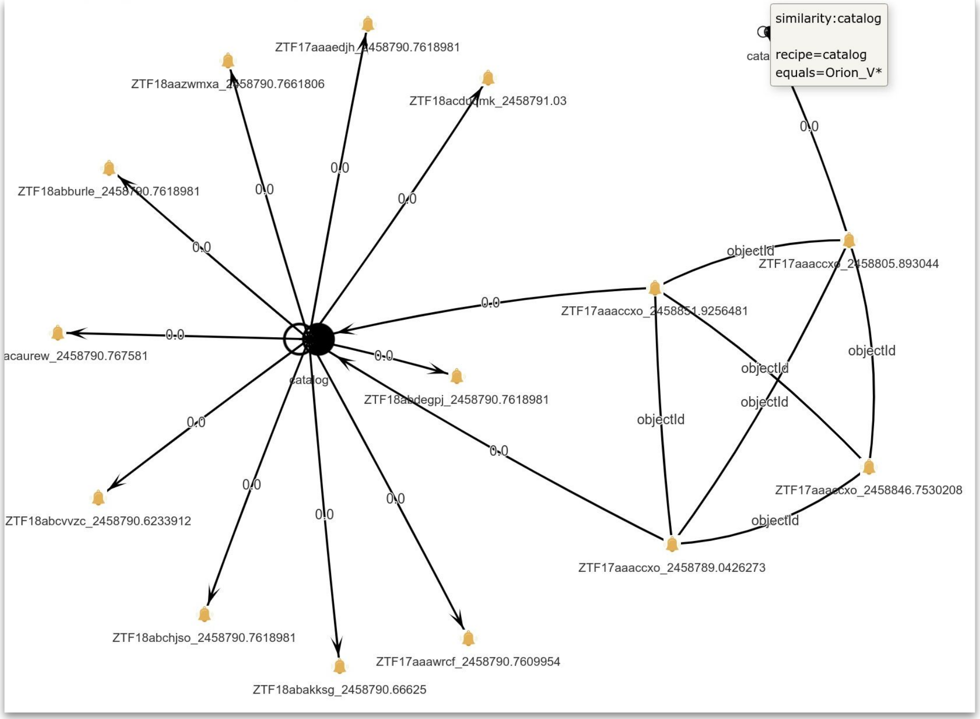
Graphs & Data Explorer


similarity:catalog
recipe=catalog
equals=Orion_V*
cata
catalog
ZTF17aaaedjh_2458790.7618981
ZTF18aazwmxa_2458790.7661806
ZTF18acdudmk_2458791.03
ZTF18abburle_2458790.7618981
acaurew_2458790.767581
ZTF18abdegpj_2458790.7618981
ZTF18abcvvzc_2458790.6233912
ZTF18abchjso_2458790.7618981
ZTF18abakksg_2458790.66625
ZTF17aaawrcf_2458790.7609954
ZTF17aaaccxo_2458805.893044
ZTF17aaaccxo_2458851.9256481
ZTF17aaaccxo_2458846.7530208
ZTF17aaaccxo_2458789.0426273
0.0
objectId

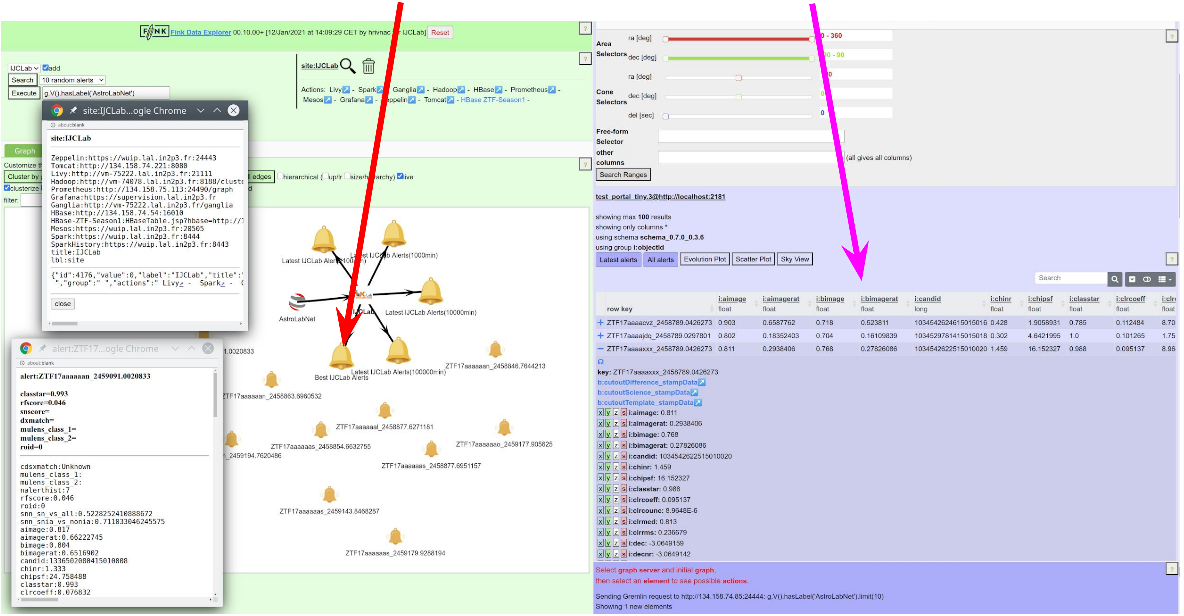
- ➢ Graphs Schema
- ➢ JanusGraph Deployment
- ➢ Data Explorer
- ➢ Graph Construction ?
- ➢ Graphs for Configuration ?

