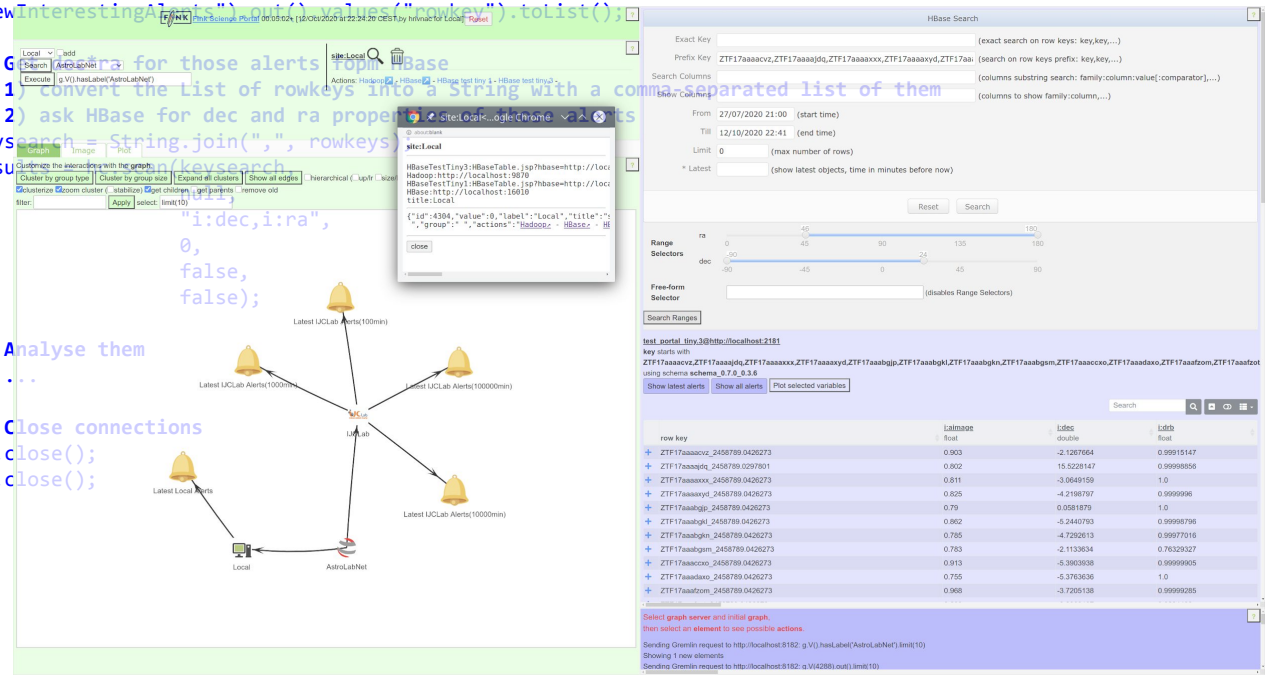
```
// Connect to JanusGraph
GremlinClient gc = new GremlinClient("134.158.74.85", 24444);
g = gc.g();

// Connect to HBase
HBaseClient hc = new HBaseClient("134.158.74.54", 2181);
hc.connect("test_portal_tiny.3", "schema_0.7.0_0.3.6");

// Get new interesting alerts from JanusGraph
// 1) get AlertCollection with name = NewInterestingAlerts
// 2) navigate all outgoing edges to get all alerts in this collection
// 3) convert their rowkeys into a List
rowkeys = g.V().has("AlertCollection", "name",
"NewInterestingAlerts").out().values("rowkey").toList();

// Get data for those alerts from HBase
// 1) convert the list of rowkeys into a String with a comma separated list of them
// 2) ask HBase for dec and ra properties of those alerts
keysearch = String.join(",", rowkeys)
result = hc.search(keysearch,
                   "i:dec,i:ra",
                   0,
                   false,
                   false);

// Analyse them
// ...

// Close connections
gc.close();
hc.close();
```

Fink Browser

status



- Mission
- Architecture
- Design
- Implementation
- Command Line / API
- Web Service
- Status

Julius Hrivnac, IJCLab

Fink Meeting, 13/10/2020

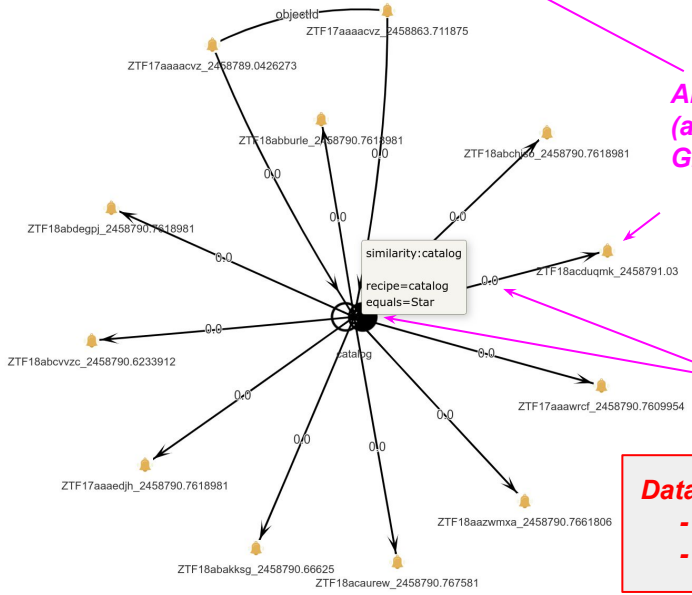
Mission

- To give
  - Transparent and
  - interactive access
- To all Fink
  - Data (stored in HBase and JanusGraph databases) and
  - Processing
- In a distributed environment
- From the
  - Web Service
  - Command Line
- Integratable into other frameworks
- Extendable with existing (third party) tools
- Using standard technologies

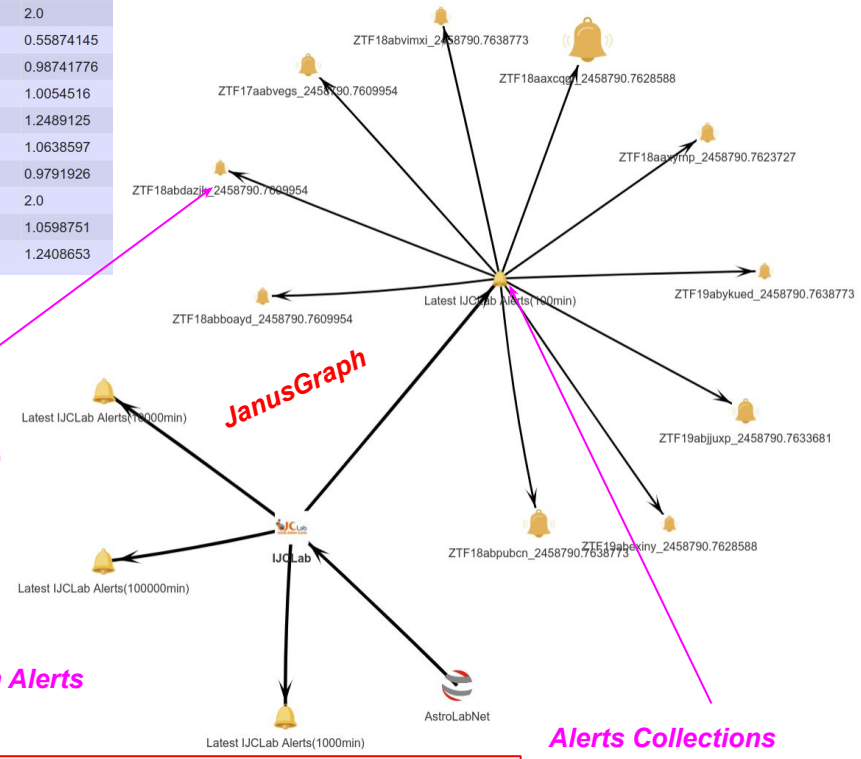
Architecture - 1

HBase

row key	i:aimage float	i:bimage float	i:dec double	i:ra double	i:seeratio float
ZTF17aaaacvz_2458789.0426273	0.903	0.718	-2.1267664	83.2148851	2.0
ZTF17aaaajdq_2458789.0297801	0.802	0.704	15.5228147	149.1123409	0.55874145
ZTF17aaaaxxx_2458789.0426273	0.811	0.768	-3.0649159	84.5695002	0.98741776
ZTF17aaaaxyd_2458789.0426273	0.825	0.763	-4.2198797	83.9509267	1.0054516
ZTF17aaabgjp_2458789.0426273	0.79	0.778	0.0581879	86.5794079	1.2489125
ZTF17aaabgkl_2458789.0426273	0.862	0.822	-5.2440793	84.0823252	1.0638597
ZTF17aaabgkn_2458789.0426273	0.785	0.737	-4.7292613	83.3925766	0.9791926
ZTF17aaabgsm_2458789.0426273	0.783	0.684	-2.1133634	84.0362482	2.0
ZTF17aaaccxo_2458789.0426273	0.913	0.881	-5.3903938	83.4445077	1.0598751
ZTF17aaadaxo_2458789.0426273	0.755	0.727	-5.3763636	84.9028841	1.2408653



