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IVOA TDIG Group

IVOA DM Group

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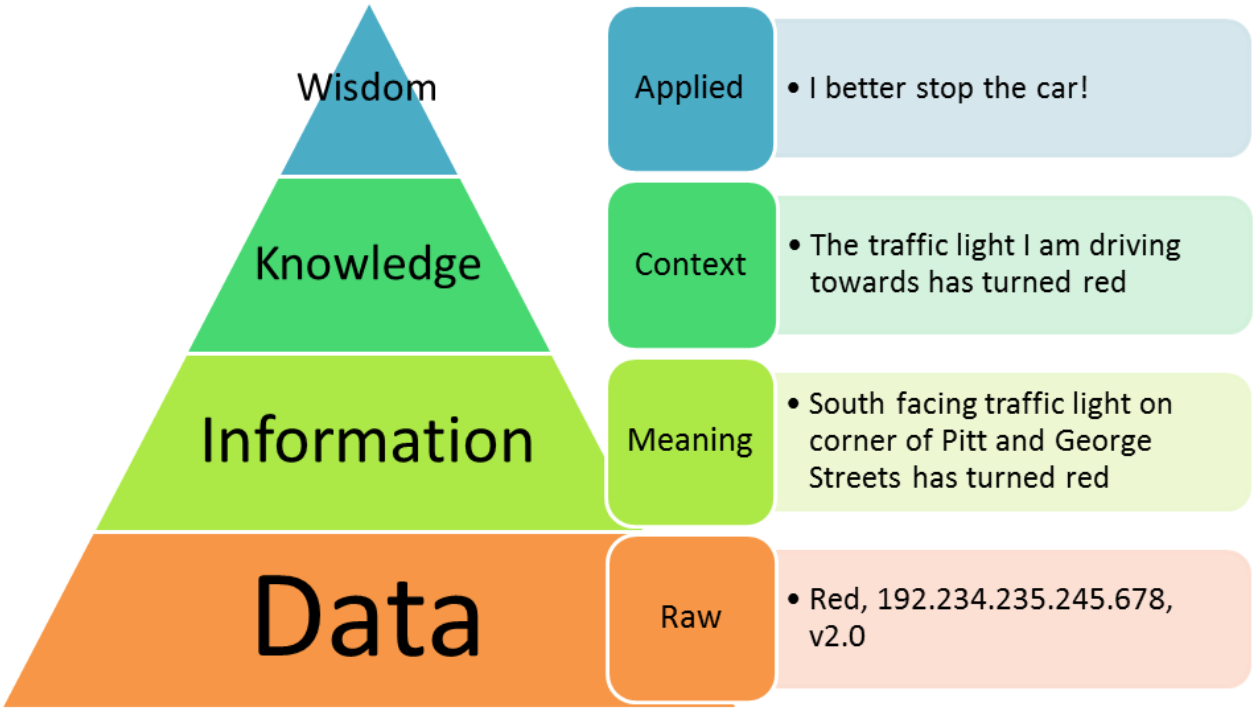
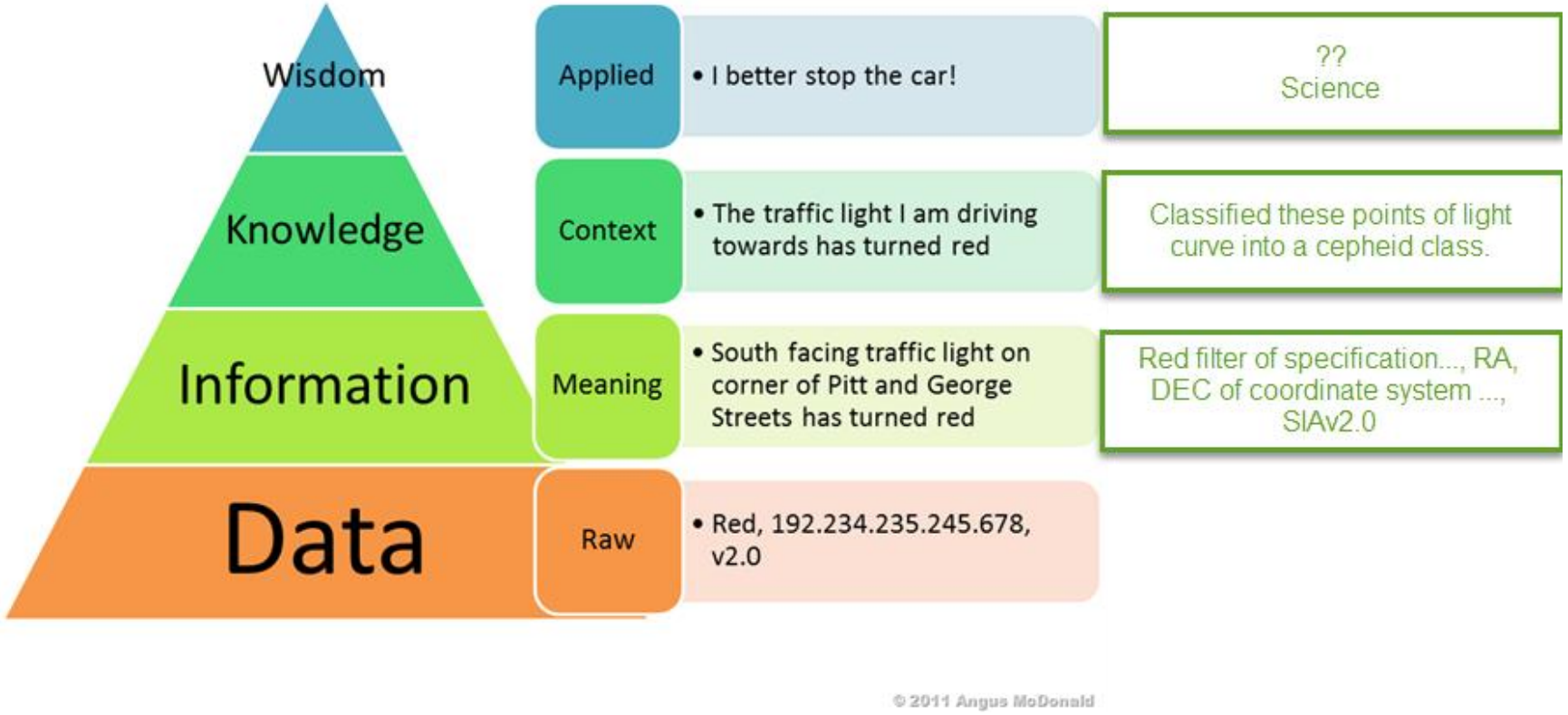
Outline