Julius Hrivnac, IJCLab
19/Jan/2021

Graph Schema

- ➢ **HBase** has more information, but only contains alerts
- ➢ **Graph** has less information, but contains structural elements
  - ○ Relations between alerts
  - ○ Group of Alerts
  - ○ Server (site) properties
- ➢ HBase is read-only, Graph can be extended (by users, groups,...)
- ➢ HBase rows and Graph Vertices are linked (user can navigate between them)

Graph Vertices linked with HBase rows



F/NK
Fink Data Explorer 00.10.00+ [12/Jan/2021 at 14:09:29 CET by hrivnac for IJCLab]
Reset
IJCLab
☑add
Search
10 random alerts
Execute
site:IJCLab
Actions: Livy - Spark - Ganglia - Hadoop - HBase - Prometheus - Mesos - Grafana - Zeppelin - Tomcat - HBase ZTF-Season1 -
Graph
Customize th
Cluster by
☑clusterize
filter:
edges
☐hierarchical (☐up/lr ☐size/hierarchy) ☑live
site:IJCLab...ogle Chrome
about:blank
close
alert:ZTF17...ogle Chrome
about:blank
AstroLabNet
IJCLab
Latest IJCLab Alerts(100min)
Latest IJCLab Alerts(1000min)
Latest IJCLab Alerts(10000min)
Latest IJCLab Alerts(100000min)
Best IJCLab Alerts
1.0020833
ZTF17aaaaaan_2458846.7644213
ZTF17aaaaaan_2458863.6960532
ZTF17aaaaaal_2458877.6271181
ZTF17aaaaaas_2458854.6632755
ZTF17aaaaaao_2459177.905625
n_2459194.7620486
ZTF17aaaaaas_2458877.6951157
ZTF17aaaaaas_2459143.8468287
ZTF17aaaaaas_2459179.9288194
Area Selectors
ra [deg]
dec [deg]
0 - 360
-90 - 90
Cone Selectors
ra [deg]
dec [deg]
del [sec]
0
0
0
Free-form Selector
other columns
(all gives all columns)
Search Ranges
Latest alerts
All alerts
Evolution Plot
Scatter Plot
Sky View
Search

g.V().hasLabel('AstroLabNet')

site:IJCLab

```
Zeppelin:https://wuip.lal.in2p3.fr:24443
Tomcat:http://134.158.74.221:8080
Livy:http://vm-75222.lal.in2p3.fr:21111
Hadoop:http://vm-74078.lal.in2p3.fr:8188/cluste
Prometheus:http://134.158.75.113:24490/graph
Grafana:https://supervision.lal.in2p3.fr
Ganglia:http://vm-75222.lal.in2p3.fr/ganglia
HBase:http://134.158.74.54:16010
HBase-ZTF-Season1:HBaseTable.jsp?hbase=http://1
Mesos:https://wuip.lal.in2p3.fr:20505
Spark:https://wuip.lal.in2p3.fr:8444
SparkHistory:https://wuip.lal.in2p3.fr:8443
title:IJCLab
lbl:site
```

```
{"id":4176,"value":0,"label":"IJCLab","title":'
 ","group":" ","actions":" Livy -  Spark -  (
```

alert:ZTF17aaaaaan_2459091.0020833

classtar=0.993
rfscore=0.046
snscore=
dxmatch=
mulens_class_1=
mulens_class_2=
roid=0

```
cdsxmatch:Unknown
mulens_class_1:
mulens_class_2:
nalerthist:7
rfscore:0.046
roid:0
snn_sn_vs_all:0.5228252410888672
snn_snia_vs_nonia:0.711033046245575
aimage:0.817
aimagerat:0.66222745
bimage:0.804
bimagerat:0.6516902
candid:1336502080415010008
chinr:1.333
chipsf:24.758488
classtar:0.993
clrcoeff:0.076832
```