Alerts
(all alerts are both in
Graph and in HBase table)



Relations between Alerts

Data are available simultaneously in the
- HBase table - more details
- JanusGraph graph - to express their structure and relations

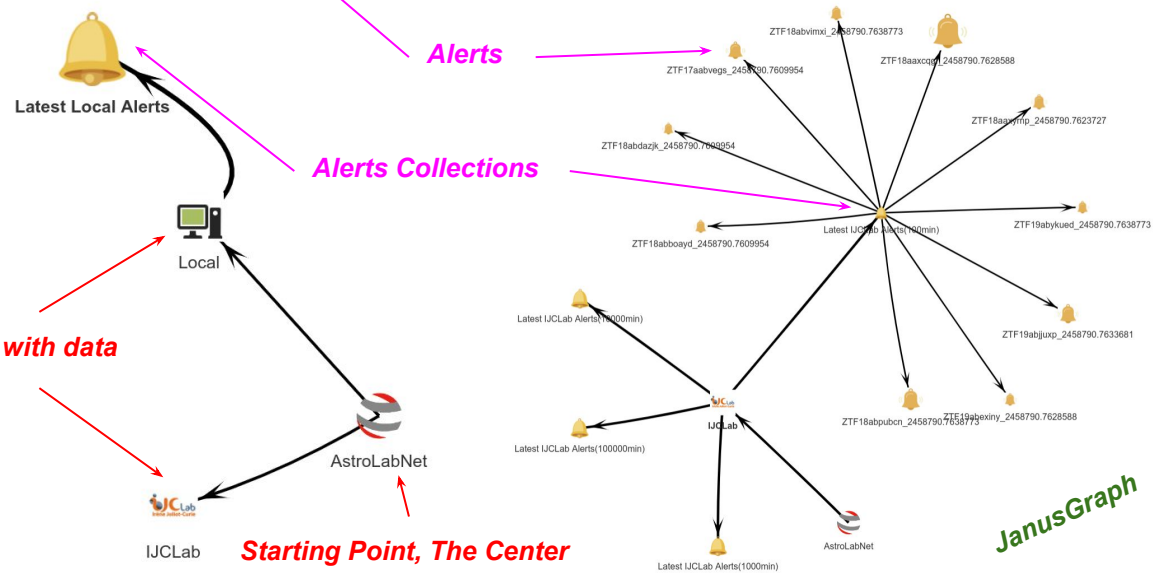
Alerts Collections
- Latest alerts
- Alerts with some properties
- ...

Architecture - 2

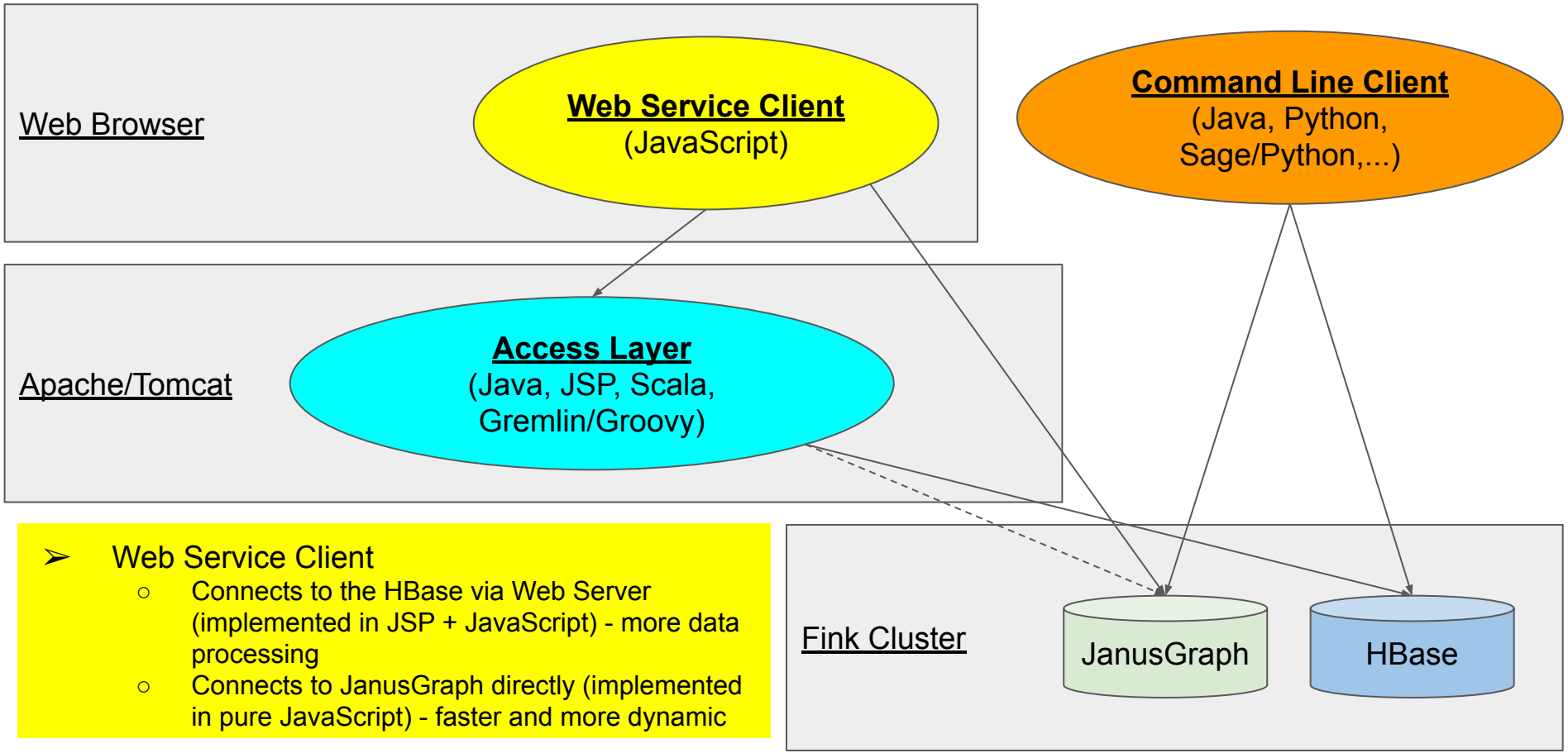
- All functionality is available on the Graph of elements
  - Sites
  - Data (alerts)
  - Data Collections
- Each element shows:
  - Its properties (incl. graphics)
  - Relations to other elements
  - Available Actions/Operations (local or external)
- Other elements and relations can be created
  - And analysed
  - Even by end users
- Full data are available from the HBase table
  - Interlinked with Graph elements

HBase

row key	i:aimage float	i:bimage float	i:dec double	i:ra double	i:seeratio float
ZTF17aaaacvz_2458789.0426273	0.903	0.718	-2.1267664	83.2148851	2.0
ZTF17aaaajdq_2458789.0297801	0.802	0.704	15.5228147	149.1123409	0.55874145
ZTF17aaaaxxx_2458789.0426273	0.811	0.768	-3.0649159	84.5695002	0.98741776
ZTF17aaaaxyd_2458789.0426273	0.825	0.763	-4.2198797	83.9509267	1.0054516
ZTF17aaabgjp_2458789.0426273	0.79	0.778	0.0581879	86.5794079	1.2489125
ZTF17aaabgkl_2458789.0426273	0.862	0.822	-5.2440793	84.0823252	1.0638597
ZTF17aaabgkn_2458789.0426273	0.785	0.737	-4.7292613	83.3925766	0.9791926
ZTF17aaabgsm_2458789.0426273	0.783	0.684	-2.1133634	84.0362482	2.0
ZTF17aaaccxo_2458789.0426273	0.913	0.881	-5.3903938	83.4445077	1.0598751
ZTF17aaadaxo_2458789.0426273	0.755	0.727	-5.3763636	84.9028841	1.2408653



