Linked Visualizations for Astrophysical Data

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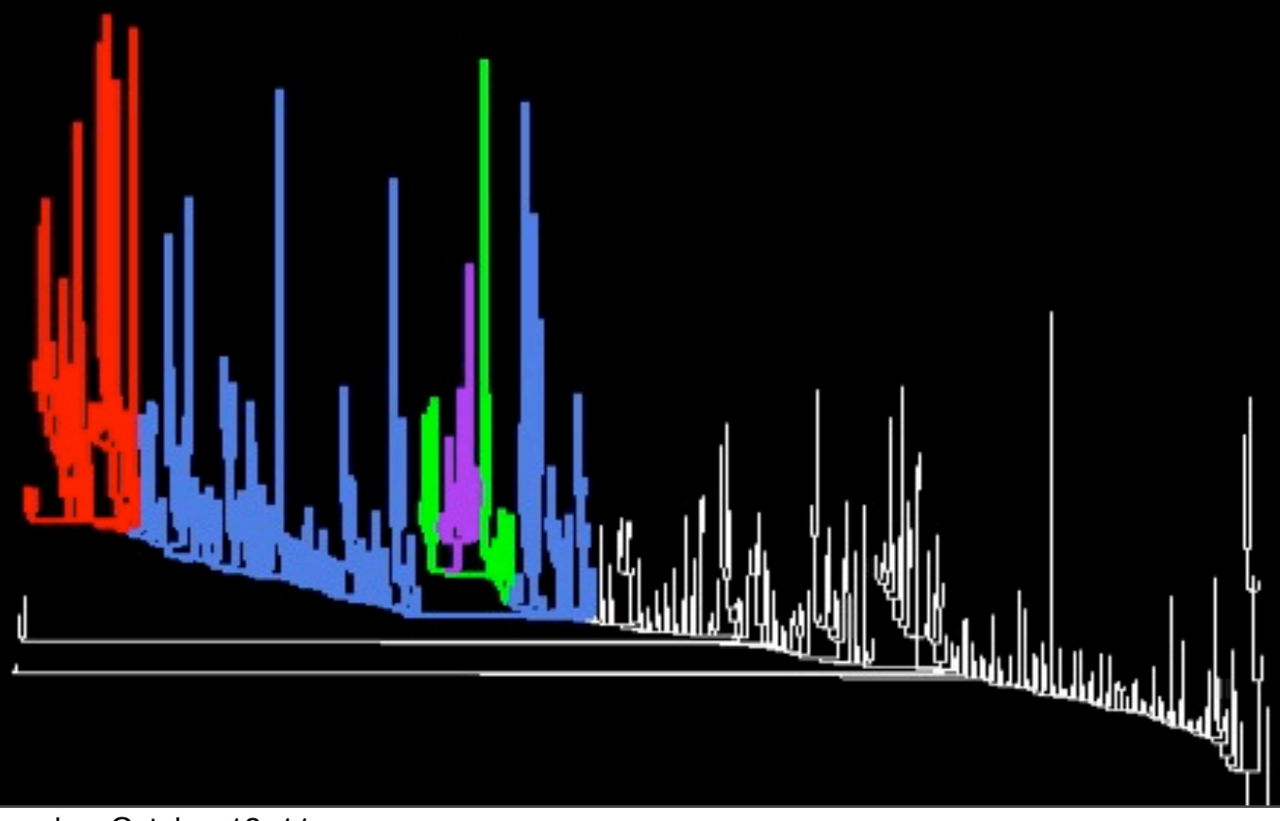
