Science User Interface and Tools: Status

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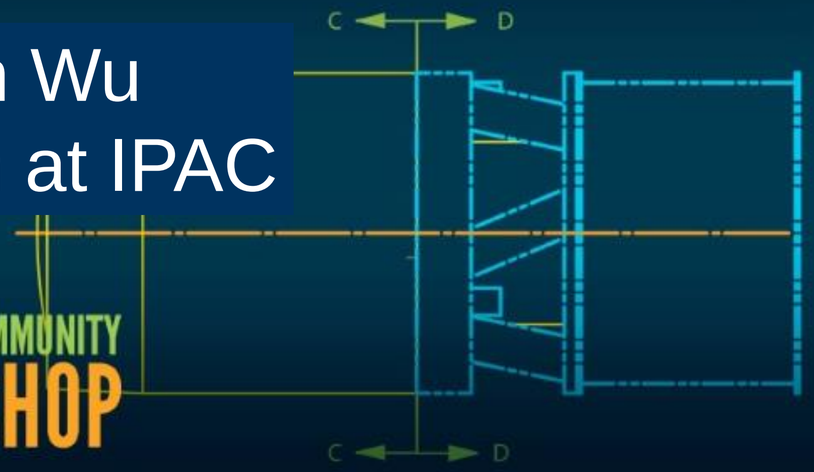
On Behalf of the SUIT Team at IPAC