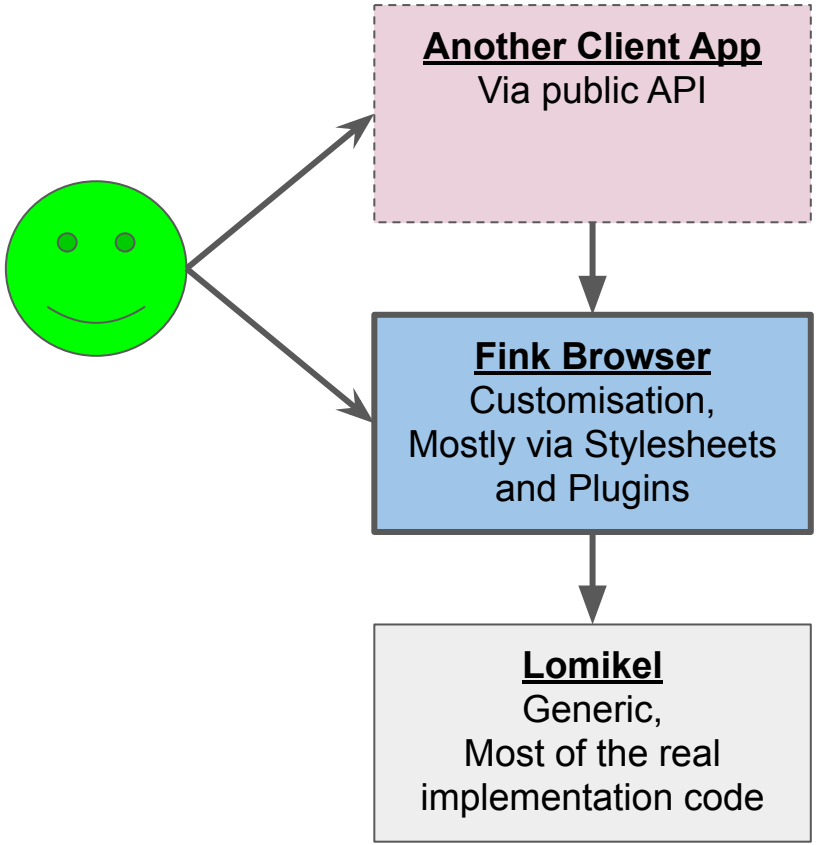
Design



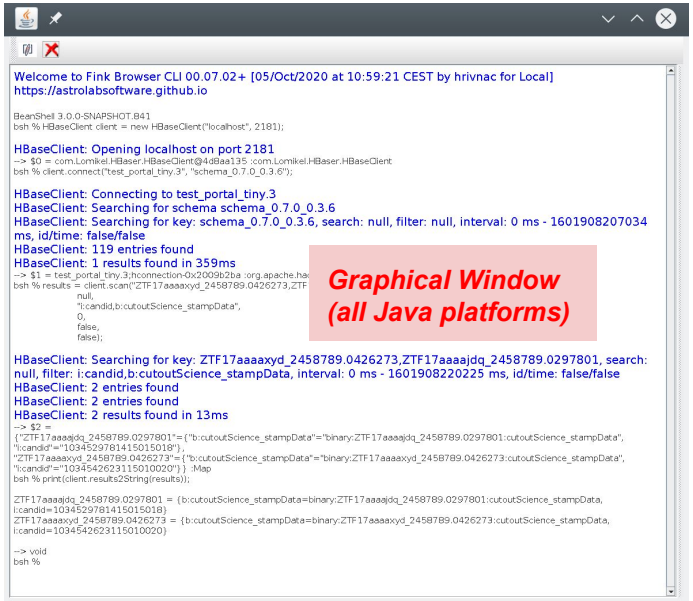
- Web Service Client
  - Connects to the HBase via Web Server (implemented in JSP + JavaScript) - more data processing
  - Connects to JanusGraph directly (implemented in pure JavaScript) - faster and more dynamic

Implementation

- Written in
  - Java, JavaScript, JSP, Python, Groovy
- Based on
  - JavaFX, HBase, JanusGraph, TinkerPop, HttpClient, JS9, vis.js, jQuery, jQuery UI, w2ui, Popper, Font Awesome, BootStrap, BootStrap Table, Moment.js, Knockout.js, jRange.js, BeanShell, CLI Parser, org.json, (Jython, JPype, Sage, MatPlotLib)
- Build with the help of
  - Ant, J2H, Vizant, UmlGraph, FindBugs, ApiViz, JDepend
- **Distributed as a single (static) file, containing all dependencies**
  - **`FinkBrowser.exe.jar` serves all command line applications (Java, Python,....)**
  - **`FinkBrowser.war` can be deployed in any Apache/Tomcat server container**



Command Line - Java



Graphical Window (all Java platforms)

```
[localhost] ~/work/LSST/FinkBrowser/ant $ java -jar ../lib/FinkBrowser.exe.jar
Welcome to Fink Browser CLI 00.07.02+ [05/Oct/2020 at 10:59:
https://astrolabsoftware.github.io
BeanShell 3.0.0-SNAPSHOT.841
bsh % HBaseClient client = new HBaseClient("localhost", 2181
    0 INFO  (HBaser.HBaseClient           :  82) : Opening localhost on port 2181
--> $0 = com.Lomikel.HBaser.HBaseClient@34dbfff2 :com.Lomikel.HBaser.HBaseClient
bsh % client.connect("test_portal_tiny.3", "schema_0.7.0_0.3.6");
 6601 INFO  (HBaser.HBaseClient           : 143) : Connecting to test_portal_tiny.3
 6610 INFO  (HBaser.HBaseClient           : 157) : Searching for schema schema_0.7.0_0.3.6
 6610 INFO  (HBaser.HBaseClient           : 400) : Searching for key: schema_0.7.0_0.3.6, search: null,
 6977 INFO  (HBaser.HBaseClient           : 448) : 119 entries found
 6980 INFO  (HBaser.HBaseClient           : 560) : 1 results found in 370ms
--> $1 = test_portal_tiny.3;hconnection-0x56cdbe1e :org.apache.hadoop.hbase.client.HTable
bsh %
```

Linux Command Line

```
// Connect to HBase table
HBaseClient client = new HBaseClient("134.158.74.54", 2181);
client.connect("test_portal_tiny.3", "schema_0.7.0_0.3.6");

// Get two known alerts (just one column)
print(client.scan("ZTF17aaaaxyd_2458789.0426273,ZTF17aaaajdq_2458789.0297801",
                  null,
                  "i:candid",
                  null));

// Get all alerts with row starting with 'ZTF19'
print(client.scan(null,
                  "key:key:ZTF19",
                  "i:candid",
                  "10000"));

// Get timeline dependece of i:candid
print(client.timeline("i:candid"));

// Get all recent (last 100000 minutes) objectIds
print(client.latests("i:objectId",
                     null,
                     100000,
                     true));

// Apply formula to filter results
client.setEvaluation("isWithinGeoLimits(80, 85, -4.0, 0.0)", "ra,dec");
print(client.scan(null,
                  null,
                  null,
                  null));

client.close();
```