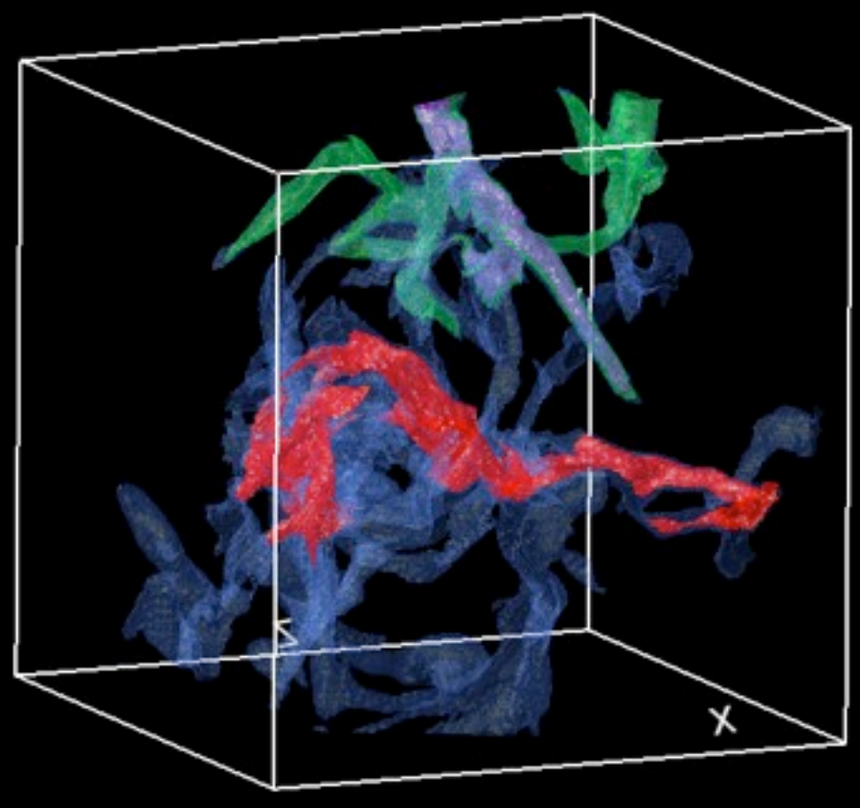
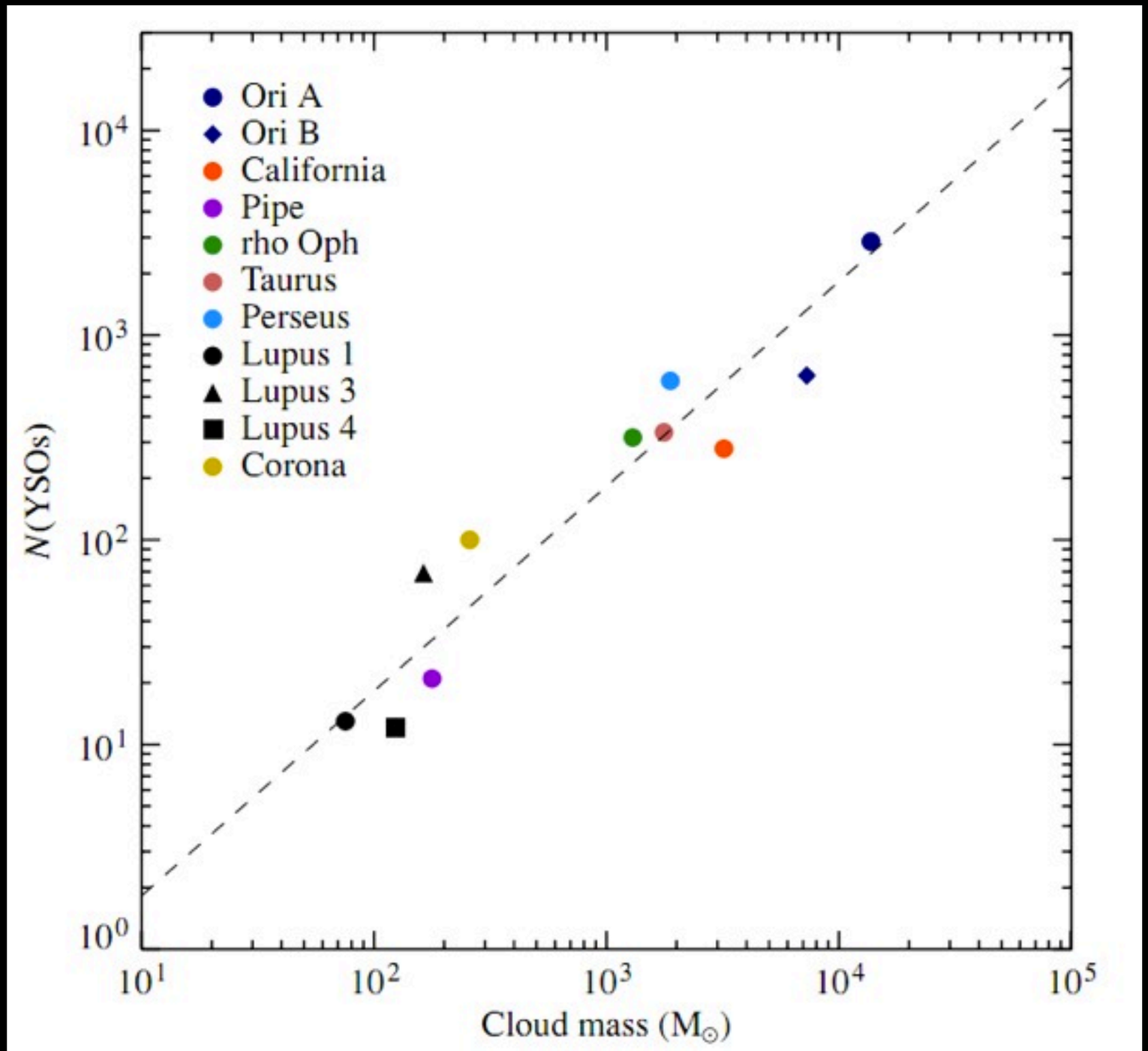
with
Alyssa Goodman, Michelle Borkin, Thomas Robitaille