LSST2016 PROJECT AND COMMUNITY WORKSHOP
AUGUST 15-19, 2016 | TUCSON, ARIZONA

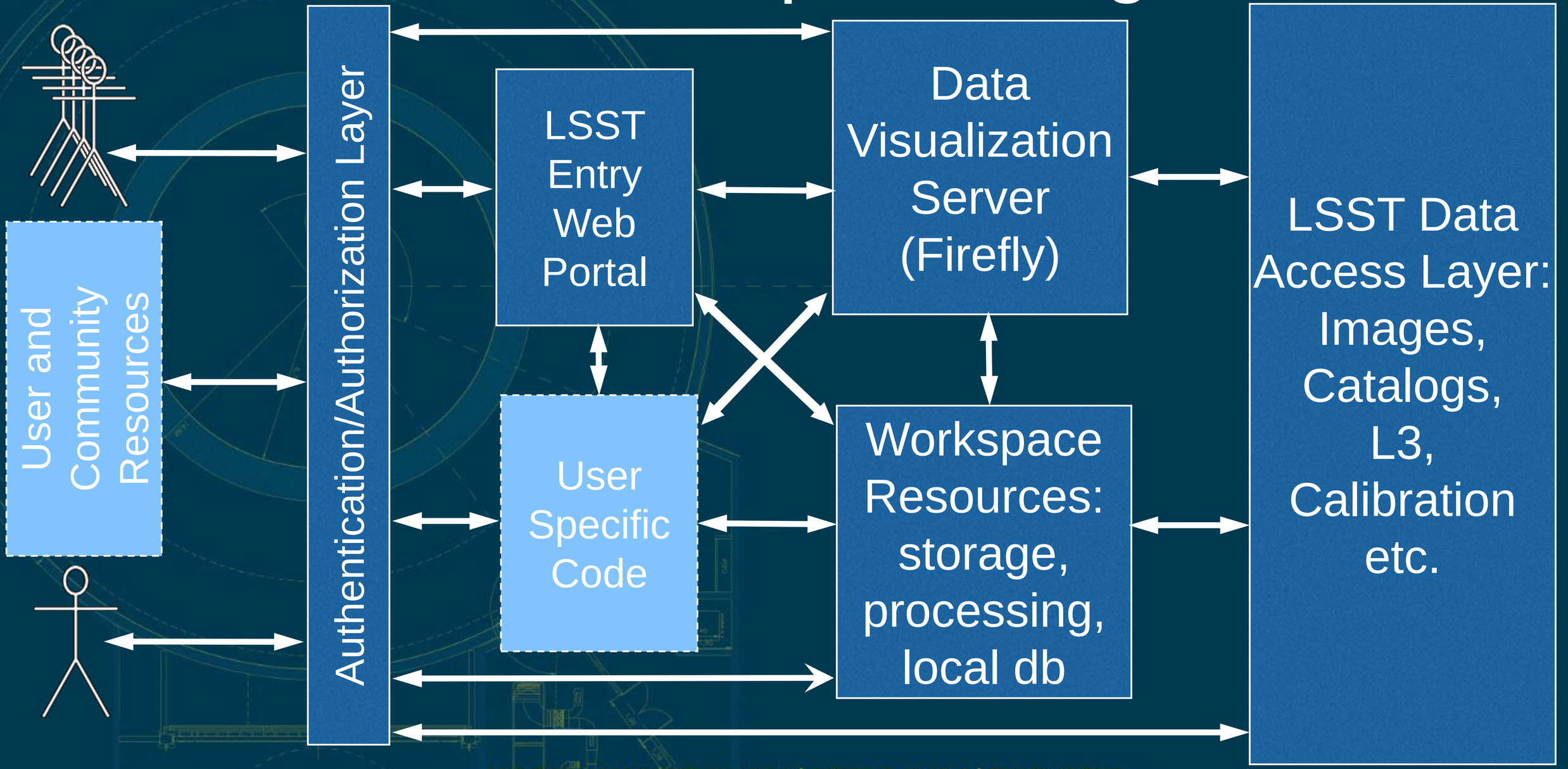
Purpose of the SUIT

- Enable access to the LSST data products
- Enable visualization and exploration of the LSST data
- Provide an interface to Level 3 facilities enabling added-value processing and analysis close to the data"

Philosophy of the SUIT

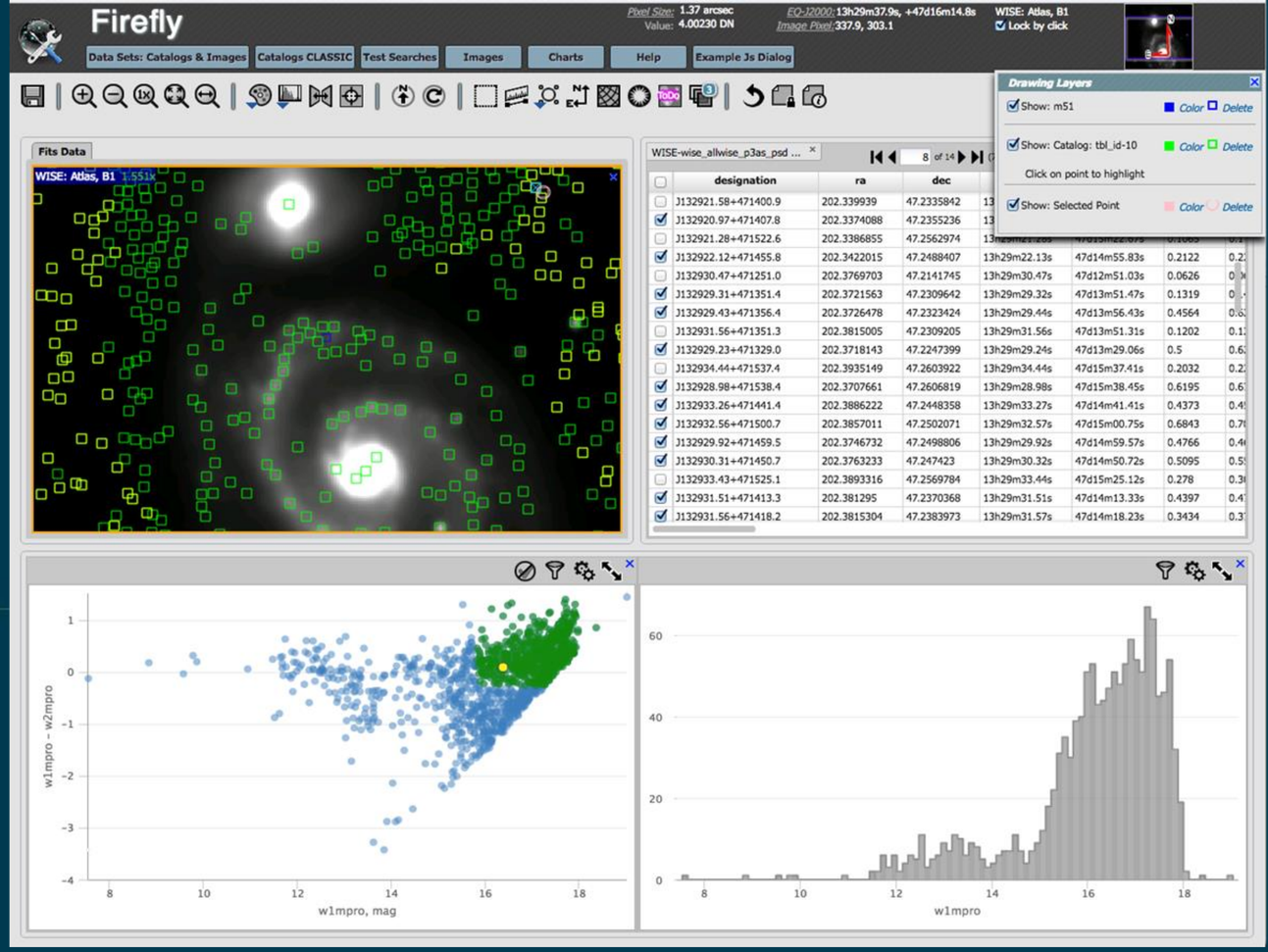
- The SUIT needs to be simple enough to engage the novice and general users while flexible enough to meet the needs of the experienced users
- DM will build a environment that fulfills the needs of the general user (e.g., portal and workspace, searching, image visualization, table manipulation, plotting, etc.)
- Components usable by others to build tools that meet their own special needs
- Enable creativity and flexibility
- SUIT is a portal, a set of tools, a workspace, and a toolkit of JS and Python APIs – all designed to mate the user with the data.