Command Line - Python

CPython wrapper over Java client

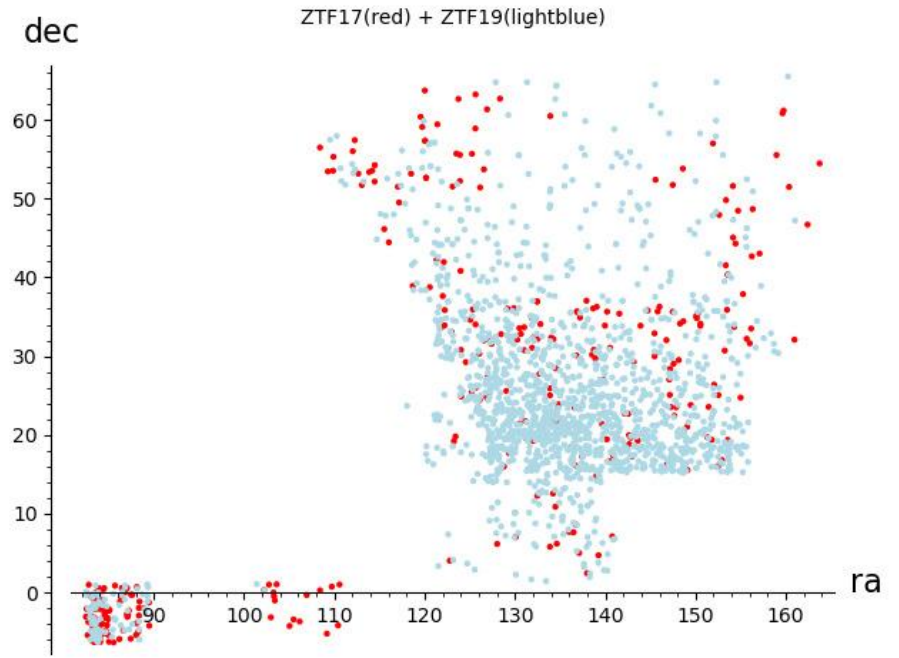
```
import sys

import jpype
import jpype.imports
from jpype import JImplements, JOverride, JImplementationFor

# ../dist/FinkBrowser.exe.jar
jpype.startJVM(jpype.getDefaultJVMPath(), "-ea", "-Djava.class.path=" + sys.argv[1], convertStrings=False)

from com.Lomikel.HBaser import HBaseClient

true  = jpype.java.lang.Boolean(True)
false = jpype.java.lang.Boolean(False)

client = HBaseClient("localhost", 2181)
client.connect("test_portal_tiny.3", "schema_0.7.0_0.3.6")
client.setLimit(10)

print(client.scan(None, "key:key:ZTF17", None, 100000, true, true))

client.close()

jpype.shutdownJVM()
```

Jython wrapper over Java client

```
import sys

# ../dist/FinkBrowser.exe.jar
sys.path.append(sys.argv[1])

from com.Lomikel.HBaser import HBaseClient

client = HBaseClient("localhost", 2181)
client.connect("test_portal_tiny.3", "schema_0.7.0_0.3.6")
client.setLimit(10)

print(client.scan(None, "key:key:ZTF17", None, 100000, True, True))

client.close()
```

Command Line - Sage

```
# like Python
a17 = [];
a19 = [];
for r in client.scan("", "key:key:ZTF17", "i:ra,i:dec", 100000, false, false).values():
  a17 += [(float(r['i:ra']), float(r['i:dec']))];
for r in client.scan("", "key:key:ZTF19", "i:ra,i:dec", 100000, false, false).values():
  a19 += [(float(r['i:ra']), float(r['i:dec']))];
p = list_plot(a17, color='red') + list_plot(a19, color='blue');
show(p, axes_labels = ('ra', 'dec'), title='ZTF17(red) + ZTF19(blue)');
```



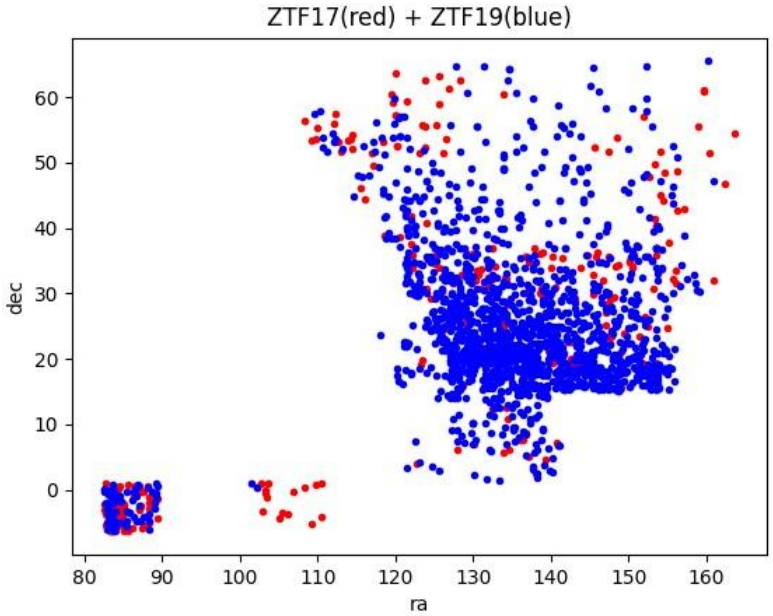
Advanced Math & Graphics
(interface to other Python frameworks can be easily added)

? Graph Math ?

Command Line - MatPlotLib

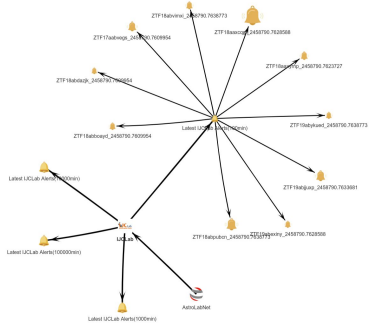
```
# like Python
import matplotlib.pyplot as plt
a17_x = [];
a17_y = [];
a19_x = [];
a19_y = [];
for r in client.scan("", "key:key:ZTF17", "i:ra,i:dec", 0, false, false).values():
  a17_x += [float(r['i:ra'])]
  a17_y += [float(r['i:dec'])]
for r in client.scan("", "key:key:ZTF19", "i:ra,i:dec", 0, false, false).values():
  a19_x += [float(r['i:ra'])]
  a19_y += [float(r['i:dec'])]

plt.plot(a17_x, a17_y, 'r.')
plt.plot(a19_x, a19_y, 'b.')
plt.title('ZTF17(red) + ZTF19(blue)')
plt.xlabel('ra')
plt.ylabel('dec')
plt.show()
```

Advanced Graphics
(interface to other Python frameworks can be easily added)



Command Line - Full Example

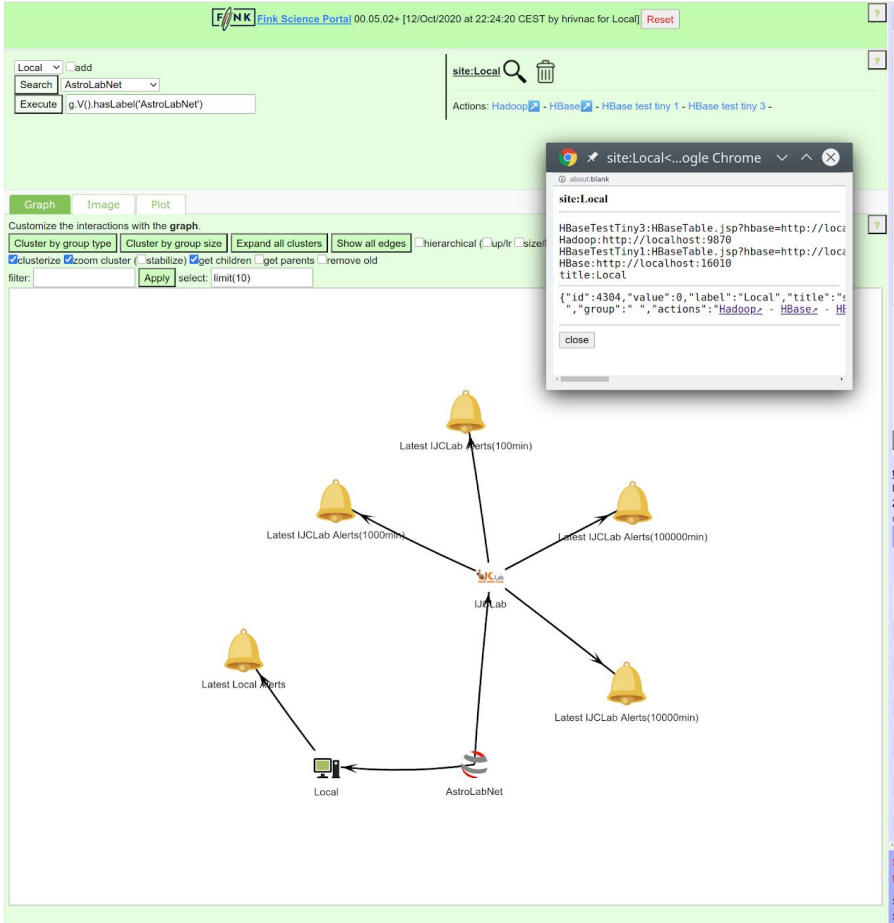
```
// Connect to JanusGraph
GremlinClient gc = new GremlinClient("134.158.74.85", 24444);
g = gc.g();

// Connect to HBase
HBaseClient hc = new HBaseClient("134.158.74.54", 2181);
hc.connect("test_portal_tiny.3", "schema_0.7.0_0.3.6");

// Get new interesting alerts from JanusGraph
// 1) get AlertCollection with name = NewInterestingAlerts
// 2) navigate all outgoing edges to get all alerts in this collection
// 3) convert their rowkeys into a List
rowkeys = g.V().has("AlertCollection", "name", "NewInterestingAlerts")
               .out().values("rowkey")
               .toList();

// Get dec*ra for those alerts fopm HBase
// 1) convert the List of rowkeys into a String with a comma-separated list of them
// 2) ask HBase for dec and ra properties of those alerts
keysearch = String.join(",", rowkeys);
results = hc.scan(keysearch,
                  null,
                  "i:dec,i:ra",
                  0,
                  false,
                  false);

// Analyse them
// ...

// Close connections
gc.close();
hc.close();
```