test_portal_tiny.3@http://localhost:2181

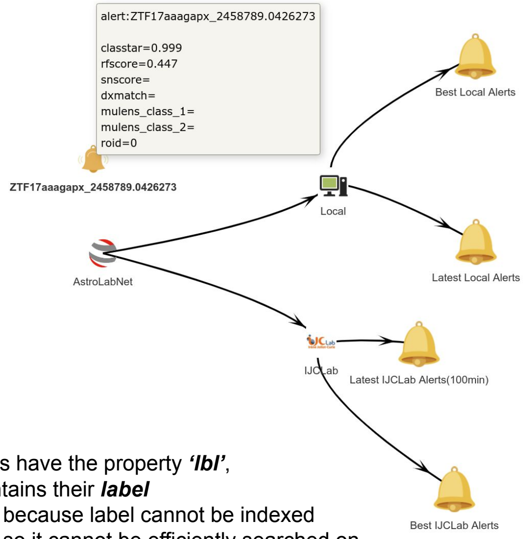
showing max **100** results
showing only columns *
using schema **schema_0.7.0_0.3.6**
using group **i:objectId**

	row key	i:aimage float	i:aimagerat float	i:bimage float	i:bimagerat float	i:candid long	i:chinr float	i:chipsf float	i:classtar float	i:clrcoeff float	i:clr float
+	ZTF17aaaacvz_2458789.0426273	0.903	0.6587762	0.718	0.523811	1034542624615015016	0.428	1.9058931	0.785	0.112484	8.70
+	ZTF17aaaajdq_2458789.0297801	0.802	0.18352403	0.704	0.16109839	1034529781415015018	0.302	4.6421995	1.0	0.101265	1.75
−	ZTF17aaaaxxx_2458789.0426273	0.811	0.2938406	0.768	0.27826086	1034542622515010020	1.459	16.152327	0.988	0.095137	8.96

key: ZTF17aaaaxxx_2458789.0426273
b:cutoutDifference_stampData
b:cutoutScience_stampData
b:cutoutTemplate_stampData
x y z s **i:aimage:** 0.811
x y z s **i:aimagerat:** 0.2938406
x y z s **i:bimage:** 0.768
x y z s **i:bimagerat:** 0.27826086
x y z s **i:candid:** 1034542622515010020
x y z s **i:chinr:** 1.459
x y z s **i:chipsf:** 16.152327
x y z s **i:classtar:** 0.988
x y z s **i:clrcoeff:** 0.095137
x y z s **i:clrcounc:** 8.9648E-6
x y z s **i:clrmed:** 0.813
x y z s **i:clrrms:** 0.236679
x y z s **i:dec:** -3.0649159
x y z s **i:decnr:** -3.0649142

Select **graph server** and initial **graph**,
then select an **element** to see possible **actions**.

Sending Gremlin request to http://134.158.74.85:24444: g.V().hasLabel('AstroLabNet').limit(10)
Showing 1 new elements



alert:ZTF17aaagapx_2458789.0426273

classtar=0.999
rfscore=0.447
snscore=
dxmatch=
mulens_class_1=
mulens_class_2=
roid=0

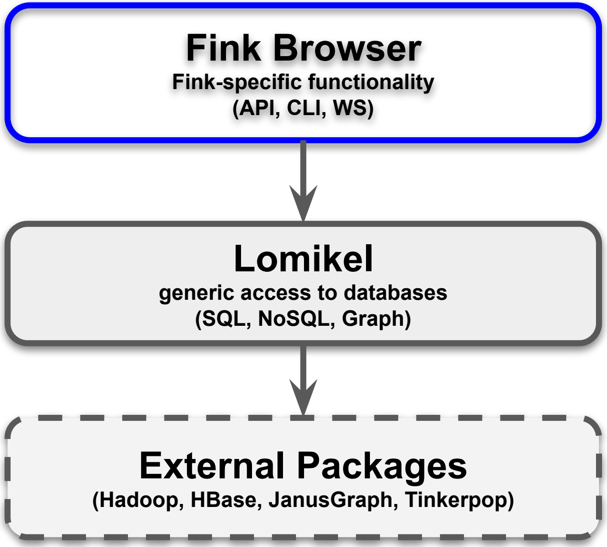
All vertices have the property ***'lbl'***, which contains their ***label***