User Oriented Conceptual Diagram



What is Firefly ?

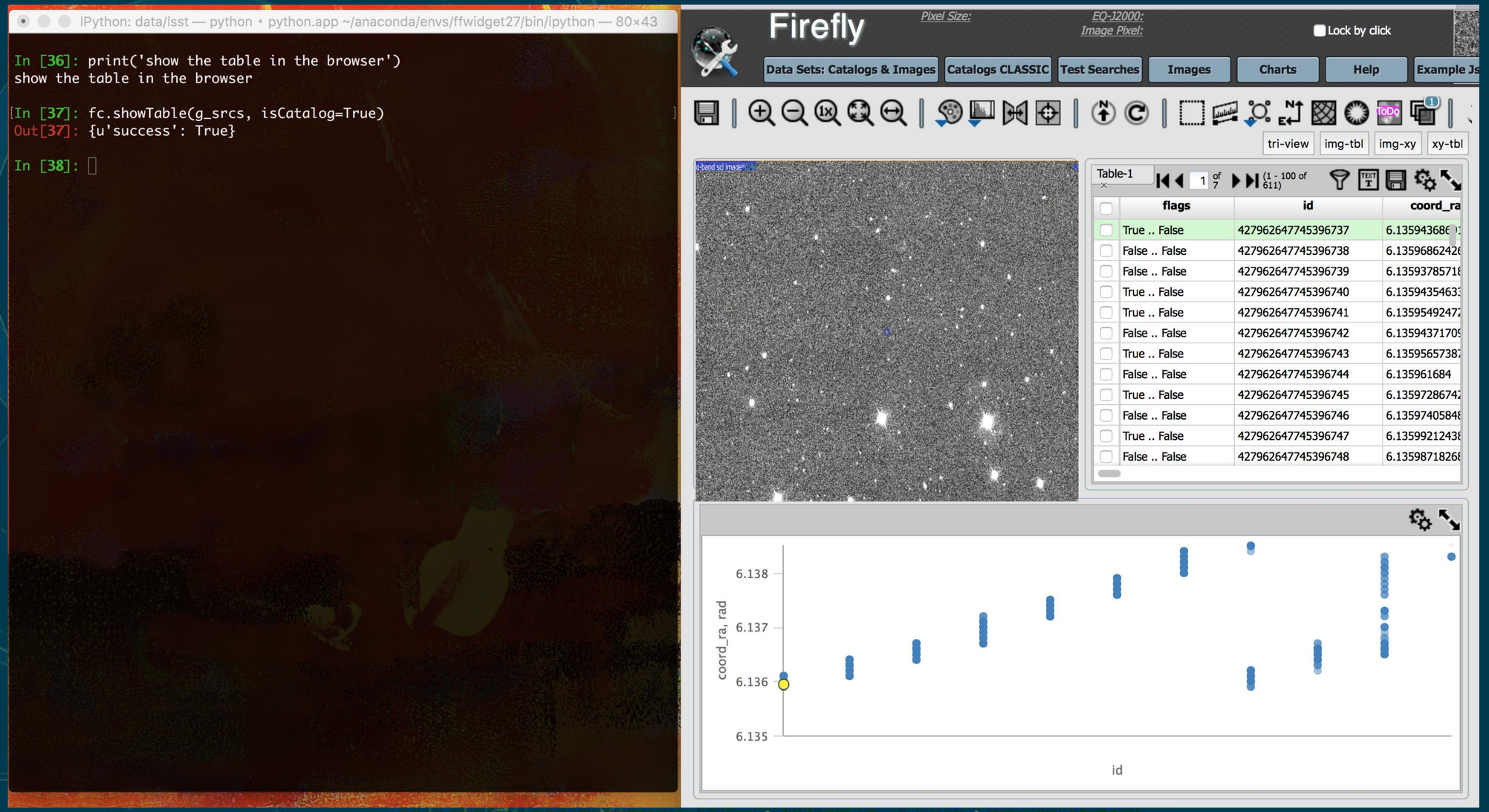
- Image and Data visualization suite
- Client – Server architecture
- Data are maintained on server
- Enables fast display on client side
- Unified data model (brushing & linking: images, tables, plots, histograms)
- Modular components (images, tables, plots, histograms)
- Operational in Infrared Science Archive at IPAC