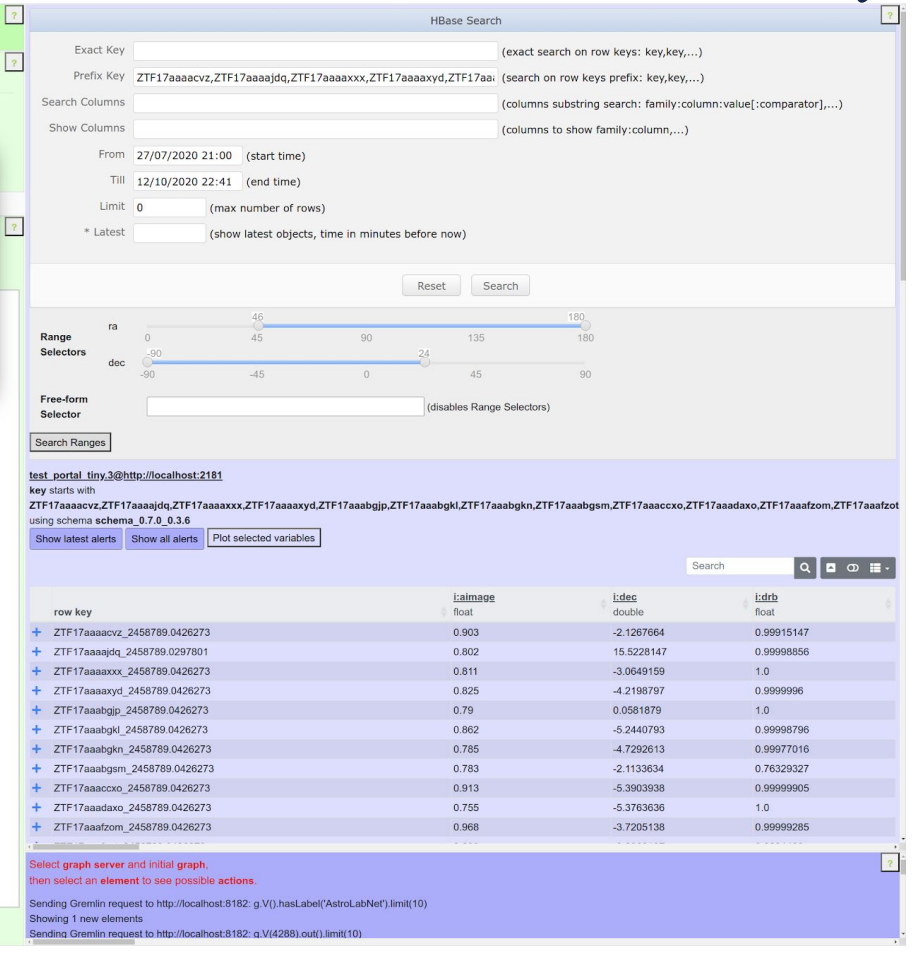


Connecting to both databases

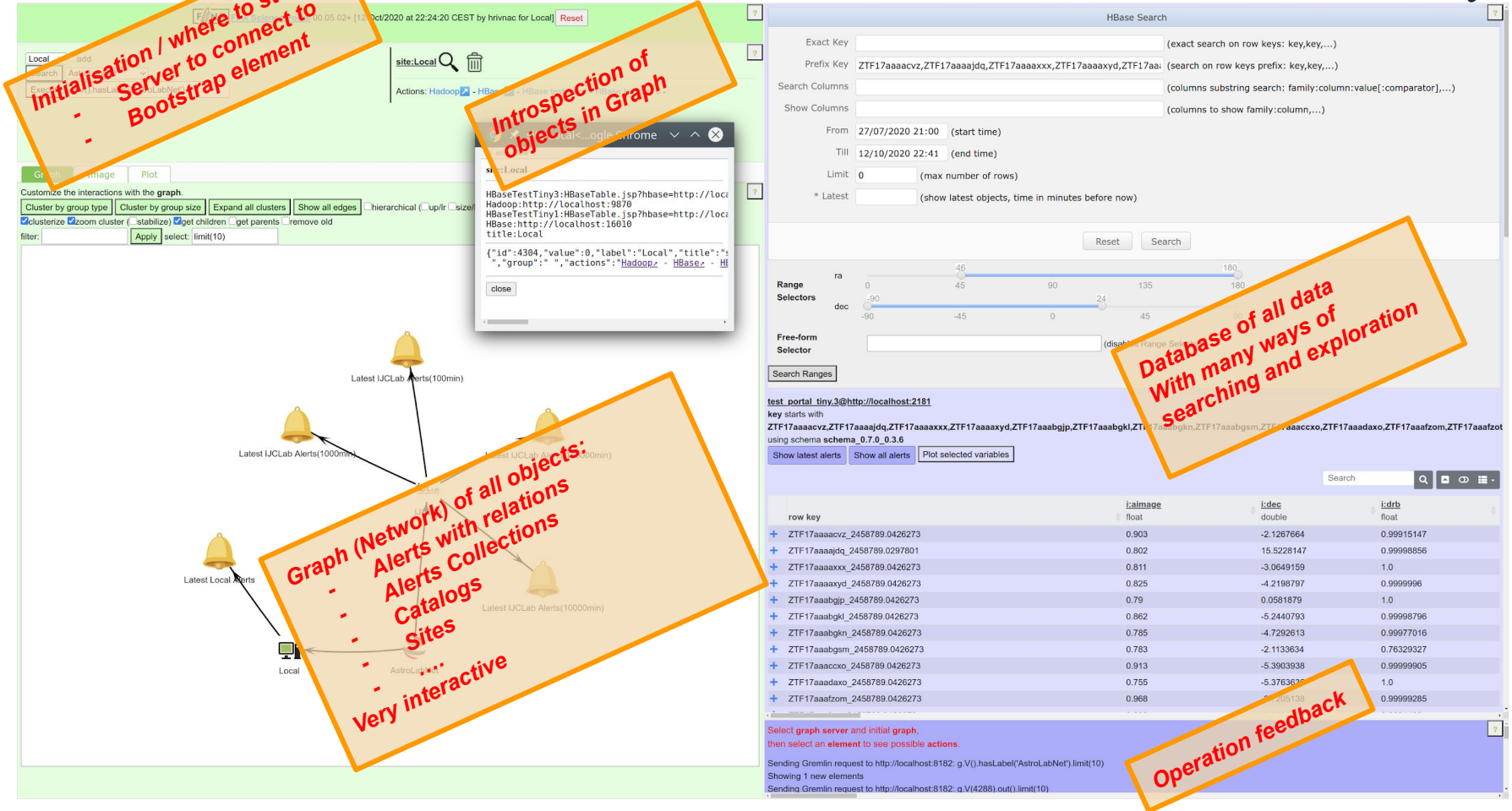
row key	i:aimage float	i:bimage float	i:dec double	i:ra double	i:seeratio float
ZTF17aaaacvz_2458789.0426273	0.903	0.718	-2.1267664	83.2148851	2.0
ZTF17aaaajdq_2458789.0297801	0.802	0.704	15.5228147	149.1123409	0.55874145
ZTF17aaaaxxx_2458789.0426273	0.811	0.768	-3.0649159	84.5695002	0.98741776
ZTF17aaaaxyd_2458789.0426273	0.825	0.763	-4.2198797	83.9509267	1.0054516
ZTF17aaabgjp_2458789.0426273	0.79	0.778	0.0581879	86.5794079	1.2489125
ZTF17aaabgkl_2458789.0426273	0.862	0.822	-5.2440793	84.0823252	1.0638597
ZTF17aaabgkn_2458789.0426273	0.785	0.737	-4.7292613	83.3925766	0.9791926
ZTF17aaabgsm_2458789.0426273	0.783	0.684	-2.1133634	84.0362482	2.0
ZTF17aaaccxo_2458789.0426273	0.913	0.881	-5.3903938	83.4445077	1.0598751
ZTF17aaadaxo_2458789.0426273	0.755	0.727	-5.3763636	84.9028841	1.2408653