- because label cannot be indexed
- so it cannot be efficiently searched on

```
// Vertexes
AstroLabNet      = mgmt.makeVertexLabel('AstroLabNet'     ).make()
site             = mgmt.makeVertexLabel('site'            ).make()
AlertsCollection = mgmt.makeVertexLabel('AlertsCollection').make()
alert            = mgmt.makeVertexLabel('alert'           ).make()

// Edges
has      = mgmt.makeEdgeLabel('has'     ).multiplicity(ONE2MANY ).make()
holds    = mgmt.makeEdgeLabel('holds'   ).multiplicity(ONE2MANY ).make()
contains = mgmt.makeEdgeLabel('contains').multiplicity(MULTI    ).make()

// Properties
title  = mgmt.makePropertyKey('title' ).dataType(String.class).cardinality(Cardinality.SINGLE).make()
lbl    = mgmt.makePropertyKey('lbl'   ).dataType(String.class).cardinality(Cardinality.SINGLE).make()
rowkey = mgmt.makePropertyKey('rowkey').dataType(String.class).cardinality(Cardinality.SINGLE).make()

// Vertex properties
mgmt.addProperties(AstroLabNet, lbl, title)
mgmt.addProperties(site, lbl, title)
mgmt.addProperties(AlertsCollection, lbl, title)
mgmt.addProperties(alert, lbl, rowkey)

// Edge properties
mgmt.addProperties(has, lbl)
mgmt.addProperties(holds, lbl)
mgmt.addProperties(contains,lbl)

// Connections
mgmt.addConnection(has,      AstroLabNet,      site)
mgmt.addConnection(holds,    site,             AlertsCollection)
mgmt.addConnection(contains, AlertsCollection, alert)
```

JanusGraph Deployment

- ➢ All necessary external packages installed (not deployed) under /opt at janus-server and tomcat-server
- ➢ Lomikel and FinkBrowser installed from GIT
- ➢ Customised JanusGraph configuration deployed
  - ○ With the main graph **‘g’**
- ➢ Authentication deployed, but disabled



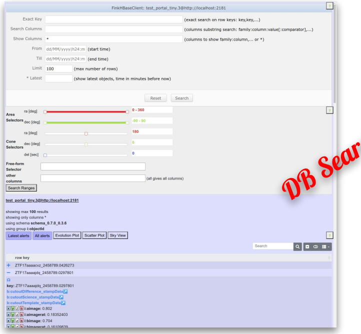
Fink Browser
Fink-specific functionality
(API, CLI, WS)
Lomikel
generic access to databases
(SQL, NoSQL, Graph)
External Packages
(Hadoop, HBase, JanusGraph, Tinkerpop)

```
# to prepare
# and create executable CLI
# callable from Java, Scala, Python, Jupyter,...
cd Lomikel/ant
source setup.sh
ant dist
cd ../../FinkBrowser/ant
source setup.sh
ant jar
```

```
# to deploy Tomcat Web Service
# @tomcat-server
# as janusgraph
cd FinkBrowser/ant
source setup.sh
ant deploy-prod
```

```
# to initialise Graphs
# @janusgraph-server
# as centos
cd Lomikel/ant
source setup.sh
ant janus-patch # patch JanusGraph
ant janus-restart # restart JanusGraph (also does patch)
cd ../../FinkBrowser/ant
source setup.sh
# initiate (empty) database with schema and index
gremlin_console < ../src/gremlin/schema-IJClab.gremlin
gremlin_console < ../src/gremlin/index-IJCLab.gremlin
# create top-level structures
gremlin_console < ../src/gremlin/astrolabnet-IJCLab.gremlin
# fill alerts from HBase
ant populate_graph
```

Data Views



FinkHBaseClient: test_portal_tiny.3@http://localhost:2181

Exact Key (exact search on row keys: key,key,...)

Search Columns (columns substring search: family:column:value[:comparator],...)

Show Columns * (columns to show family:column,... or *)

From dd/MM/yyyy|h24:m (start time)

Till dd/MM/yyyy|h24:m (end time)

Limit 100 (max number of rows)

* Latest (show latest objects, time in minutes before now)

Reset Search

Area Selectors ra [deg] 0 - 360

dec [deg] -90 - 90

Cone Selectors ra [deg] 180

dec [deg] 0

del [sec] 0

Free-form Selector

other columns (all gives all columns)