Visualization & Python

- We've made the first steps in the integration of the Firefly visualization components with Python
- Enables complex processing and analysis beyond the visualization tools: Creativity and Flexibility
- Callable from a Python command-line prompt or from within a Jupyter Notebook
- Calculational capabilities of the SUIT extensible by providing for standard ways to invoke Python code in response to GUI actions.
- Currently in the prototype stage to inform the requirements, the design and architecture, and the development plan

Python Command & Firefly



Jupyter Notebook Widget

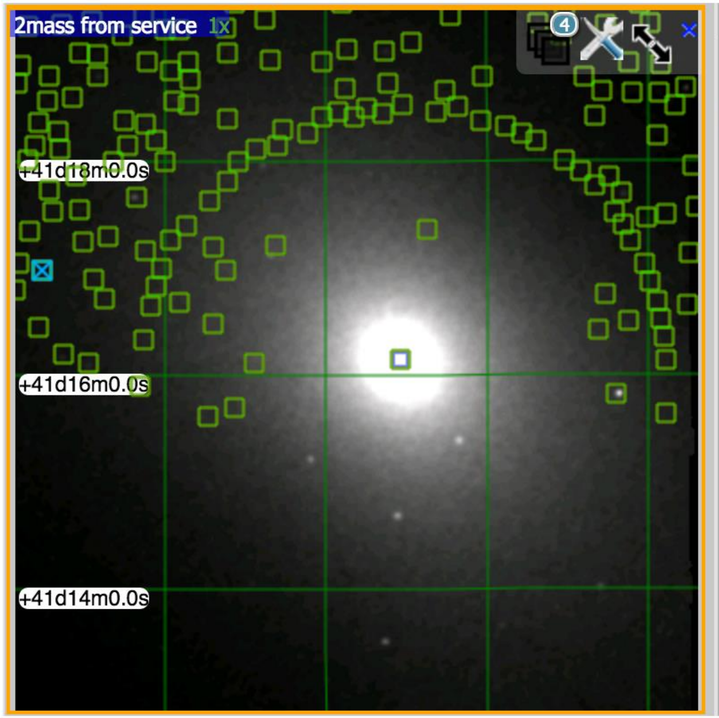
The ArchiveImage widget displays an image retrieved from an IRSA query. In this experimental version, it is a 'k' image from 2MASS centered on M31..

In [6]:
```
iv = ArchiveImage(width='400px', height='400px', GridOn=True)
```

The ArchiveTable widget displays a catalog retrieved from an IRSA query. In this experimental version, it is a WISE catalog.