Web Service

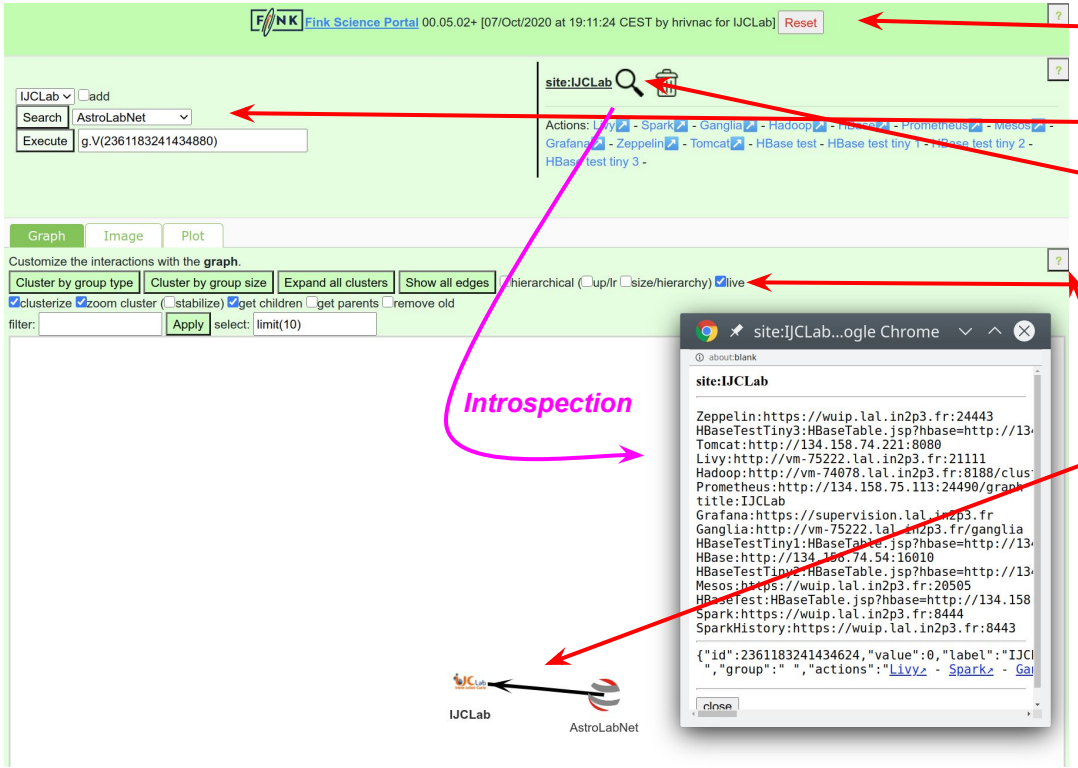

Fink Science Portal 00.05.02+ [12/Oct/2020 at 22:24:20 CEST by hrivnac for Local]
Reset
Local
add
Search
AstroLabNet
Execute
g.V().hasLabel('AstroLabNet')
site:Local
Actions: Hadoop - HBase - HBase test tiny 1 - HBase test tiny 3 -
Graph
Image
Plot
Customize the interactions with the graph.
Cluster by group type
Cluster by group size
Expand all clusters
Show all edges
hierarchical
clusterize
zoom cluster
stabilize
get children
get parents
remove old
filter:
Apply
select:
limit(10)
site:Local<...ogle Chrome
about:blank
site:Local
HBaseTestTiny3:HBaseTable.jsp?hbase=http://loca
Hadoop:http://localhost:9870
HBaseTestTiny1:HBaseTable.jsp?hbase=http://loca
HBase:http://localhost:16010
title:Local
close
Latest IJCLab Alerts(100min)
Latest IJCLab Alerts(1000min)
Latest IJCLab Alerts(100000min)
IJCLab
Latest Local Alerts
Latest IJCLab Alerts(10000min)
Local
AstroLabNet


HBase Search
Exact Key
(exact search on row keys: key,key,...)
Prefix Key
ZTF17aaaacvz,ZTF17aaaajdq,ZTF17aaaaxxx,ZTF17aaaaxyd,ZTF17aa
(search on row keys prefix: key,key,...)
Search Columns
(columns substring search: family:column:value[:comparator],...)
Show Columns
(columns to show family:column,...)
From
27/07/2020 21:00
(start time)
Till
12/10/2020 22:41
(end time)
Limit
0
(max number of rows)
* Latest
(show latest objects, time in minutes before now)
Reset
Search
Range Selectors
ra
dec
Free-form Selector
(disables Range Selectors)
Search Ranges
test_portal_tiny,3@http://localhost:2181
key starts with
ZTF17aaaacvz,ZTF17aaaajdq,ZTF17aaaaxxx,ZTF17aaaaxyd,ZTF17aaabgjp,ZTF17aaabgkl,ZTF17aaabgkn,ZTF17aaabgsm,ZTF17aaaccxo,ZTF17aaadaxo,ZTF17aaafzom,ZTF17aaafzot
using schema schema_0.7.0_0.3.6
Show latest alerts
Show all alerts
Plot selected variables
Search
row key
i:aimage
float
i:dec
double
i:drb
float
ZTF17aaaacvz_2458789.0426273 0.903 -2.1267664 0.99915147
ZTF17aaaajdq_2458789.0297801 0.802 15.5228147 0.99998856
ZTF17aaaaxxx_2458789.0426273 0.811 -3.0649159 1.0
ZTF17aaaaxyd_2458789.0426273 0.825 -4.2198797 0.9999996
ZTF17aaabgjp_2458789.0426273 0.79 0.0581879 1.0
ZTF17aaabgkl_2458789.0426273 0.862 -5.2440793 0.99998796
ZTF17aaabgkn_2458789.0426273 0.785 -4.7292613 0.99977016
ZTF17aaabgsm_2458789.0426273 0.783 -2.1133634 0.76329327
ZTF17aaaccxo_2458789.0426273 0.913 -5.3903938 0.99999905
ZTF17aaadaxo_2458789.0426273 0.755 -5.3763636 1.0
ZTF17aaafzom_2458789.0426273 0.968 -3.7205138 0.99999285
Select graph server and initial graph,
then select an element to see possible actions.
Sending Gremlin request to http://localhost:8182: g.V().hasLabel('AstroLabNet').limit(10)
Showing 1 new elements
Sending Gremlin request to http://localhost:8182: g.V(4288).out().limit(10)