1. What is TS cube
2. Time Series Cube structure
3. Discovering TS Cube
4. Cutouting TS Cube
5. Open Questions

Separation of Data vs. Information



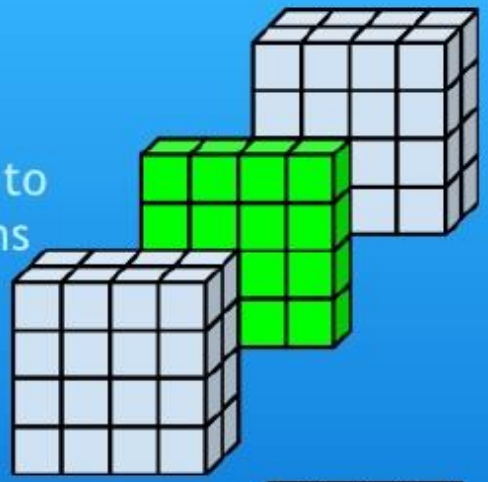
Separation of Data vs. Information



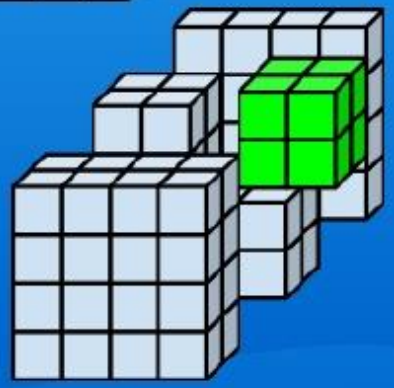
What is a data cube

OLAP Cubes - operations

- **Slice** = choose values corresponding to ONE value on one or more dimensions



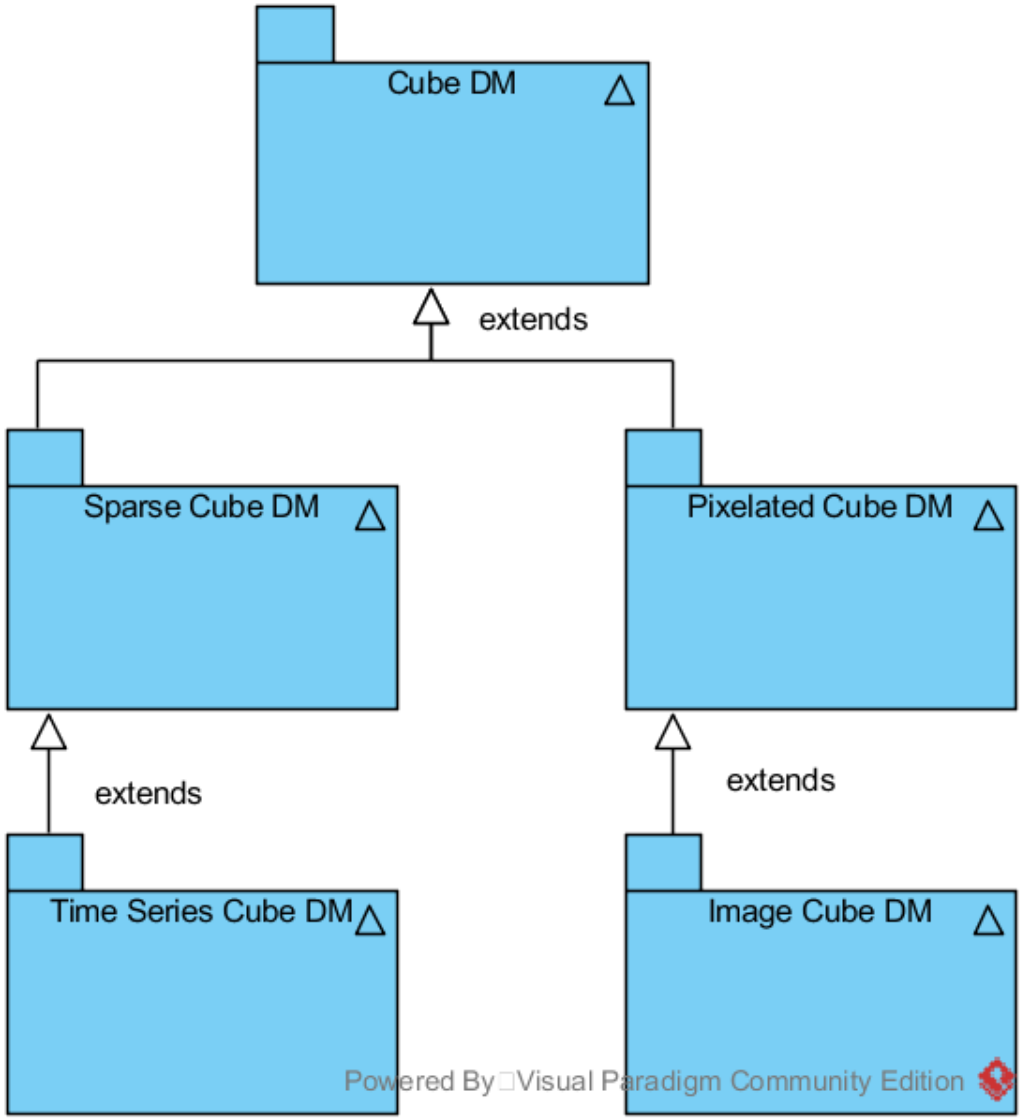
- **Dice** = choose values corresponding to one slice or a number of consecutive slices on more than 2 dimensions of the cube