In [7]:
```
tv = ArchiveTable(width='600px', height='400px')
```

In [8]:
```
ipywidgets.HBox([iv,tv])
```



wise_allwise_p3as_psd × 1 of 7 (1 - 50 of 315)

designation	ra	dec	clon	clat	sigra
J004302.11+411658.2	10.75882	41.28284	00h43m02.12s	41d16m58.22s	0.1646
J004259.53+411654.0	10.7480704	41.2816839	00h42m59.54s	41d16m54.06s	0.1059
J004256.73+411638.3	10.7364019	41.2773059	00h42m56.74s	41d16m38.30s	0.1298
J004257.09+411619.7	10.7378976	41.2721435	00h42m57.10s	41d16m19.72s	0.125
J004301.09+411611.5	10.75458	41.26988	00h43m01.10s	41d16m11.57s	0.093
J004259.07+411642.4	10.746133	41.2784448	00h42m59.07s	41d16m42.40s	0.0923
J004259.86+411606.6	10.7494393	41.2685167	00h42m59.87s	41d16m06.66s	0.1297
J004251.62+411606.8	10.7150945	41.2685667	00h42m51.62s	41d16m06.84s	0.0703
J004252.53+411541.6	10.7188801	41.2615757	00h42m52.53s	41d15m41.67s	0.0868
J004253.85+411536.5	10.7244122	41.2601478	00h42m53.86s	41d15m36.53s	0.0855
J004257.26+411553.7	10.7385866	41.2649191	00h42m57.26s	41d15m53.71s	0.0802
J004303.97+411927.4	10.7665735	41.3242852	00h43m03.98s	41d19m27.43s	0.1632
J004301.29+411951.5	10.75539	41.33099	00h43m01.29s	41d19m51.56s	0.1923
J004302.49+411935.6	10.7604088	41.3265762	00h43m02.50s	41d19m35.67s	0.2631
J004252.51+411928.8	10.7188148	41.3246809	00h42m52.52s	41d19m28.85s	0.1451
J004251.05+411919.2	10.7127087	41.322022	00h42m51.05s	41d19m19.28s	0.138

Firefly & Python Data Sharing

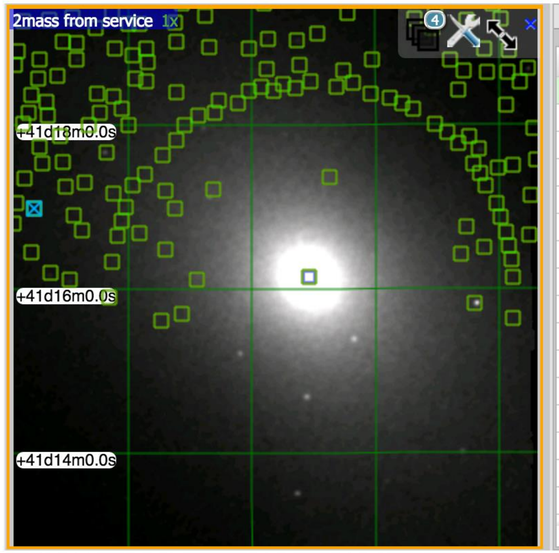
The ArchiveImage widget displays an image retrieved from an IRSA query. In this experimental version, it is a 'k' image from 2MASS centered on M31..

```
In [6]: iv = ArchiveImage(width='400px', height='400px', GridOn=True)
```

The ArchiveTable widget displays a catalog retrieved from an IRSA query. In this experimental version, it is a WISE catalog.

```
In [7]: tv = ArchiveTable(width='600px', height='400px')
```

```
In [8]: ipywidgets.HBox([iv,tv])
```



wise_allwise_p3as_psd

1 of 7 (1 - 50 of 315)

designation	ra	dec	clon	clat	sigra
J004302.11+411658.2	10.75882	41.28284	00h43m02.12s	41d16m58.22s	0.1646
J004259.53+411654.0	10.7480704	41.2816839	00h42m59.54s	41d16m54.06s	0.1059
J004256.73+411638.3	10.7364019	41.2773059	00h42m56.74s	41d16m38.30s	0.1298
J004257.09+411619.7	10.7378976	41.2721435	00h42m57.10s	41d16m19.72s	0.125
J004301.09+411611.5	10.75458	41.26988	00h43m01.10s	41d16m11.57s	0.093
J004259.07+411642.4	10.746133	41.2784448	00h42m59.07s	41d16m42.40s	0.0923
J004259.86+411606.6	10.7494393	41.2685167	00h42m59.87s	41d16m06.66s	0.1297
J004251.62+411606.8	10.7150945	41.2685667	00h42m51.62s	41d16m06.84s	0.0703
J004252.53+411541.6	10.7188801	41.2615757	00h42m52.53s	41d15m41.67s	0.0868
J004253.85+411536.5	10.7244122	41.2601478	00h42m53.86s	41d15m36.53s	0.0855
J004257.26+411553.7	10.7385866	41.2649191	00h42m57.26s	41d15m53.71s	0.0802
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J004252.51+411928.8	10.7188148	41.3246809	00h42m52.52s	41d19m28.85s	0.1451
J004251.05+411919.2	10.7127087	41.322022	00h42m51.05s	41d19m19.28s	0.138

```
In [12]: tv.filters
Out[12]: u'dec > 41.26'
```