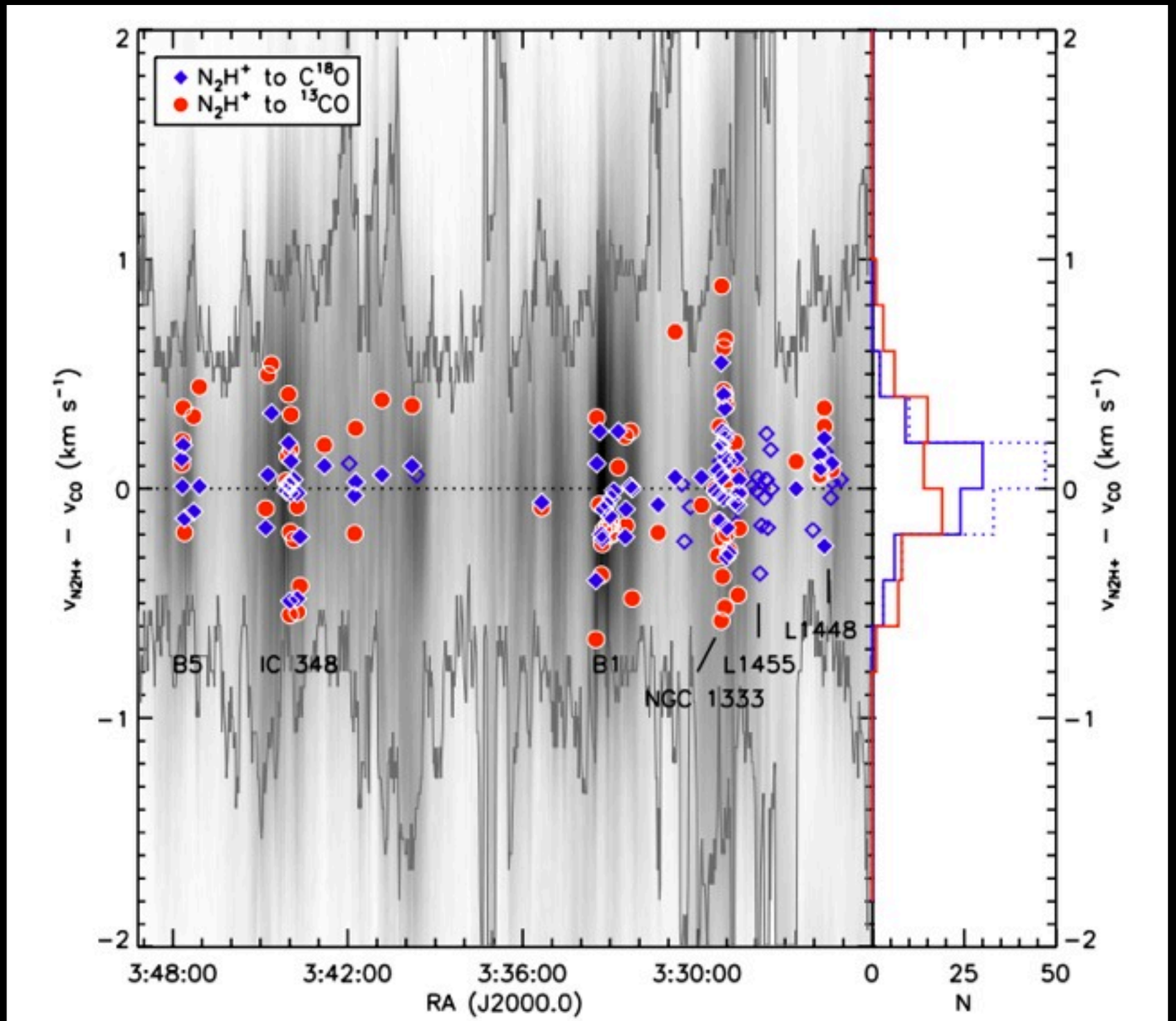
Motivation

Links Across Data



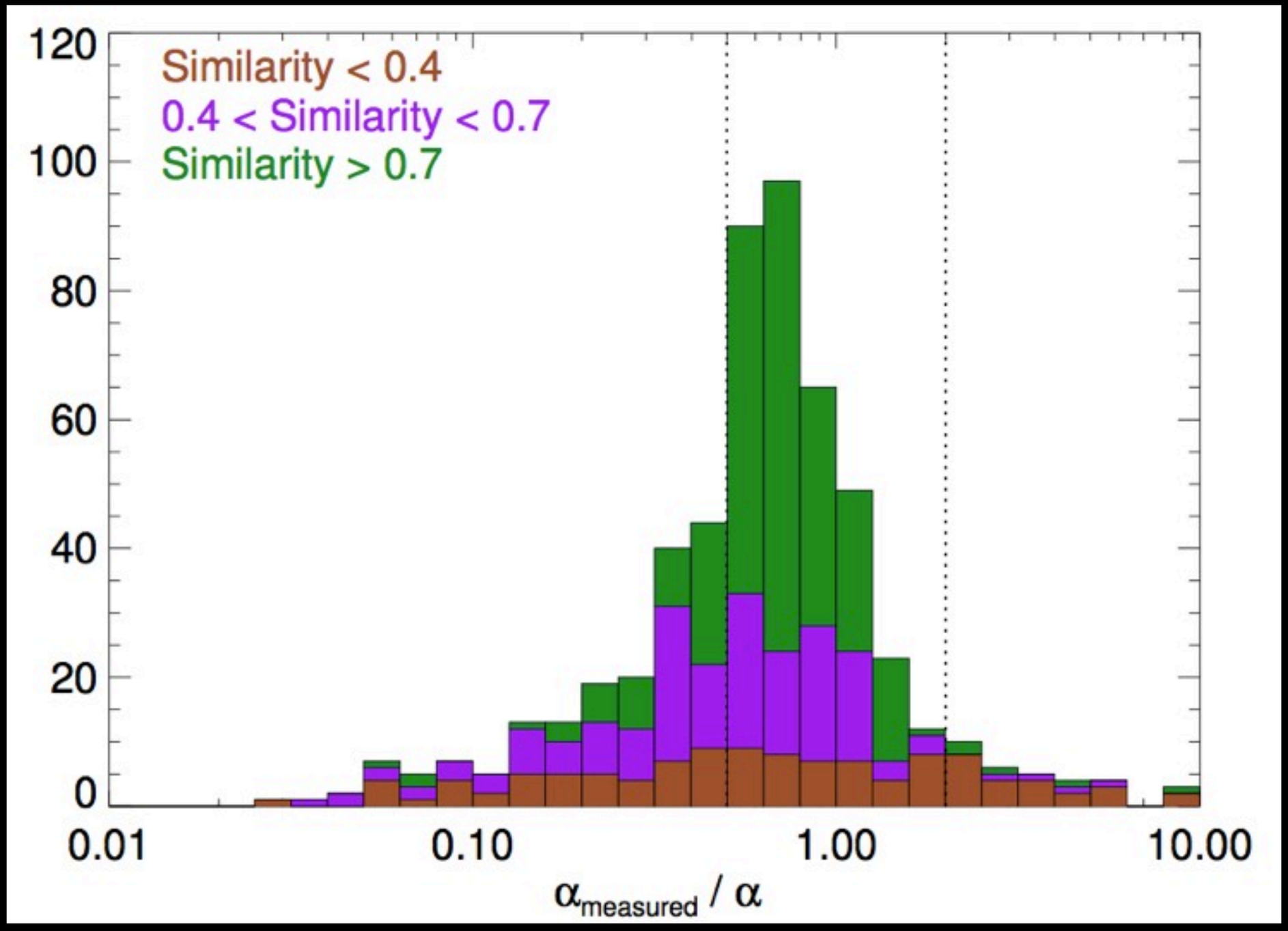
Lada, Lombardi, Alves 2010

Links Across Data



Kirk et al. 2010

Links Across Data



Beaumont et al. in prep

Two Challenges

	Conceptually Easy	Conceptually Hard
Computationally Easy	Basic reduction and analysis of small data (data << RAM)	Uncovering relationships within: several data sets high-dimensional data
Computationally Hard	Basic reduction and analysis of large data	Feature Extraction Automatic data calibration/analysis

A case for computationally easy, conceptually hard problems

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- The MB-GB realm is still relevant

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A case for computationally easy, conceptually hard problems

- The MB-GB realm is still relevant
- A wealth of computational resources
- Relevant for the resources most researchers already have
- Computers get faster -- brains don't
- Not incompatible with the computationally hard domain

Requirements

Tukey's "Four Essentials" (c.1972)

Watch the PRIM-9 video at: http://stat-graphics.org/movies/prim9.html

Tukey's "Four Essentials" (c.1972)

- Picturing

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Tukey's "Four Essentials" (c.1972)

- Picturing
- Rotation

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Tukey's "Four Essentials" (c.1972)

Picturing

Rotation

Isolation

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Tukey's "Four Essentials" (c.1972)

Picturing

Rotation

Isolation

Masking

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Tukey's "Four Essentials" (c.1972)

Picturing

Rotation

Isolation

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Selection

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Picturing

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Selection

and these *"need to work together"*
in a *"dynamic display"*

Brushing

Linking

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Tukey's "Four Essentials" (c.1972)

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Brushing

Linking

Results...

1. for immediate insight
2. as visual source of ideas for statistical algorithms

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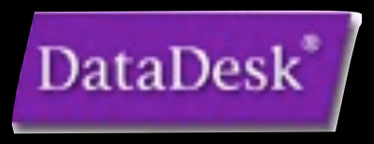
DataDesk (est. 1986)