Sparse Cube DM

- Can describe any time series axes.
- Is flexible
- Is extensible

Time Series Cube DM

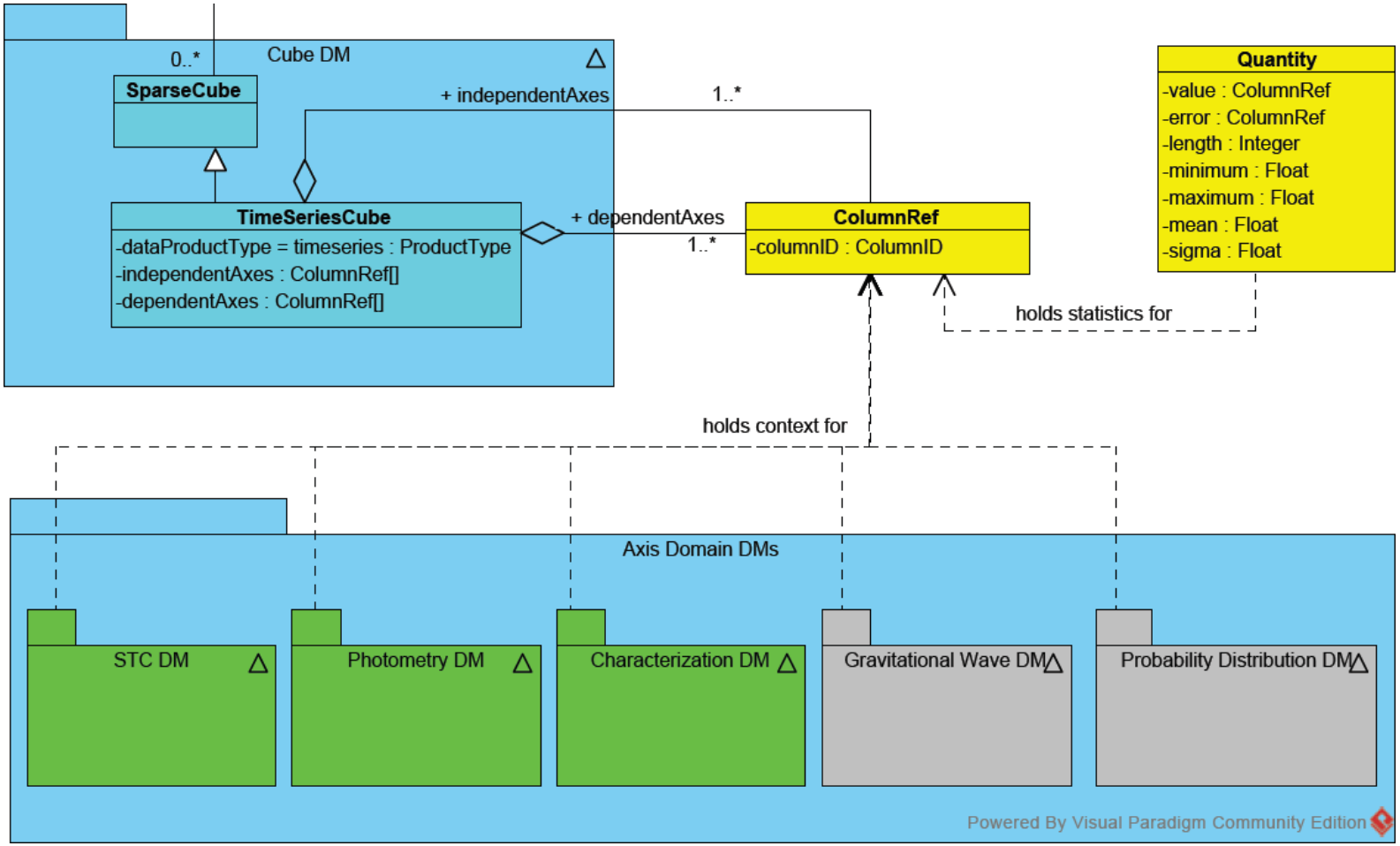


Data + Information in Time Series Cube DM

Separation of Data vs. Information

- Describing meaning (**information layer**) for any possible data in the Cube DM will create a god object
- Cube DM can still describe information about its axes (**data layer**) without needing to know every physical domain model
- Changes to physical domain models (STC, Phot DM, Provenance) won't require Cube DM to change

Time Series Cube UML



Time Series Cube UML

- Through **Time Series Cube class** I can find the axes (data) of the cube
- In the **Quantity class**, I store statistical metadata about my data
- **Axis domain DMs (frame)** metadata of already existing models (STC, Phot DM) or potential new models. If these change, it doesn't matter to the Cube DM.

Advantages of Cube

- Adding new filters during the survey
- Adding new data sources (instruments) to the survey

- -> **No change to the VOTable**

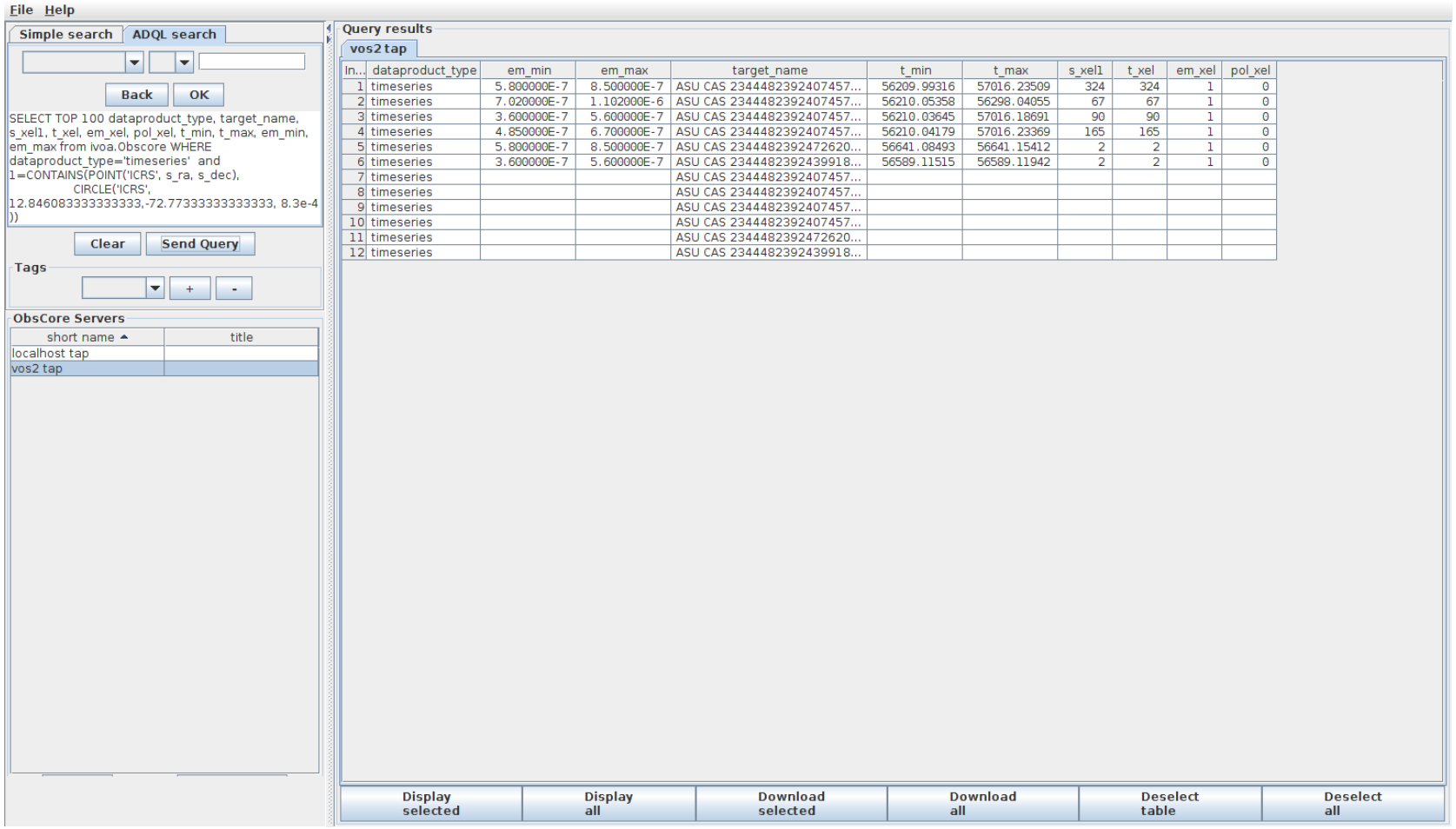
Advantage of Time Series Cube

- Time Series Cube DM does not wait for STC v2.0, Phot DM, Gravitation wave DM, …
- Domain-specific clients (Spectral, Photometry, etc.) can still use cube **without change**. Cube is just adding metadata about the data
- Discovery of “pure” cube metadata -> Time Series Cube can cutout itself without knowing about physical meaning of the data, just statistical distributions
- **Ability** to partially describe non-standardized frames (gravitational waves, hardness ratio, etc.) without the need to understand **everything** that can be stored within Cube DM