Retrieve the filtered table from the widget as an Astropy table.

```
In [13]: mytable = tv.selection()
```

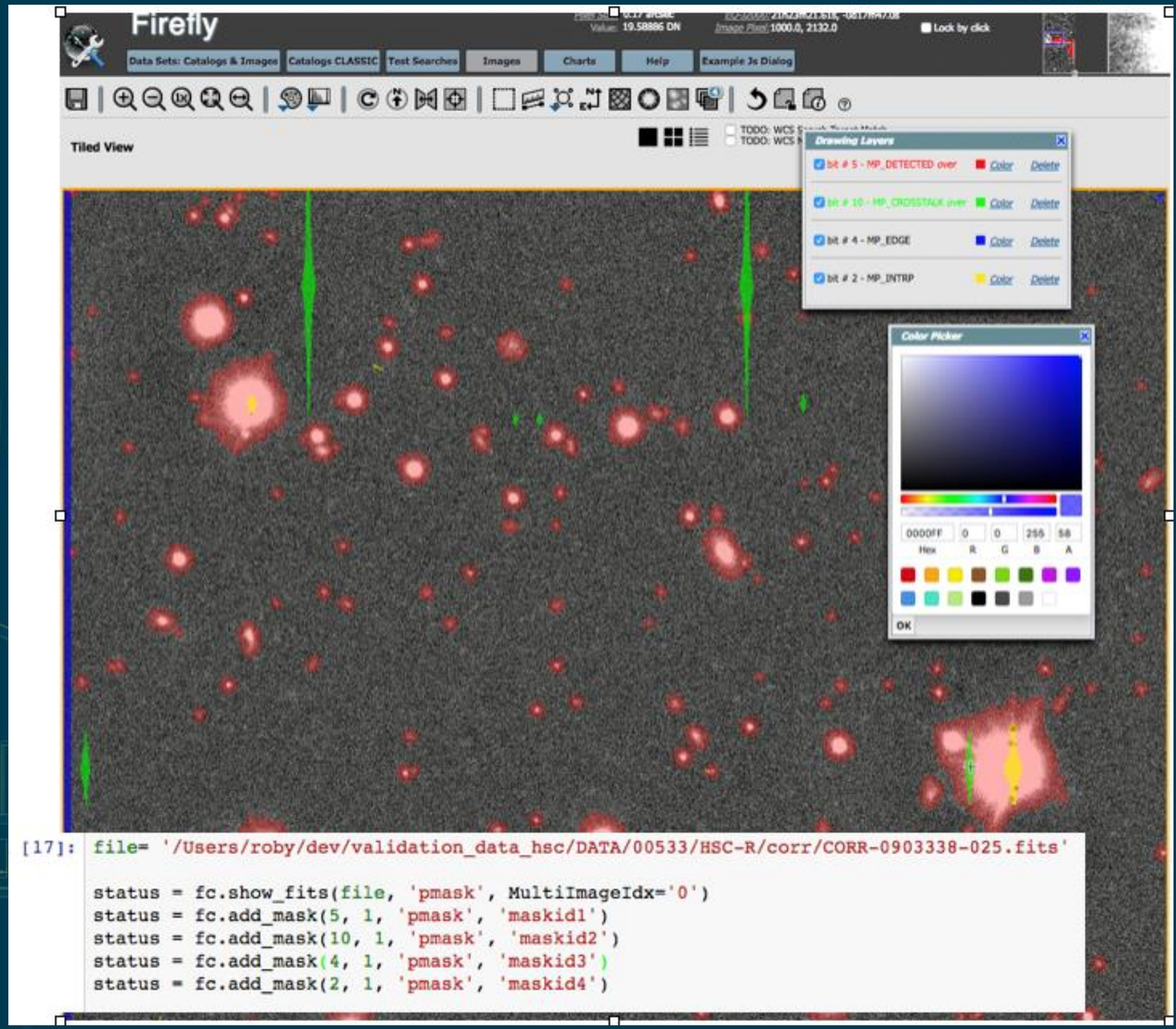
```
In [14]: mytable
Out[14]: <Table masked=True length=315>
```