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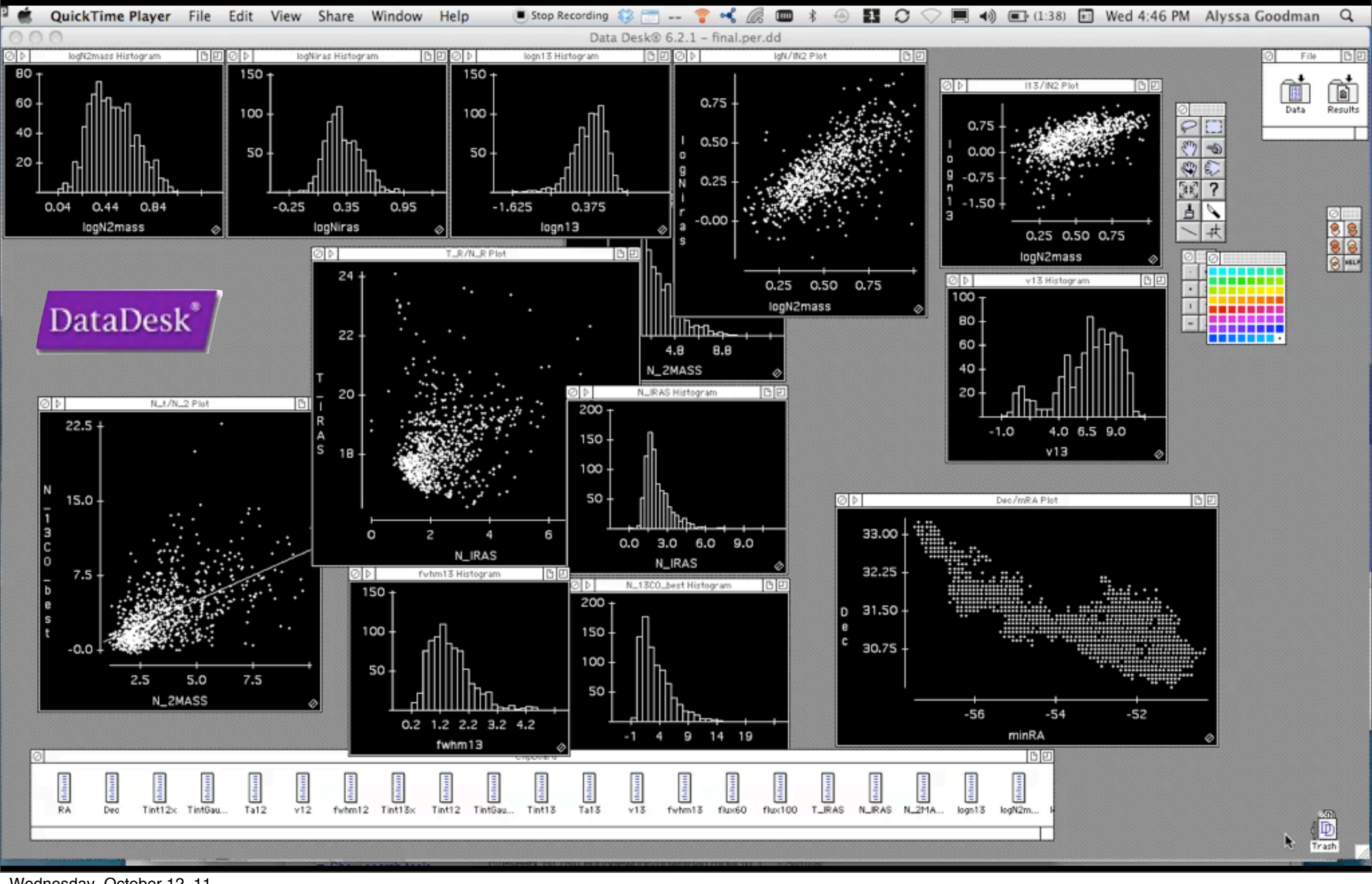


Practical Issues

- Visualization and connection of several data products
  - catalogs, images, spectra, data cubes
- Support for common file formats and coordinates
  - WCS, FITS, VOTable, CSV, ...
- Ability to script and extend
  - Preferably in a language astronomers use (IDL, Python)

Implementation

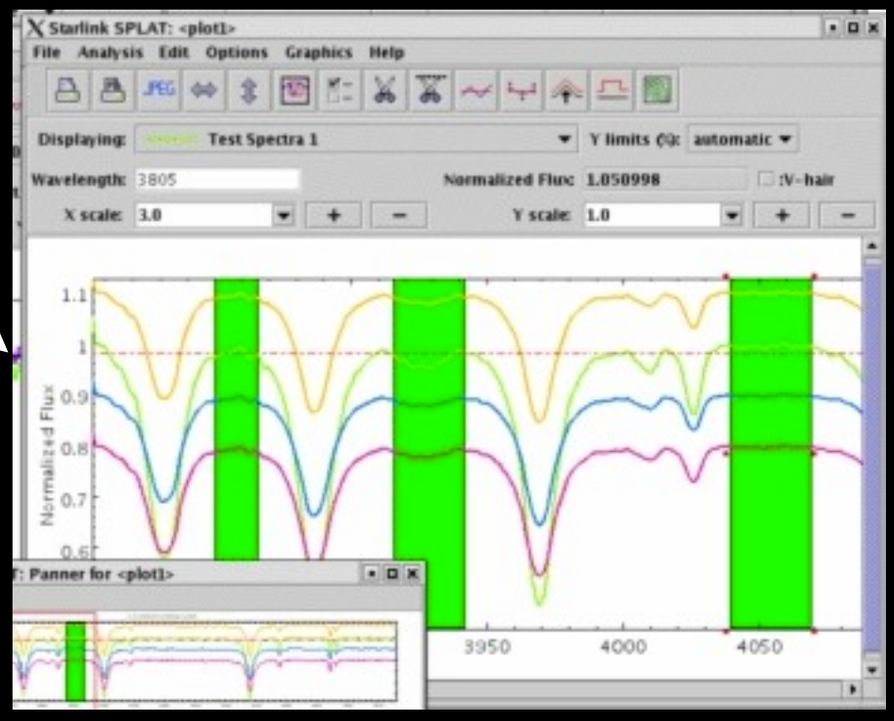
Pre-existing tools?