Search Ranges

test_portal_tiny.3@http://localhost:2181

showing max **100** results

showing only columns *

using schema **schema_0.7.0_0.3.6**

using group **i:objectId**

Latest alerts | All alerts | Evolution Plot | Scatter Plot | Sky View

Search

row key

+ ZTF17aaaacvz_2458789.0426273

− ZTF17aaaajdq_2458789.0297801

key: ZTF17aaaajdq_2458789.0297801

b:cutoutDifference_stampData

b:cutoutScience_stampData

b:cutoutTemplate_stampData

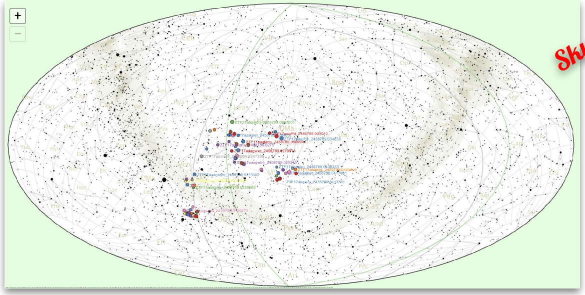
x y z s **i:aimage:** 0.802

x y z s **i:aimagerat:** 0.18352403

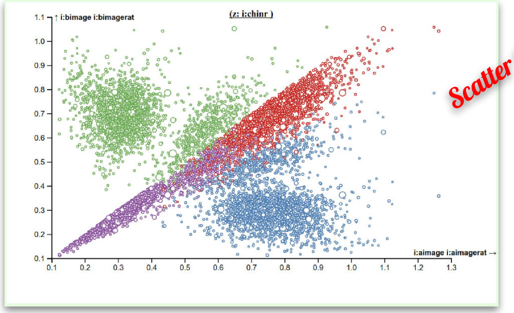
x y z s **i:bimage:** 0.704

x y z s **i:bimagerat:** 0.16109839

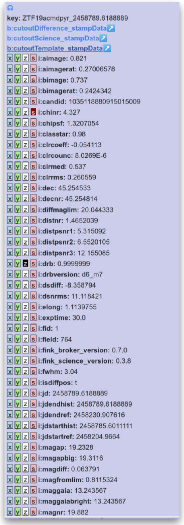
DB Search



Sky View



Scatter Plot



key: ZTF19acmdpyr_2458789.6188889

b:cutoutDifference_stampData

b:cutoutScience_stampData

b:cutoutTemplate_stampData

x y z s **i:aimage:** 0.821

x y z s **i:aimagerat:** 0.27006578

x y z s **i:bimage:** 0.737

x y z s **i:bimagerat:** 0.2424342

x y z s **i:candid:** 1035118880915015009

x y z s **i:chinr:** 4.327

x y z s **i:chipsf:** 1.3207054

x y z s **i:classtar:** 0.98

x y z s **i:clrcoeff:** -0.054113

x y z s **i:clrcounc:** 8.0269E-6

x y z s **i:clrmed:** 0.537

x y z s **i:clrrms:** 0.260559

x y z s **i:dec:** 45.254533

x y z s **i:decnr:** 45.254814

x y z s **i:diffmaglim:** 20.044333

x y z s **i:distnr:** 1.4652039

x y z s **i:distpsnr1:** 5.315092

x y z s **i:distpsnr2:** 6.5520105

x y z s **i:distpsnr3:** 12.155085

x y z s **i:drb:** 0.9999999

x y z s **i:drbversion:** d6_m7

x y z s **i:dsdiff:** -8.358794

x y z s **i:dsnrms:** 11.118421

x y z s **i:elong:** 1.1139755

x y z s **i:exptime:** 30.0

x y z s **i:fid:** 1

x y z s **i:field:** 764

x y z s **i:fink_broker_version:** 0.7.0

x y z s **i:fink_science_version:** 0.3.8

x y z s **i:fwhm:** 3.04

x y z s **i:isdiffpos:** t

x y z s **i:jd:** 2458789.6188889

x y z s **i:jdendhist:** 2458789.6188889

x y z s **i:jdendref:** 2458230.907616

x y z s **i:jdstarthist:** 2458785.6011111

x y z s **i:jdstartref:** 2458204.9664

x y z s **i:magap:** 19.2328

x y z s **i:magapbig:** 19.3116

x y z s **i:magdiff:** 0.063791

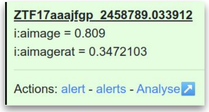
x y z s **i:magfromlim:** 0.8115324

x y z s **i:maggaia:** 13.243567

x y z s **i:maggaiabright:** 13.243567

x y z s **i:magnr:** 19.882