designation	ra	dec	clon	clat	sigra						
	deg	deg			arcsec						
str19	float64	float64	str12	str12	float64						
J004302.11+411658.2	10.75882	41.28284	00h43m02.12s	41d16m58.22s	0.1646						
J004259.53+411654.0	10.7480704	41.2816839	00h42m59.54s	41d16m54.06s	0.1059						
J004256.73+411638.3	10.7364019	41.2773059	00h42m56.74s	41d16m38.30s	0.1298						
J004257.09+411619.7	10.7378976	41.2721435	00h42m57.10s	41d16m19.72s	0.125	0.1243	-0.0255	10.979	0.047	23.3	29.74
J004301.09+411611.5	10.75458	41.26988	00h43m01.10s	41d16m11.57s	0.093	0.0928	-0.0191	11.33	0.04	27.4	35.49
J004259.07+411642.4	10.746133	41.2784448	00h42m59.07s	41d16m42.40s	0.0923	0.0944	-0.026	11.247	0.044	24.5	30.36
J004259.86+411606.6	10.7494393	41.2685167	00h42m59.87s	41d16m06.66s	0.1297	0.1307	-0.0335	11.269	0.053	20.5	16.76
J004251.62+411606.8	10.7150945	41.2685667	00h42m51.62s	41d16m06.84s	0.0703	0.0708	-0.02	9.887	0.033	33.2	72.91
J004252.53+411541.6	10.7188801	41.2615757	00h42m52.53s	41d15m41.67s	0.0868	0.0875	-0.0238	10.197	0.034	31.8	70.3
...	...	...	...	...	...	...	...	...	...	...	...

SON, ARIZONA

Image Mask Viewer

- Firefly Python API
- LSST image: mask plane taken from data
  - Detected (red)
  - Crosstalk (green)
  - Edge (blue)
  - Intrp (yellow)
- User control
  - Color
  - Transparency
  - Visibility



Guiding Development with A Prototype Data Access Center

- Enable an end-to-end integration of (initially) the Data Access, SUIT, and Middleware/Infrastructure components of DM into a cooperating system.
- Enable operational and scaling tests of the above.
- Expose the Data Access (e.g., database query) and SUIT components to a very limited science user community for early feedback on the design and implementation.
- This is an engineering facility and not intended to be a full production-level data archive service
  - Services may go up and down
  - Code and functionality will change

PDAC Deployments

- 2016/2017: Version 1
  - SDSS Stripe 82 data
  - Web portal and API data access
- 2017: Version 2
  - WISE time domain data (100 Billion rows)
  - Workspace environment

Versions 2, 3, 4 are tentative scenarios, not defined plans; more details will become available pending conclusion of DM replan

- 2018: Version 3
  - Inclusion of even larger public datasets (e.g., maybe PanSTARRS)
  - LSST processed data
  - Improved and increased SUIT functionality
- 2019: Version 4
  - Support for Commission and analysis of commissioning data
  - Transitioning over to operational DAC for 2020/2021 support of science verification and operations

PDAC Access Policy (LDM-482)

- Project team members who specifically request it and receive approval from DM management, after consultation with the teams building and operating the components.
- Astronomers with LSST data rights not employed by the project ("external users"), who submit an application substantively describing investigations they wish to perform, including a description of how they plan to provide technical and usability feedback to the project, and expressing their understanding that the PDAC is not a production system. The PDAC will initially only be able to accommodate a small number of external users

http://ls.st/LDM-482

Summary

- SUIT effort will deliver a web-based user interface allowing the community to visualize, explore, process, and analyze the LSST data, as well as advanced visualization components enabling close-to-the-data analysis in Level 3.
- Strong Python and visualization connection
- Integrated workspace and portal environments
- Python and JS APIs for user customization
- Incremental development and integration and testing through PDAC