TOPCAT

ds9

SAMP

Microsoft® Research
WorldWide Telescope



SPLAT

First Attempt: *CloudViz*

http://code.google.com/p/cloud-viz/

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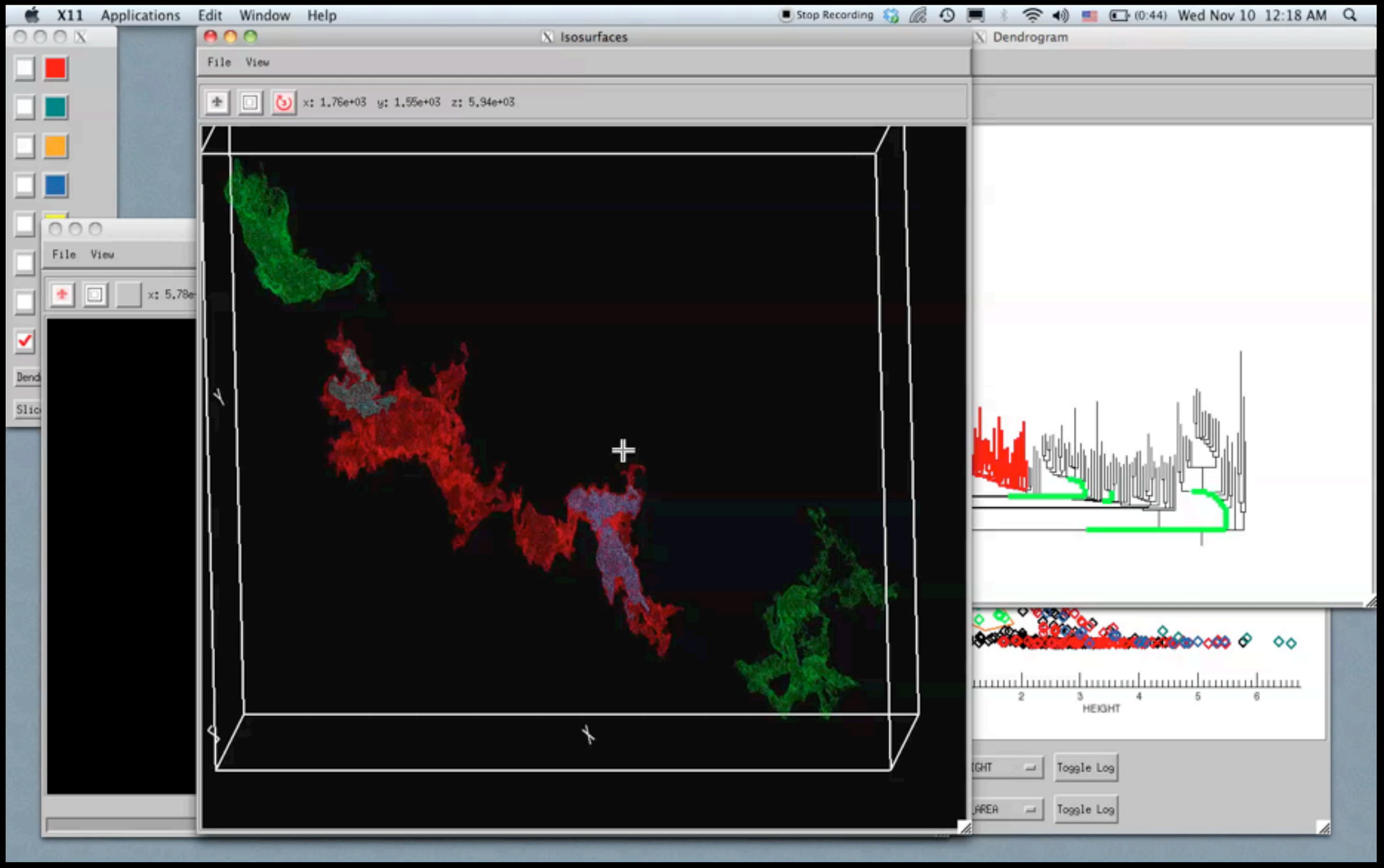


Second Attempt (python)