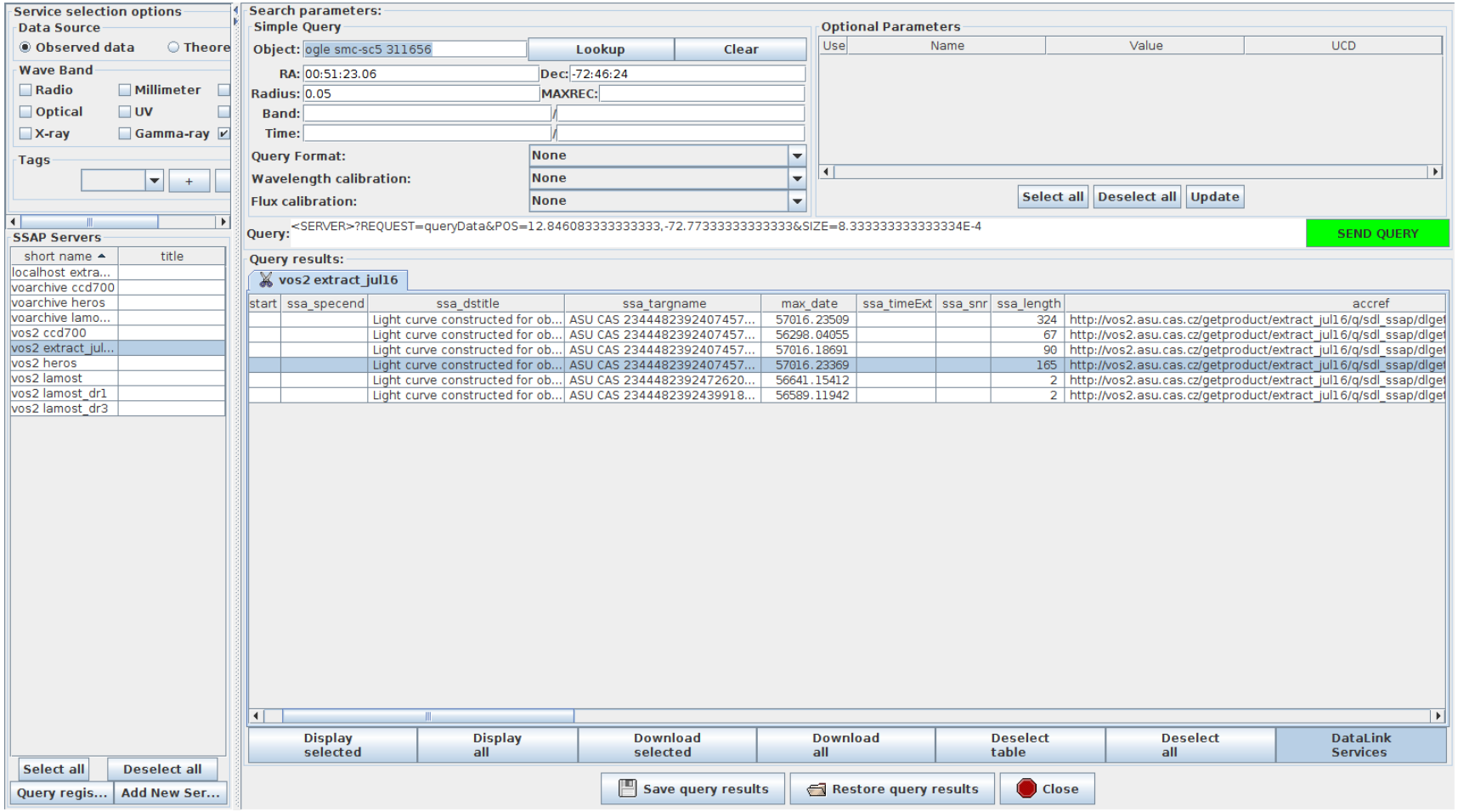
Science use Cases for Time Series

- Use cases - (2012-10-20, Enrique Solano)
- 3 groups of requirements
  - Group A: Combine photometry and light curves of a given object/list of objects in the **same photometric band**
  - Group B: Combine photometry and light curves of a given object/list of objects in **different photometric bands**
  - Group C: Time series **other** than light curves