DB View



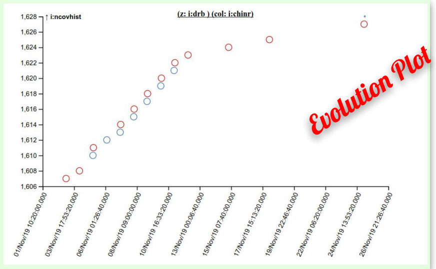
ZTF17aaajfgp_2458789.033912

i:aimage = 0.809

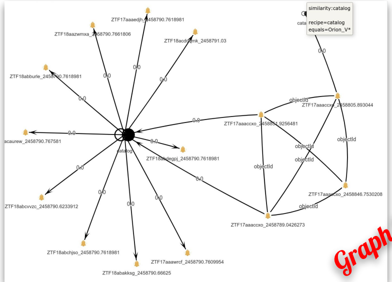
i:aimagerat = 0.3472103

Actions: alert - alerts - Analyse

Data Introspection



Evolution Plot


similarity:catalog
recipe=catalog
equals=Orion_V*
ZTF17aaaedjh_2458790.7618981
ZTF18aazwmxa_2458790.7661806
ZTF18acdqmk_2458791.03
ZTF18abburle_2458790.7618981
acaurew_2458790.767581
catalog
ZTF18abdegpj_2458790.7618981
ZTF18abcvvzc_2458790.6233912
ZTF18abchjso_2458790.7618981
ZTF18abakksg_2458790.66625
ZTF17aaawrcf_2458790.7609954
ZTF17aaaccxo_2458805.893044
ZTF17aaaccxo_2458851.9256481
ZTF17aaaccxo_2458846.7530208
ZTF17aaaccxo_2458789.0426273
0.0
objectId

Graph View

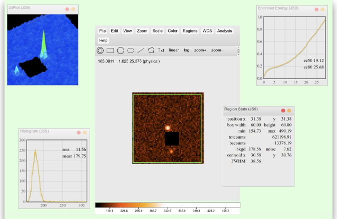
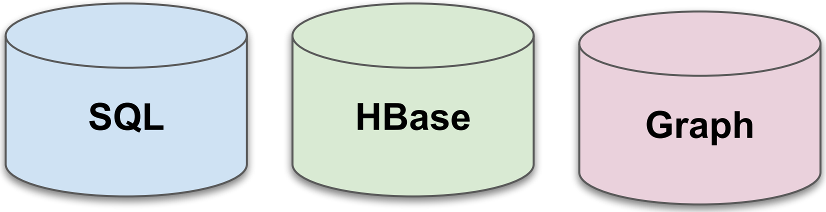
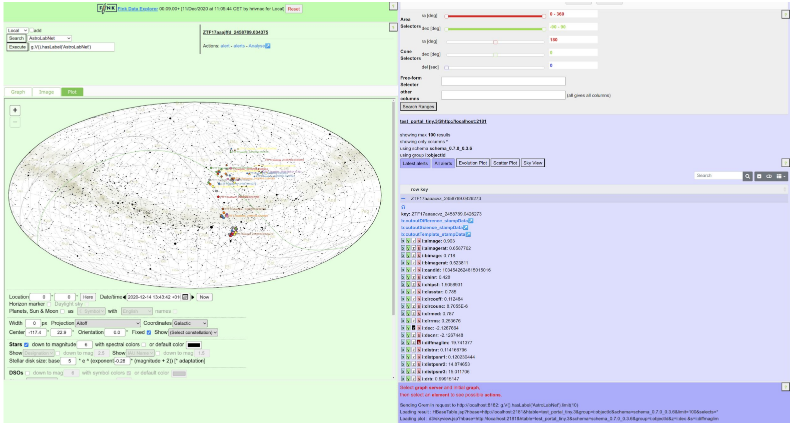


Image View



- ➢ Views are implemented in pure JavaScript
  - ○ So they are reusable in other Web applications, as-long-as they run on the same server (to satisfy CORS)
- ➢ Database backends run as Tomcat services
- ➢ Views can communicate, but can be also used separately
  - ○ In other applications

Data Explorer



Fink Data Explorer 00.09.00+ [11/Dec/2020 at 11:05:44 CET by hrivnac for Local] Reset

Local □ add
Search AstroLabNet
Execute g.V().hasLabel('AstroLabNet')

ZTF17aaajffd_2458789.034375
Actions: alert - alerts - Analyse

Location 0 ° 0 ° Here Date/time 2020-12-14 13:43:42 +01(Now
Horizon marker □ Daylight sky □
Planets, Sun & Moon □ as Symbol with English names □
Width 0 px Projection Aitoff Coordinates Galactic
Center -117.4 ° 22.9 ° Orientation 0.0 ° Fixed ☑ Show (Select constellation)
Stars ☑ down to magnitude 6 with spectral colors □ or default color
Show Designation □ down to mag 2.5 Show IAU Name □ down to mag 1.5
Stellar disk size: base 5 * e ^ (exponent -0.28 * (magnitude + 2)) [* adaptation]
DSOs □ down to mag 6 with symbol colors ☑ or default color

Area Selectors ra [deg] 0 - 360
dec [deg] -90 - 90
Cone Selectors ra [deg] 180
dec [deg] 0
del [sec] 0
Free-form Selector
other columns (all gives all columns)
Search Ranges

test_portal_tiny.3@http://localhost:2181

showing max **100** results
showing only columns *
using schema **schema_0.7.0_0.3.6**
using group **i:objectId**
Latest alerts | All alerts | Evolution Plot | Scatter Plot | Sky View