Subsets

Data

Hub

Visualization Client

Visualization Client

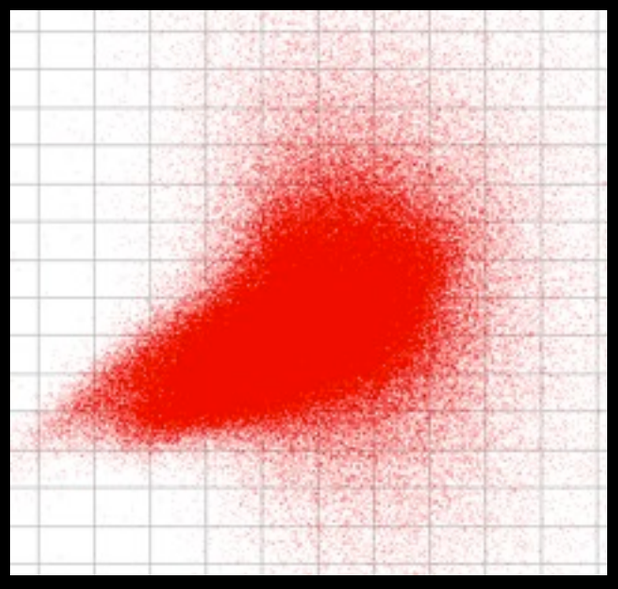
Visualization Client

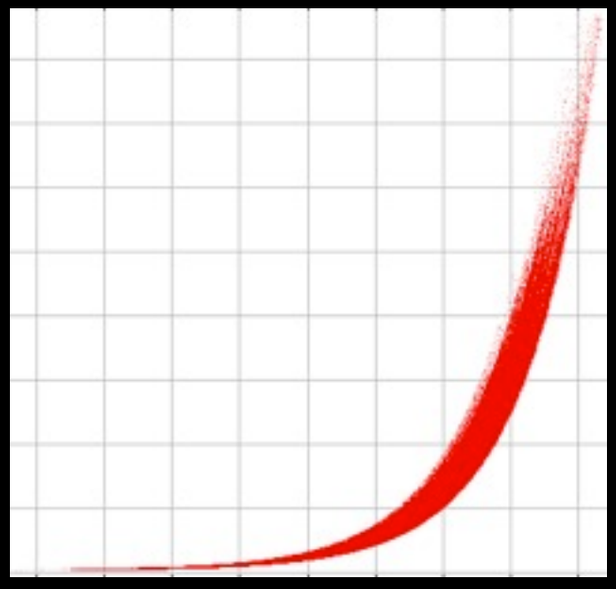
Single dataset linking

Subsets

Data

Hub



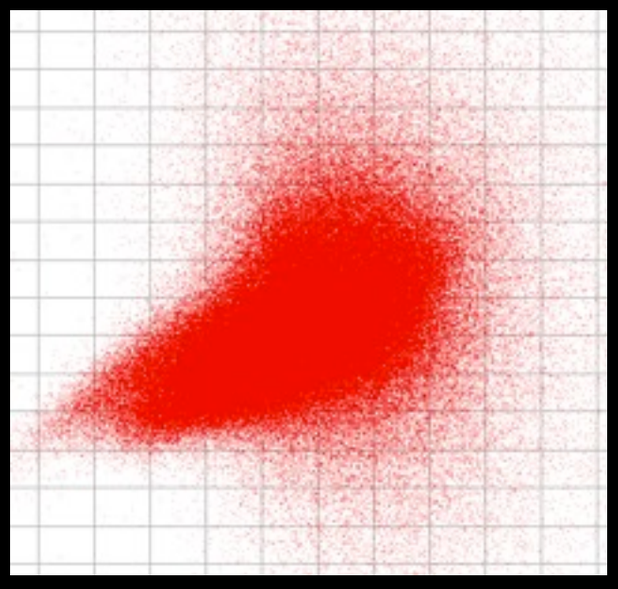


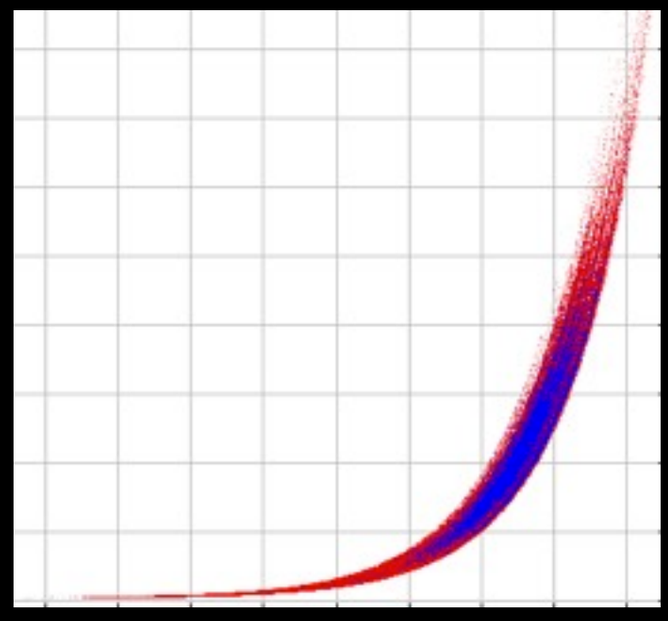
Single dataset linking

Subsets

Data

Hub





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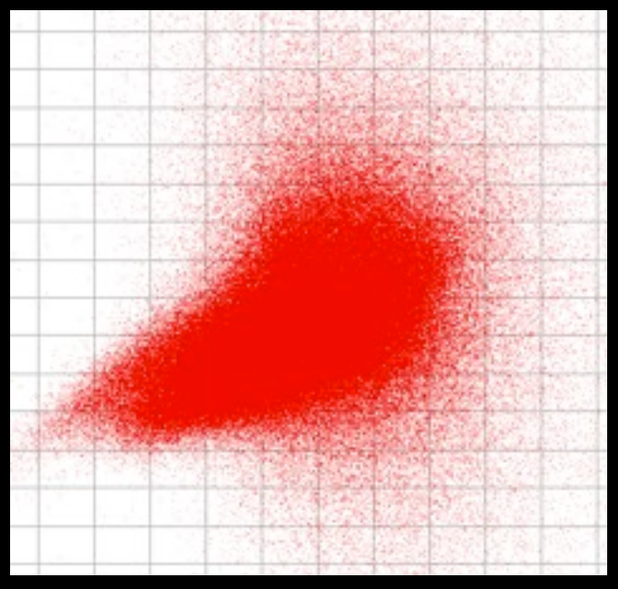