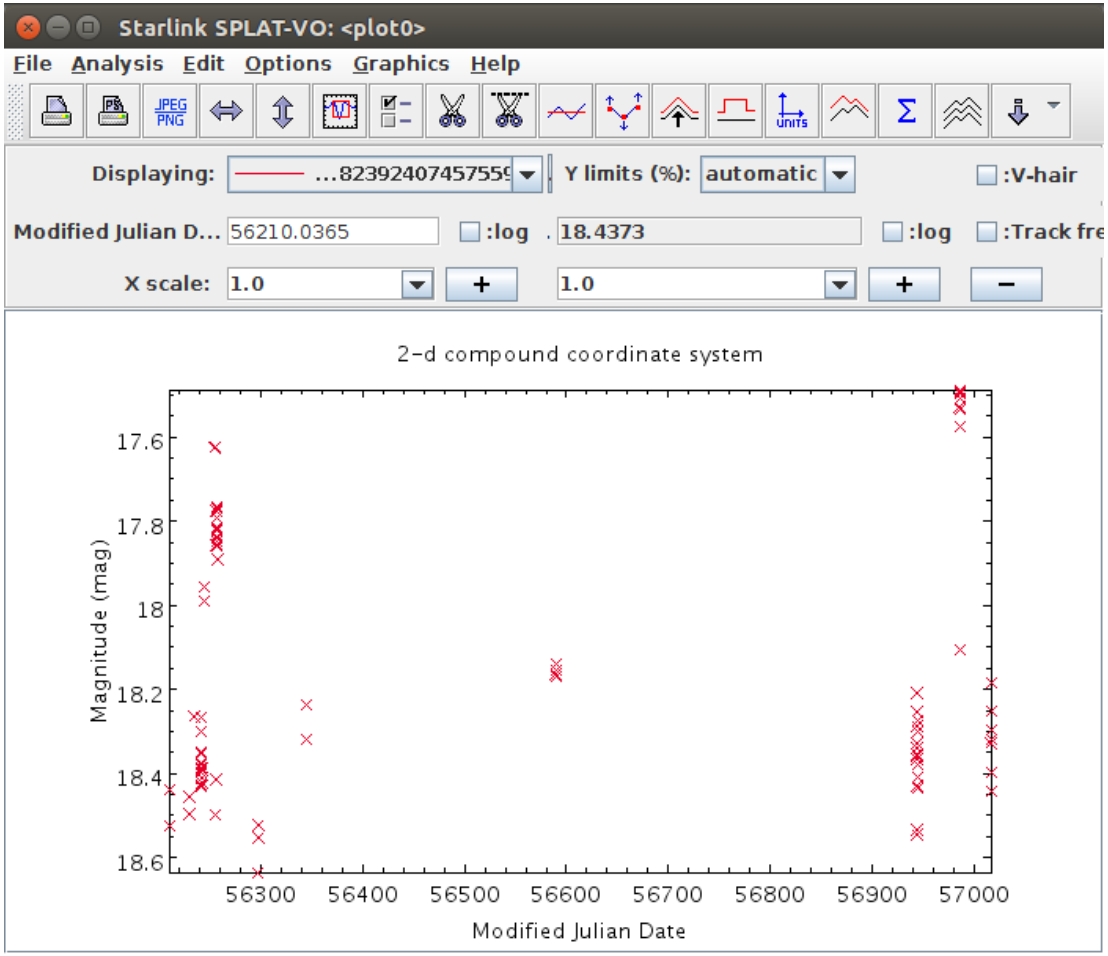
ObsCore discovery



SSA discovery



Light curve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18.4373
:log
:Track fre
X scale: 1.0
1.0
2-d compound coordinate system
Magnitude (mag)
17.6
17.8
18
18.2
18.4
18.6
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56400
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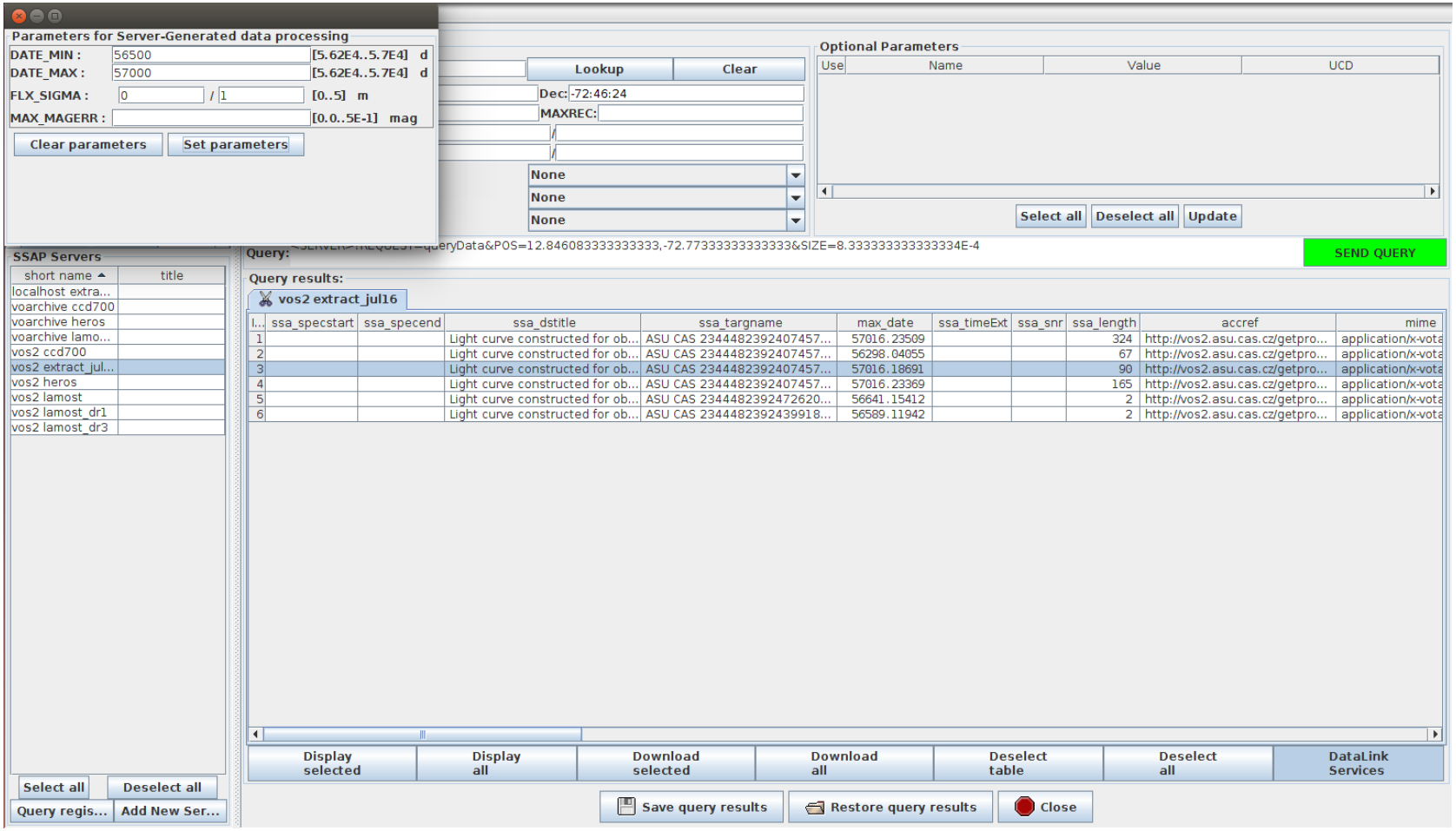
Modified Julian Date