Web Service - Description

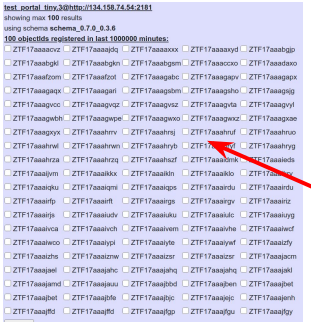


Web Service - Left (Green) Pane

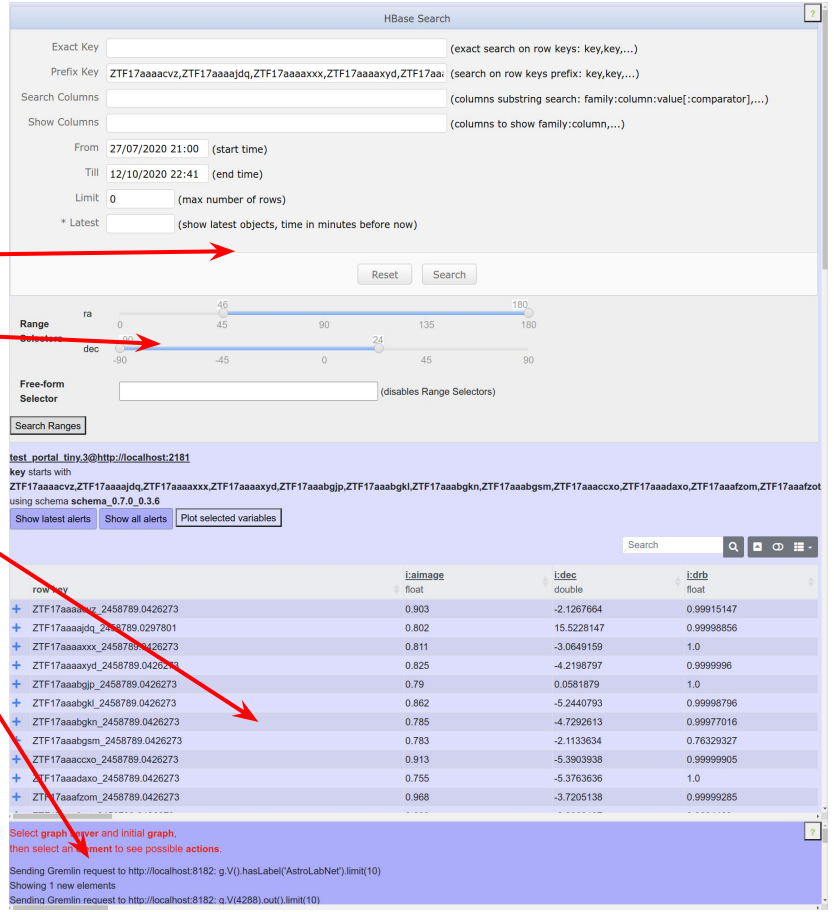


- Stable element (never changes and allows total reset)
- Initial graph search
- Graph element introspection and context-specific actions
- Graph manipulation, options and filters
- Detailed page help
- Graph

Web Service - Right (Blue) Pane



- Collection of alerts
- Detailed HBase search
- Range search
- Several possible views of the found table results
- Operation feedback with info about equivalent command line operations



Web Service - Flow

Chose server and database to start

Context-sensitive Actions

Search/Execute to get Graph

Click to see all properties (as popup)

Database search/navigations/operations

Graph manipulation/options

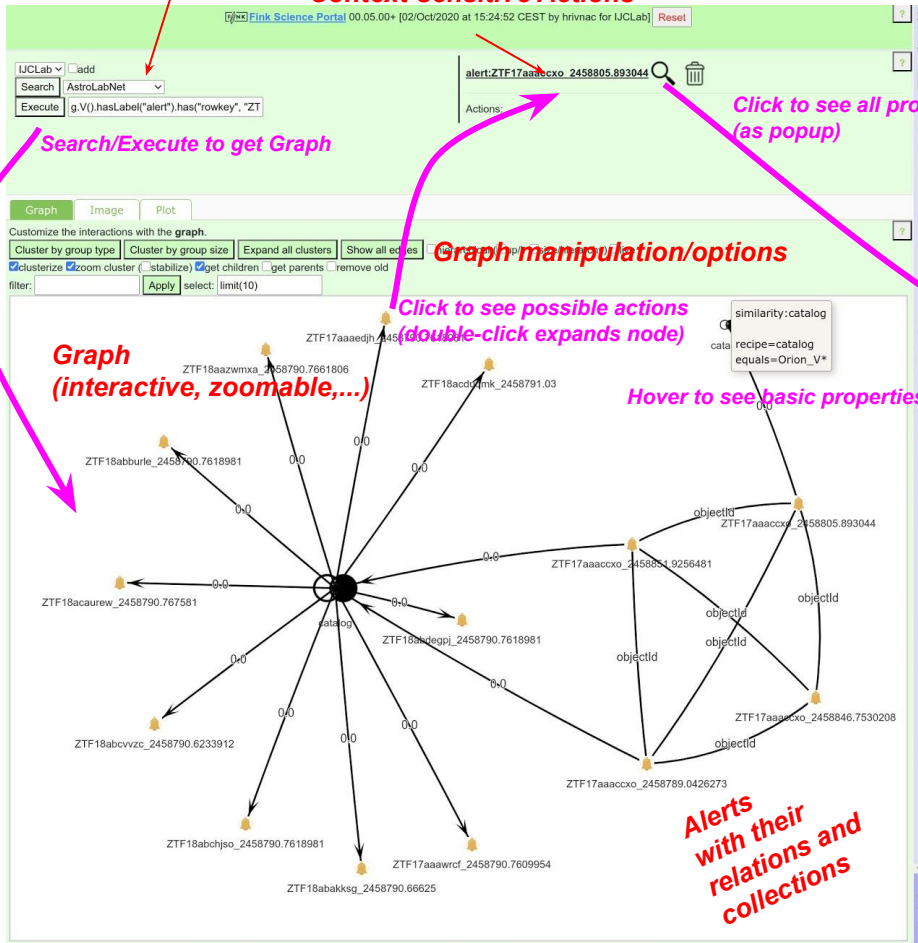
Click to see possible actions (double-click expands node)

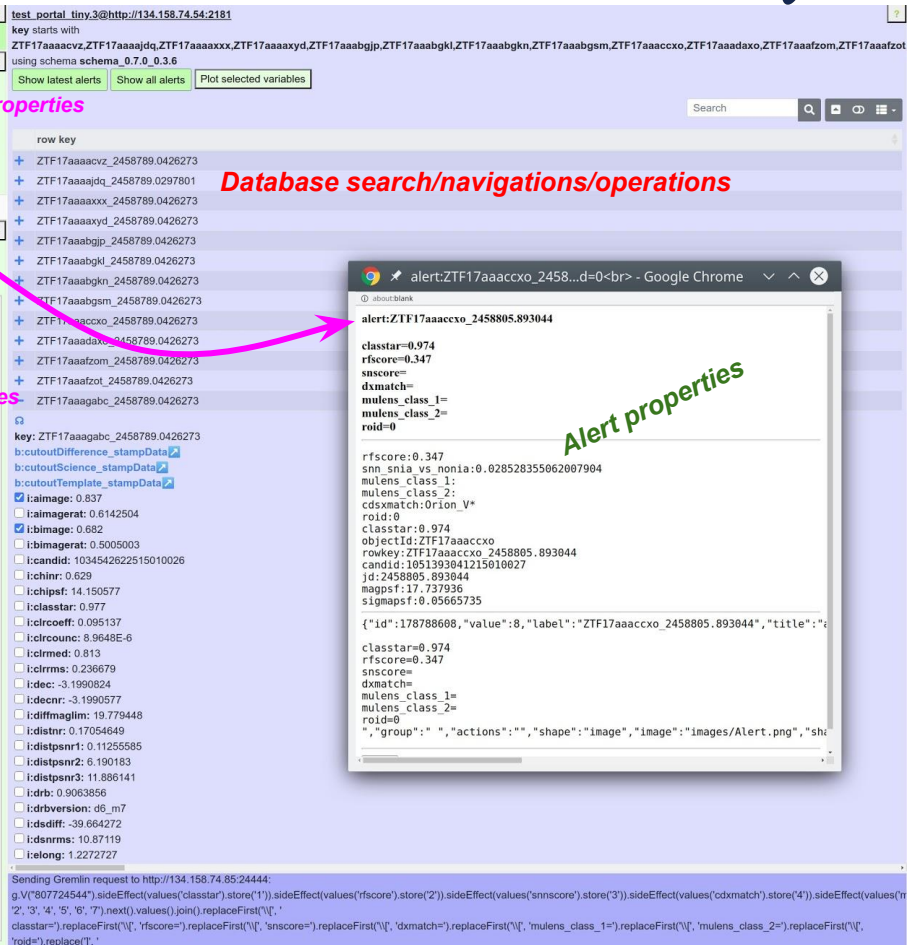
Graph (interactive, zoomable,...)