Search

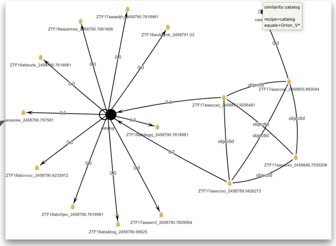
row key
− ZTF17aaaacvz_2458789.0426273

key: ZTF17aaaacvz_2458789.0426273
b:cutoutDifference_stampData
b:cutoutScience_stampData
b:cutoutTemplate_stampData
x y z s **i:aimage:** 0.903
x y z s **i:aimagerat:** 0.6587762
x y z s **i:bimage:** 0.718
x y z s **i:bimagerat:** 0.523811
x y z s **i:candid:** 1034542624615015016
x y z s **i:chinr:** 0.428
x y z s **i:chipsf:** 1.9058931
x y z s **i:classtar:** 0.785
x y z s **i:clrcoeff:** 0.112484
x y z s **i:clrcounc:** 8.7055E-6
x y z s **i:clrmed:** 0.787
x y z s **i:clrrms:** 0.253676
x y z s **i:dec:** -2.1267664
x y z s **i:decnr:** -2.1267448
x y z s **i:diffmaglim:** 19.741377
x y z s **i:distnr:** 0.114166796
x y z s **i:distpsnr1:** 0.120230444
x y z s **i:distpsnr2:** 14.874653
x y z s **i:distpsnr3:** 15.011706
x y z s **i:drb:** 0.99915147

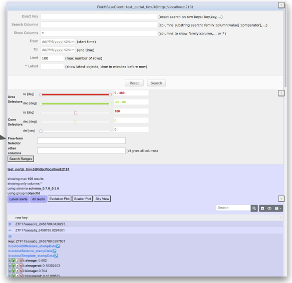
Select **graph server** and initial **graph**,
then select an **element** to see possible **actions**.

Sending Gremlin request to http://localhost:8182: g.V().hasLabel('AstroLabNet').limit(10)
Loading result : HBaseTable.jsp?hbase=http://localhost:2181&htable=test_portal_tiny.3&group=i:objectId&schema=schema_0.7.0_0.3.6&limit=100&selects=*
Loading plot : d3/skyview.jsp?hbase=http://localhost:2181&htable=test_portal_tiny.3&schema=schema_0.7.0_0.3.6&group=i:objectId&z=i:dec &s=i:diffmaglim

- ➢ Set of data views
- ➢ Views are interconnected:
  - ○ For example
    - ■ When you click on the element (Vertex or Edge) in the Graph View,
    - ■ you will get its properties in a popup
    - ■ and all possible ‘context sensitive action’ available for that element,
    - ■ which allows you to view the element in another view
    - ■ or to use it as a base for the subsequent database search
- ➢ There are two ‘hub views’:
  - ○ The **Graph View**, which gives the hierarchical structure of all elements with basic properties and the possibility to show them on other views
  - ○ The **Database View**, which allows searching for elements, their interrogation and use in other views
- ➢ Views can be embedded in other web applications
- ➢ View are customisable (stylesheets,...)



similarity:catalog
recipe=catalog
equals=Orion_V*
cata
ZTF17aaaedjh_2458790.7618981
ZTF18aazwmxa_2458790.7661806
ZTF18acddmk_2458791.03
ZTF18abburle_2458790.7618981
acaurew_2458790.767581
catalog
ZTF18abdegpj_2458790.7618981
ZTF18abcvvzc_2458790.6233912
ZTF18abchjso_2458790.7618981
ZTF18abakksg_2458790.66625
ZTF17aaawrcf_2458790.7609954
ZTF17aaaccxo_2458805.893044
ZTF17aaaccxo_2458851.9256481
ZTF17aaaccxo_2458846.7530208
ZTF17aaaccxo_2458789.0426273
0.0
objectId



FinkHBaseClient: test_portal_tiny.3@http://localhost:2181

Exact Key (exact search on row keys: key,key,...)
Search Columns (columns substring search: family:column:value[:comparator],...)
Show Columns * (columns to show family:column,... or *)
From dd/MM/yyyy|h24:m (start time)
Till dd/MM/yyyy|h24:m (end time)
Limit 100 (max number of rows)
* Latest (show latest objects, time in minutes before now)
Reset Search

