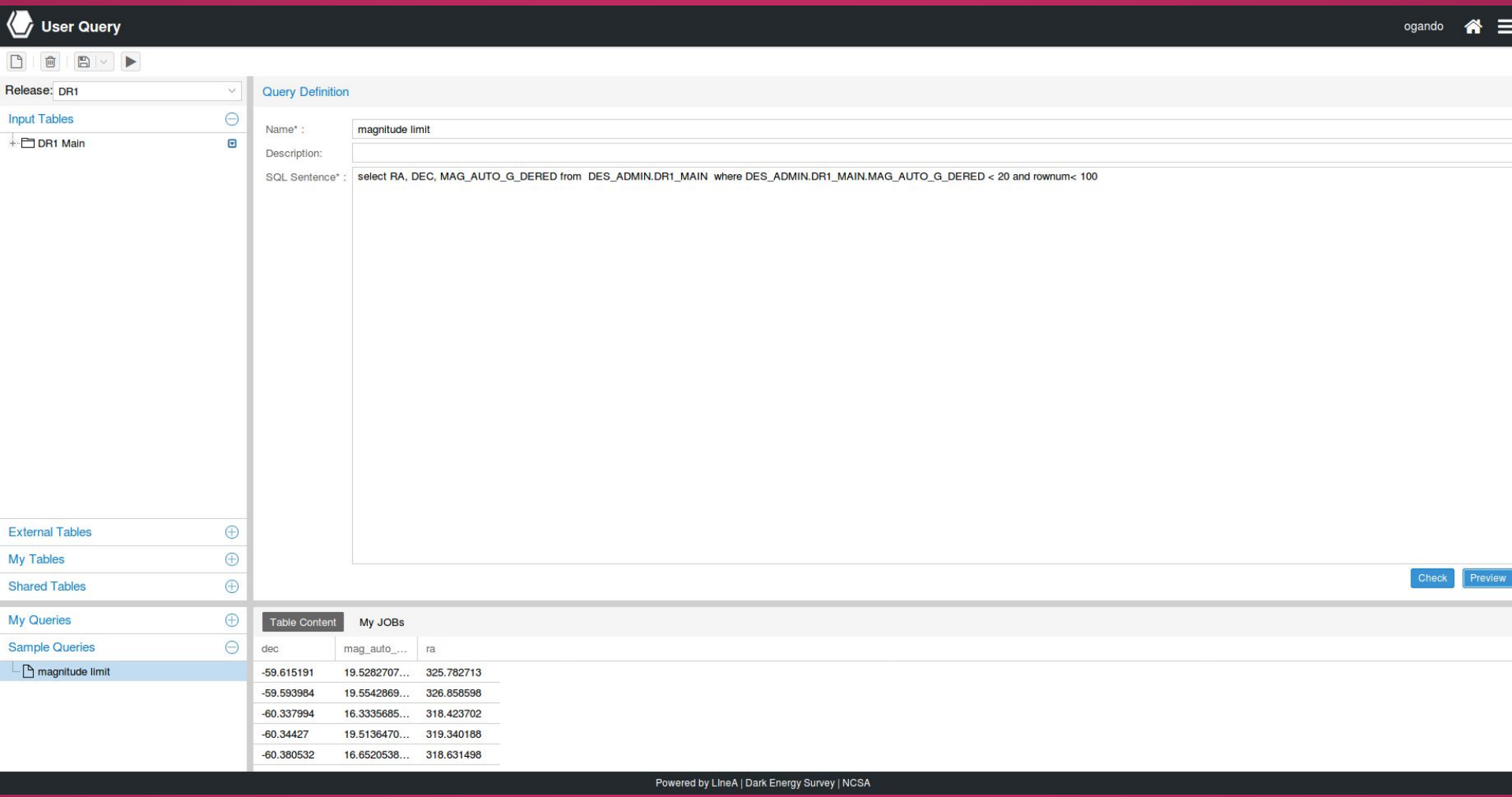
Online image visualization

Catalog overlay



User query

Query DES database



THANKS

ANY QUESTIONS?

You can find me at 🐦 @thespacelink

ogando@linea.gov.br

INCT do e-Universo

CNPq Conselho Nacional de Desenvolvimento Científico e Tecnológico

FAPERJ Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro

FAPESP

Finep INOVAÇÃO E PESQUISA