Hover to see basic properties

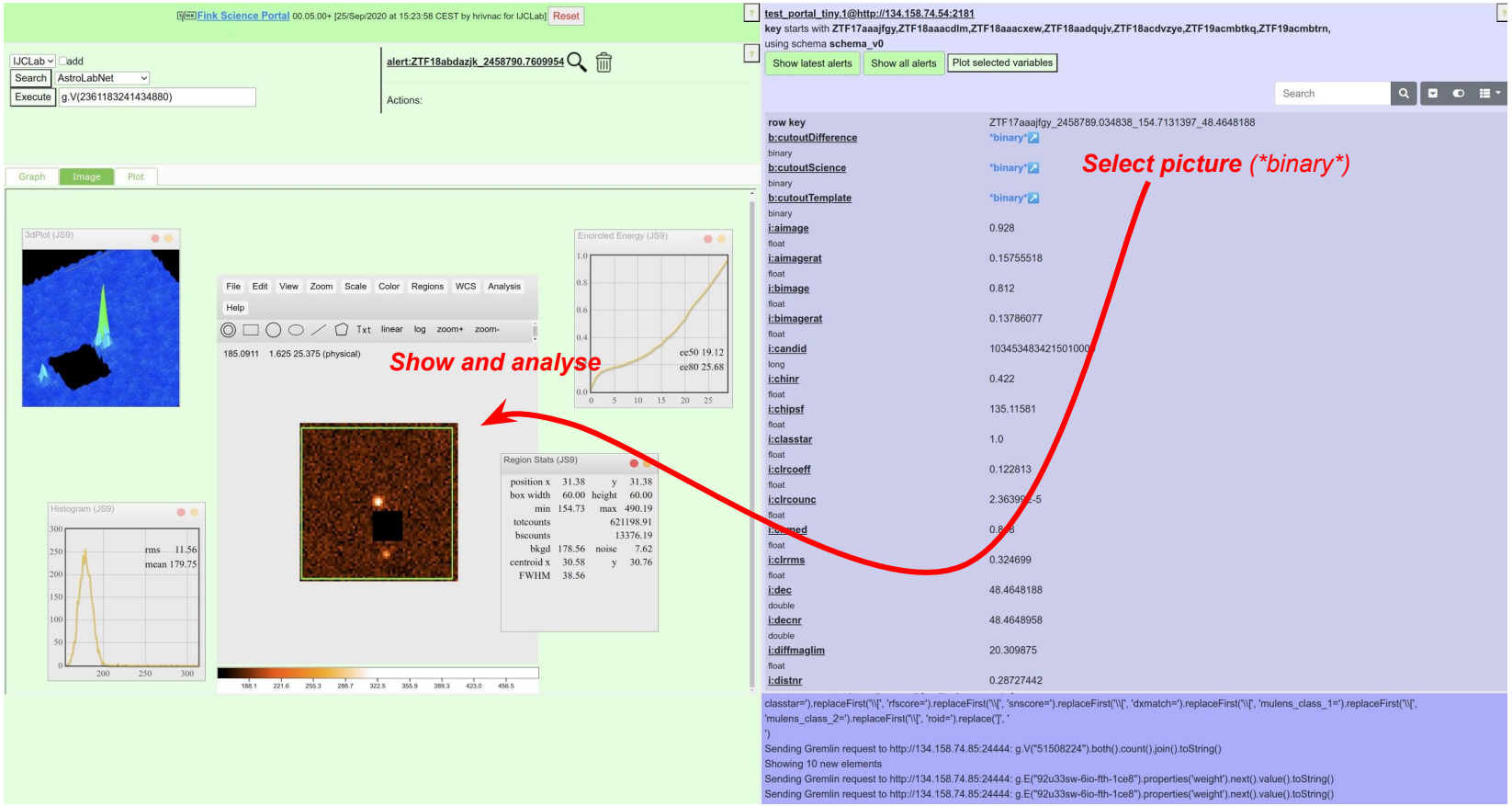
Alert properties

Alerts with their relations and collections

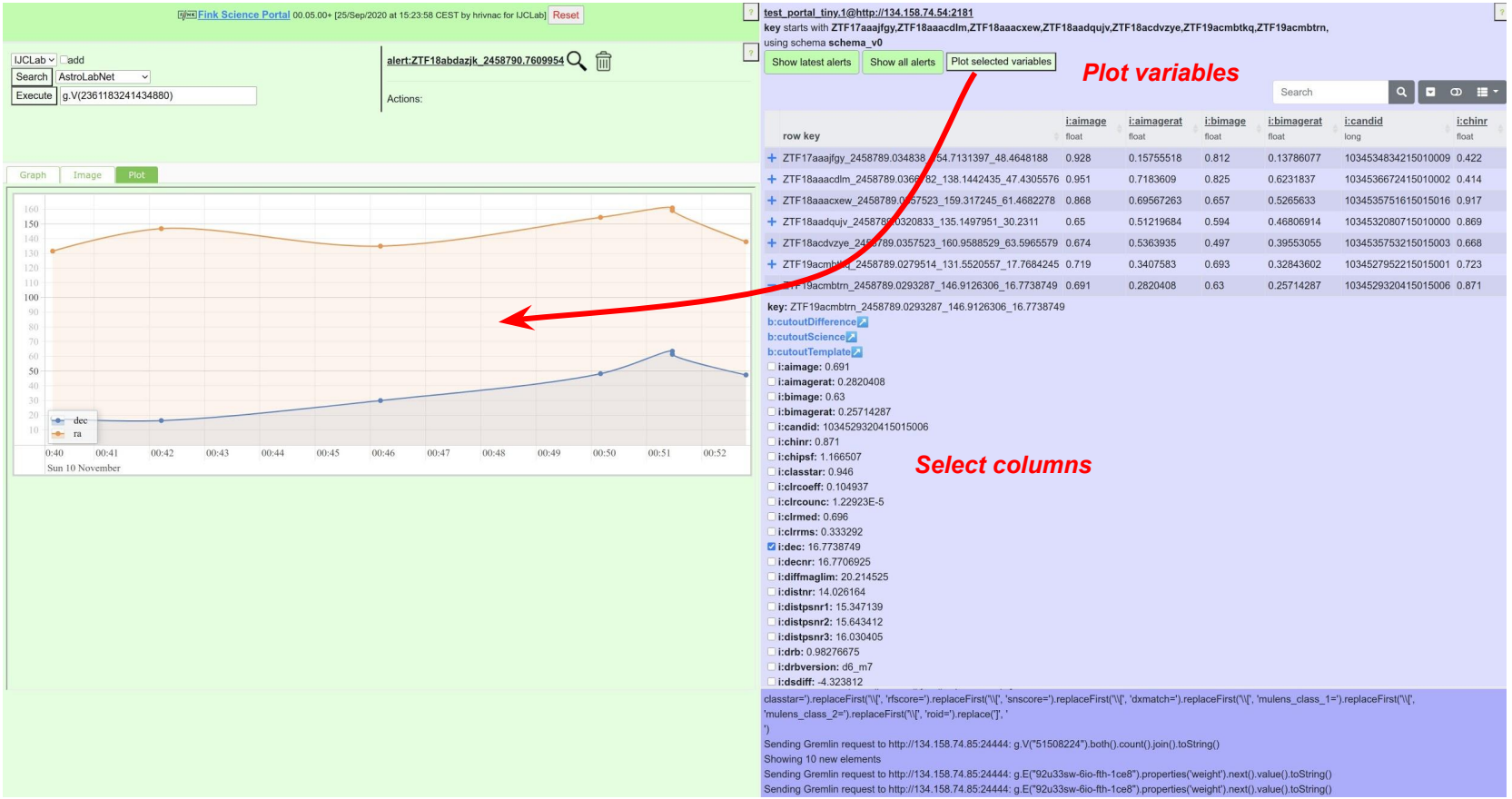




Web Service - Images



Web Service - Plots



Status

- Framework with all connections in place, running
  - Client code available to download
- Functional user interface with some functionality and limited user-friendleness
  - Very simplified style to be implemented
- Raw data in place and accessible
  - Limited structure in data (AlertCollections to be defined/implemented/filled)
- Basic documentation in place
- Basic help in place
  - To be extended
- Authentication/authorisation not yet included
- Under Active development

Home Page: https://cern.ch/hrivnac/Activities/Packages/FinkBrowser
Prototype Client: http://cern.ch/hrivnac/Activities/Packages/FinkBrowser.exe.jar
Prototype/Demo Web Service: http://134.158.74.221:8080/FinkBrowser/?profile=ijclab&style=simple

default data loaded at start

simplified interface