Area Selectors ra [deg] 0 - 360
dec [deg] -90 - 90
Cone Selectors ra [deg] 180
dec [deg] 0
del [sec] 0
Free-form Selector
other columns (all gives all columns)
Search Ranges

test_portal_tiny.3@http://localhost:2181

showing max **100** results
showing only columns *
using schema **schema_0.7.0_0.3.6**
using group **i:objectId**
Latest alerts | All alerts | Evolution Plot | Scatter Plot | Sky View

Search

row key
+ ZTF17aaaacvz_2458789.0426273
− ZTF17aaaajdq_2458789.0297801

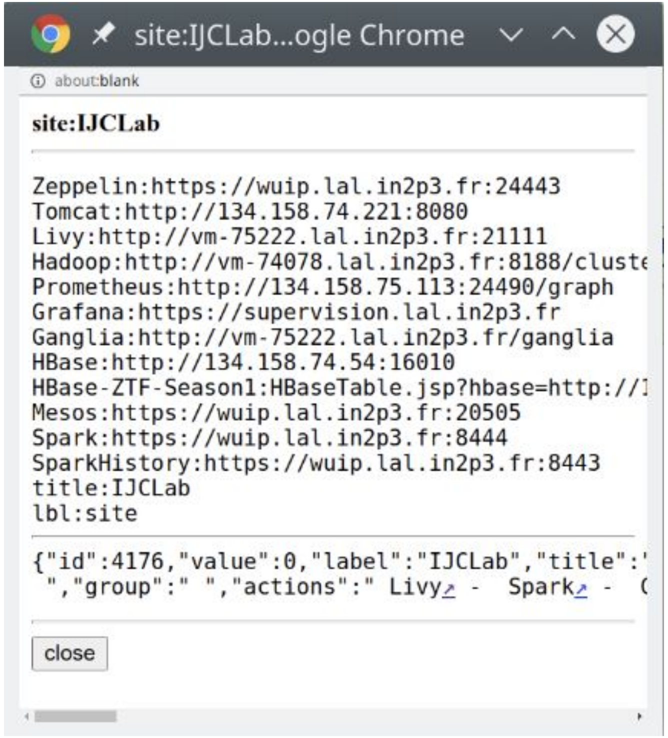
key: ZTF17aaaajdq_2458789.0297801
b:cutoutDifference_stampData
b:cutoutScience_stampData
b:cutoutTemplate_stampData
x y z s **i:aimage:** 0.802
x y z s **i:aimagerat:** 0.18352403
x y z s **i:bimage:** 0.704
x y z s **i:bimagerat:** 0.18109839

Graph Construction ?

- **HBase-to-Graph replication:**
  - **Mass replication** - fast, but limits flexibility and imposes strong restrictions on Graph schema
  - **Standard batch replication** - slower, but keeps flexibility
  - **Lazy creation** - only when vertex is requested on explicitly created (as part of a collection etc.)
- **HBase-Graph correspondance:**
  - One-to-one mapping of rows to vertices (alerts)
    - + collection vertexes (AlertsCollections) with edges to contained vertexes
  - Only collection vertexes with embedded HBase query to recuperate contained row
    - + individual vertices when parts of higher-level structures

Graphs for Configuration ?

- ➢ **AstroLabNet** top vertex keeps links (edges) to **sites**
  - ○ ***IJCLab*** or ***Local*** so far
- ➢ Sites have properties of hosted servers
  - ○ Possibly versioned
- ➢ They could be used to store servers configuration



site:IJCLab

```
Zeppelin:https://wuip.lal.in2p3.fr:24443
Tomcat:http://134.158.74.221:8080
Livy:http://vm-75222.lal.in2p3.fr:21111
Hadoop:http://vm-74078.lal.in2p3.fr:8188/cluste
Prometheus:http://134.158.75.113:24490/graph
Grafana:https://supervision.lal.in2p3.fr
Ganglia:http://vm-75222.lal.in2p3.fr/ganglia
HBase:http://134.158.74.54:16010
HBase-ZTF-Season1:HBaseTable.jsp?hbase=http://1
Mesos:https://wuip.lal.in2p3.fr:20505
Spark:https://wuip.lal.in2p3.fr:8444
SparkHistory:https://wuip.lal.in2p3.fr:8443
title:IJCLab
lbl:site
```

{"id":4176,"value":0,"label":"IJCLab","title":'
 ","group":" ","actions":" Livy↗ - Spark↗ - (

Links

- **Home page:**
  - https://cern.ch/hrivnac/Activities/Packages/Lomikel
  - https://cern.ch/hrivnac/Activities/Packages/FinkBrowser
- **Code:**
  - https://github.com/hrivnac/Lomikel
  - https://github.com/hrivnac/FinkBrowser
- **Prototype Web Service:**
  - http://134.158.74.221:8080/FinkBrowser/?profile=ijclab