Datalink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Set parameters
Lookup
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MAXREC:
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None
None
Optional Parameters
Use
Name
Value
UCD
Select all
Deselect all
Update
Query:
SEND QUERY
SSAP Servers
short name
title
localhost extra...
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voarchive heros
voarchive lamo...
vos2 ccd700
vos2 extract_jul...
vos2 heros
vos2 lamost
vos2 lamost_dr1
vos2 lamost_dr3
Select all
Deselect all
Query regis...
Add New Ser...
Query results:
vos2 extract_jul16
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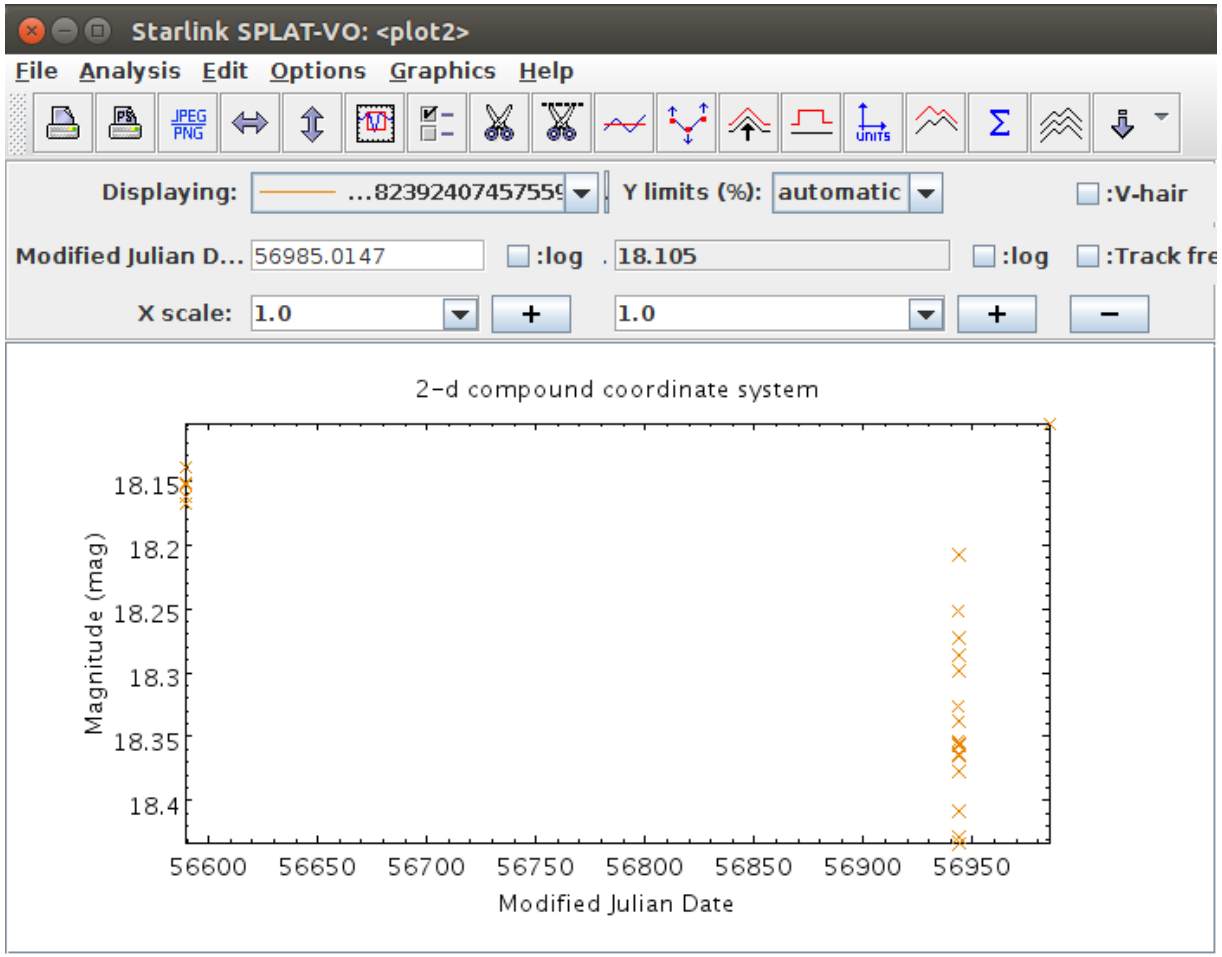
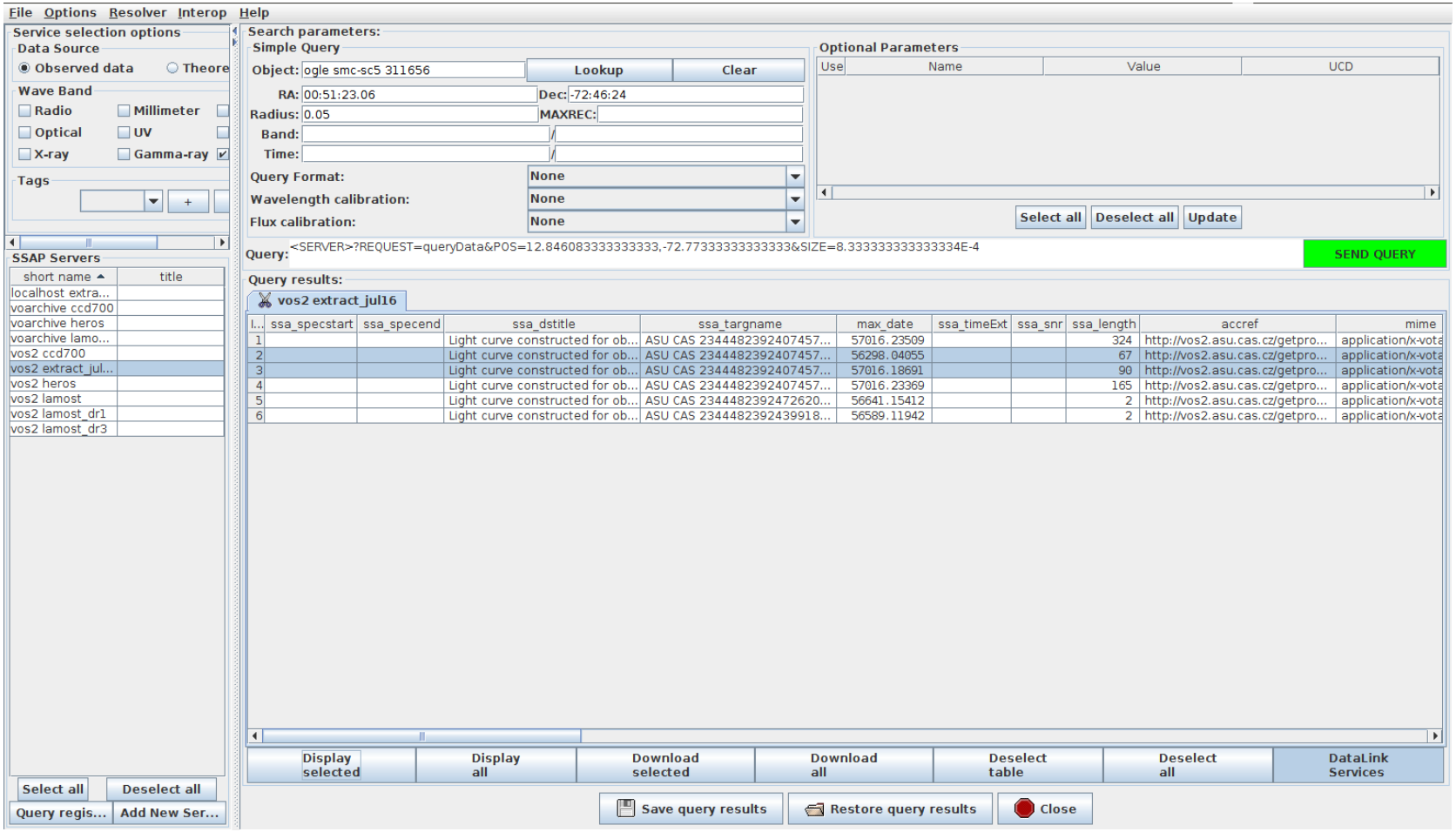
Display all
Download selected
Download all
Deselect table
Deselect all
DataLink Services
Save query results
Restore query results
Close

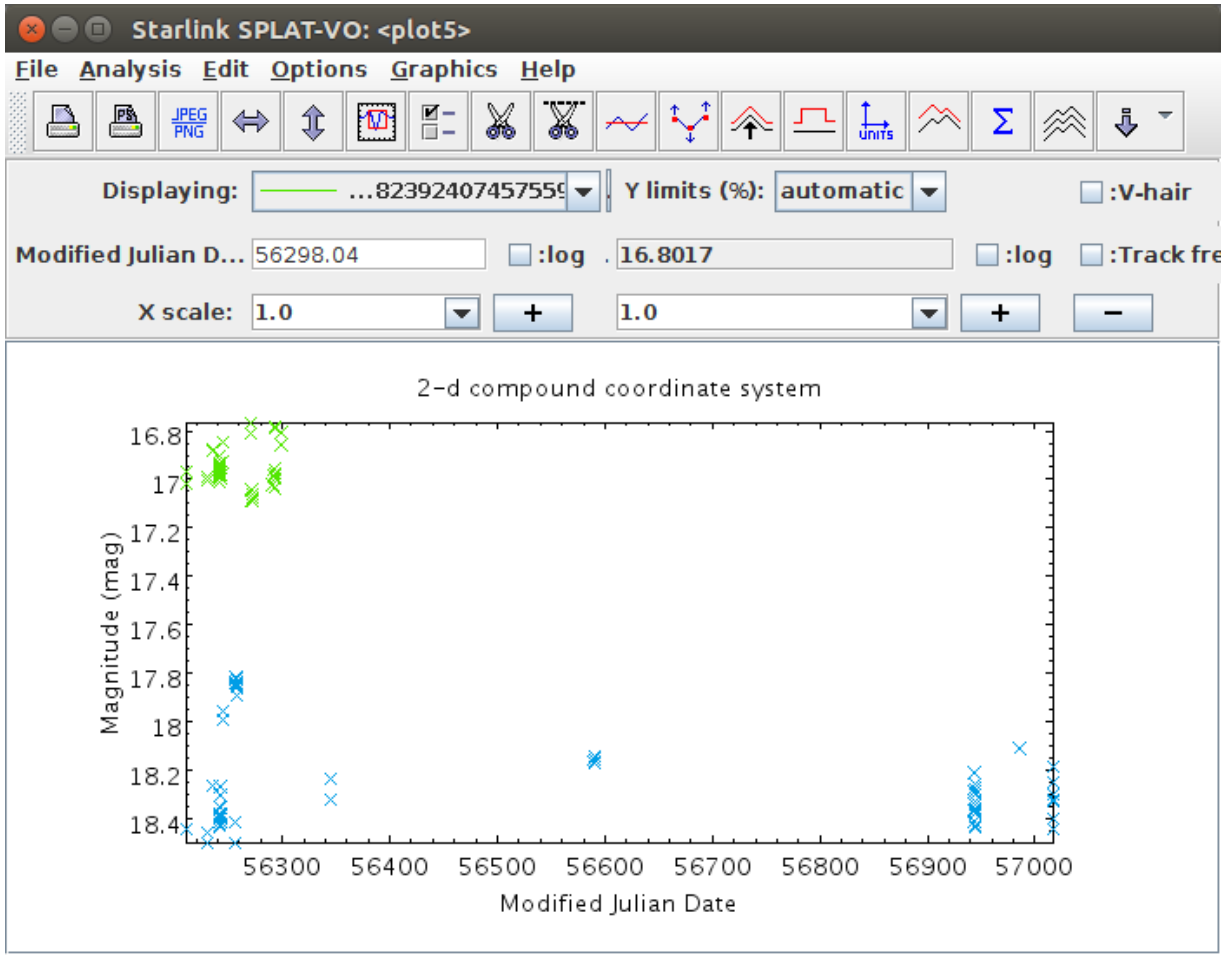
Cutouted data



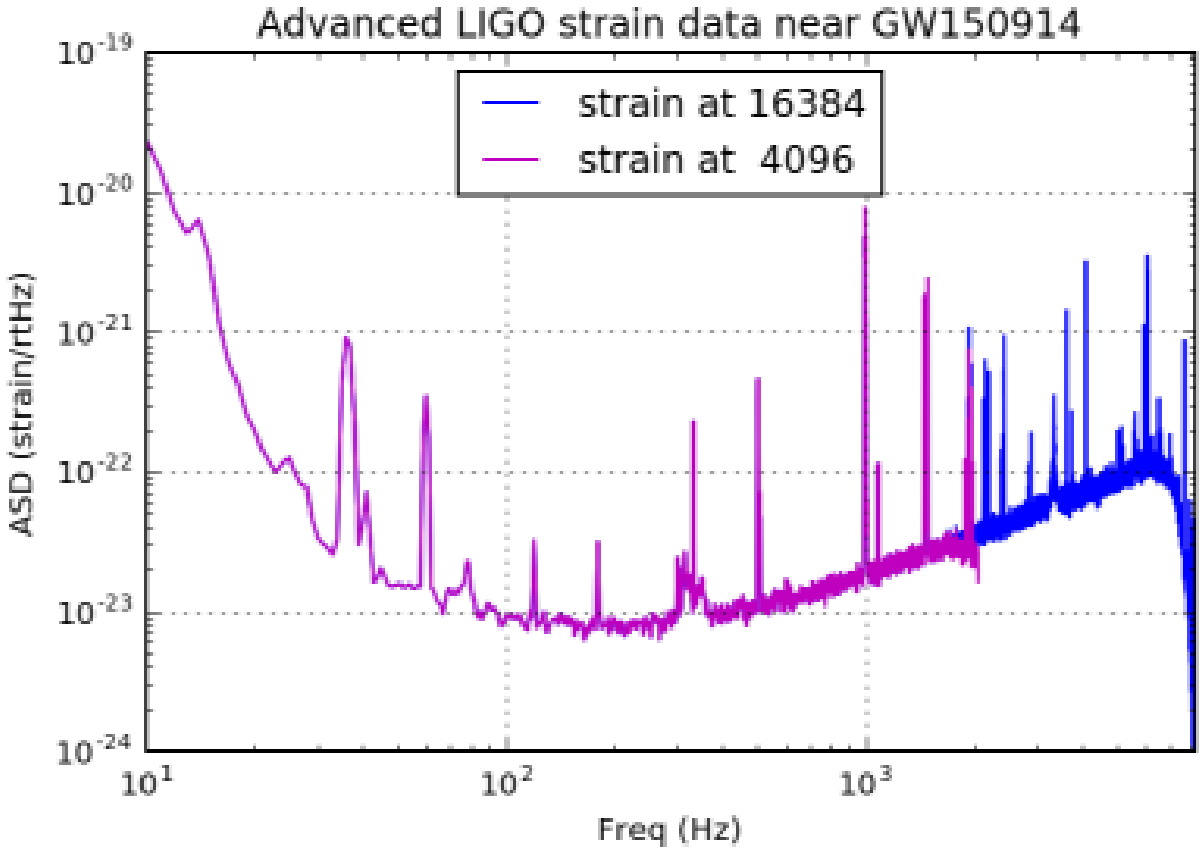
Multiple bands of one light curve



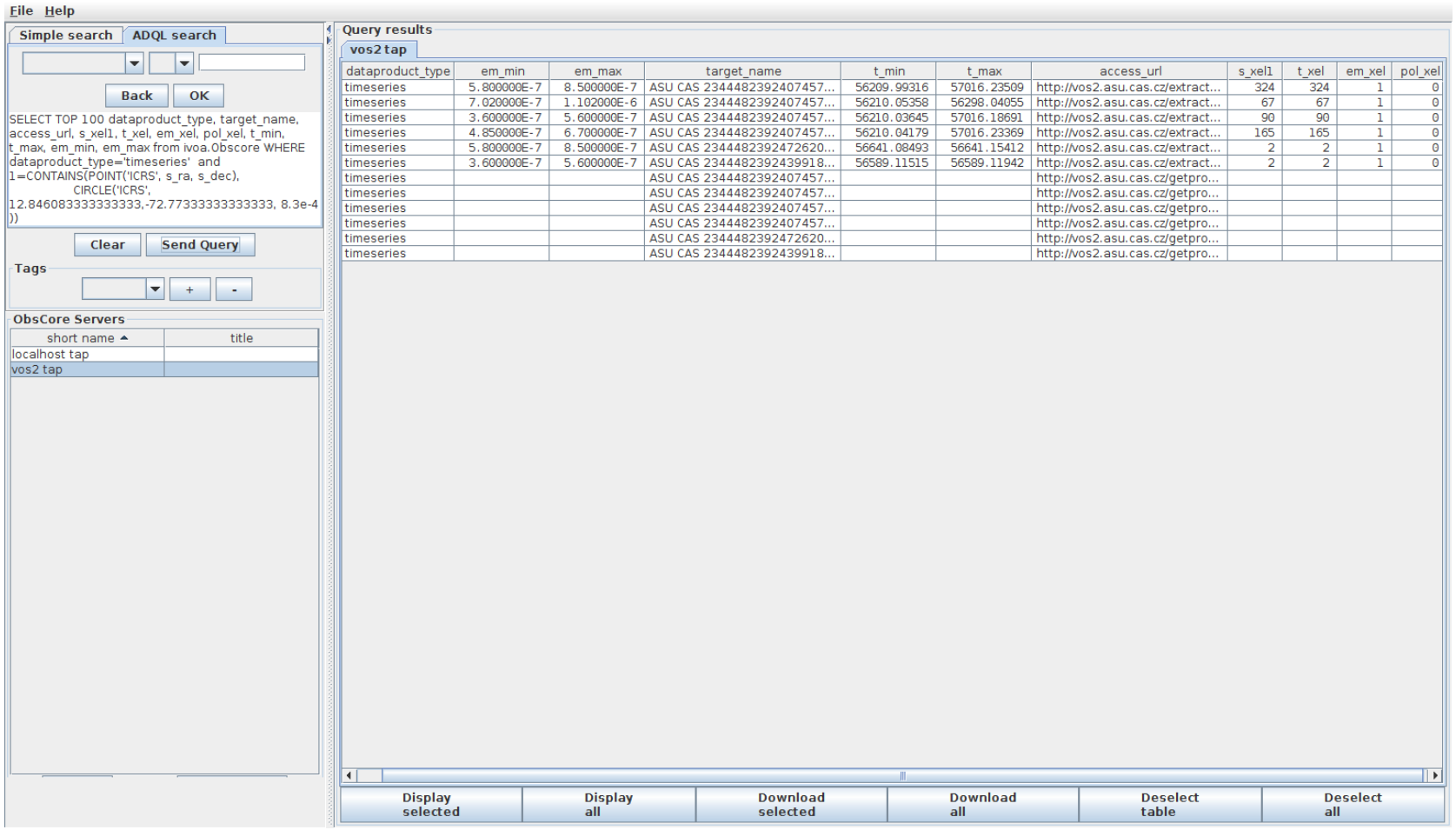
Light curves (Group A, Group B)



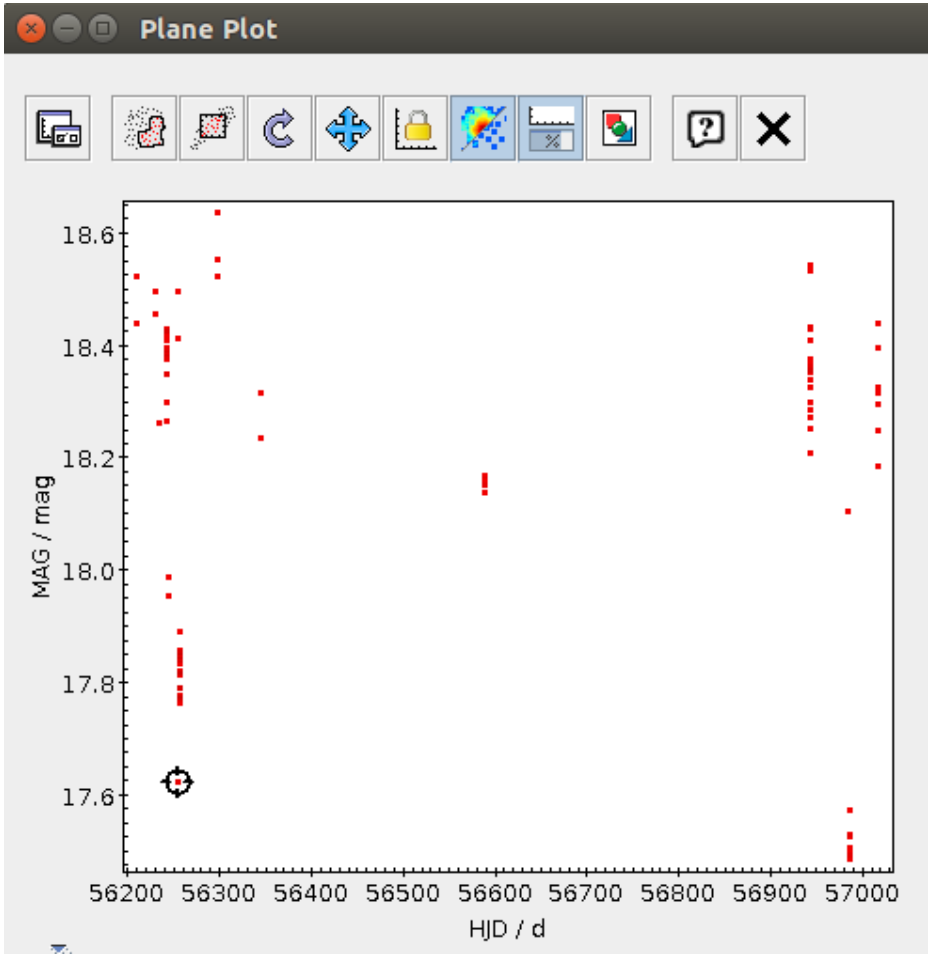
Gravitational wave data (Group C)



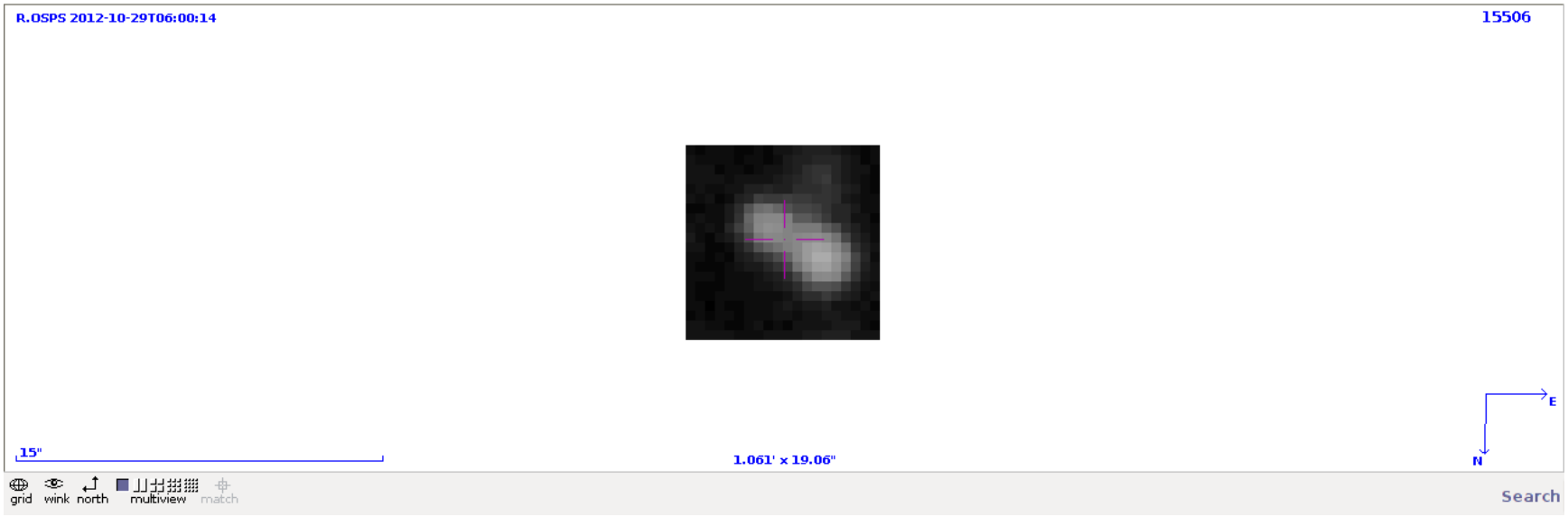
Obscore discovery



Topcat plotting + action function



Clicking point leads to cutout in Aladin



Other use cases

- Plot light curves from multiple data sources
- Looking for stars with more than N photometric points 5 sigma higher than the mean value.
- Fermi has detected a flaring blazar. It has a certain error ellipse, say a few arc-minutes. An optical counterpart is not known. How can one get **light curves for all objects in the error-ellipse** to look for variability and thus possible counterparts to the blazar?
- Retrieve all catalogues which have measurements for a given date (e.g., date of a Gaia observation)

Open Questions

- Add datalink to ObsCore
- What to put into Quantity DM
  - Underlying statistical distribution of values beneath each axis of the cube
  - Underlying statistical distribution of each point in the cube
- Two kinds of models
  - Real world model for data cubes
  - Application data model used for publishing the data (view on the real world model)
- What do I need to discover about the data cube
- Datalink for cutouts of cubes (time series) seems like the best option
- Use cases!

Join us!

- IVOA note on volute repository
- voevent@ivoa.net
- dm@ivoa.net