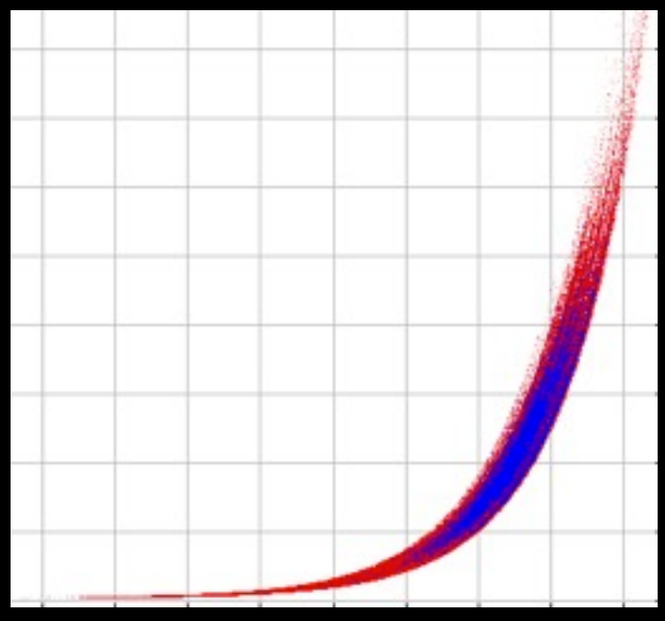

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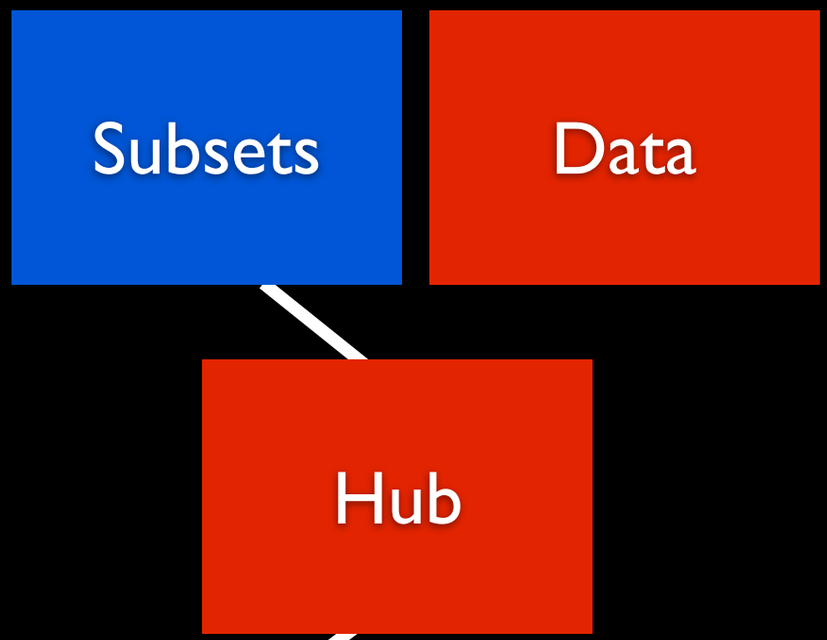

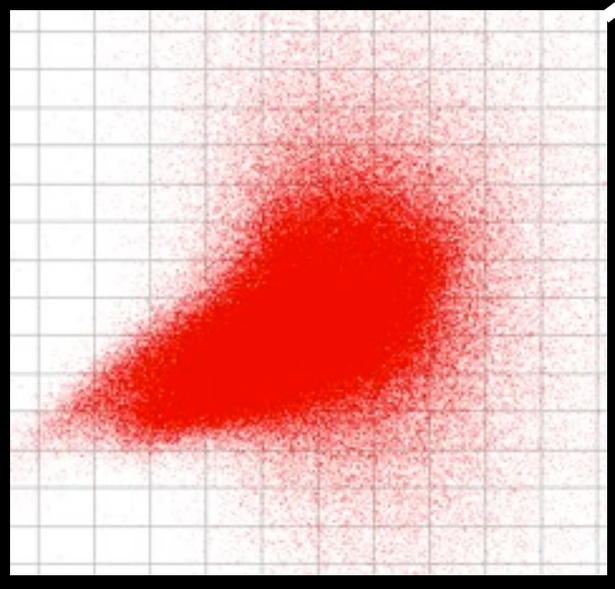

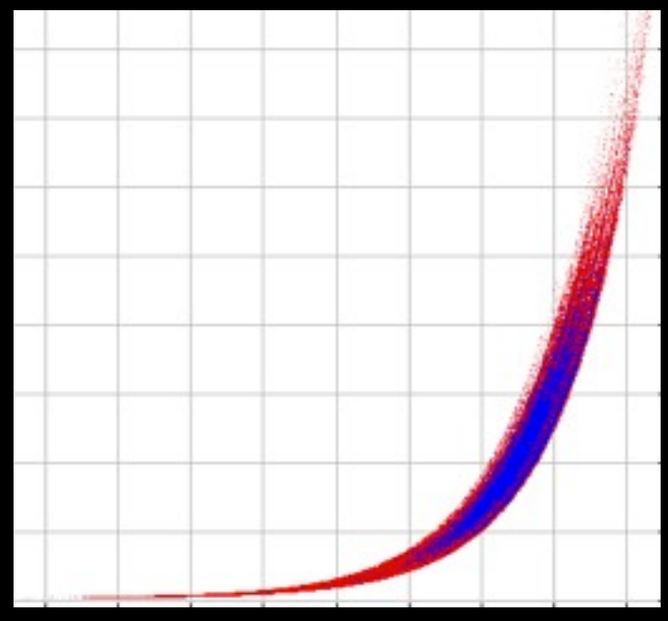

Single dataset linking

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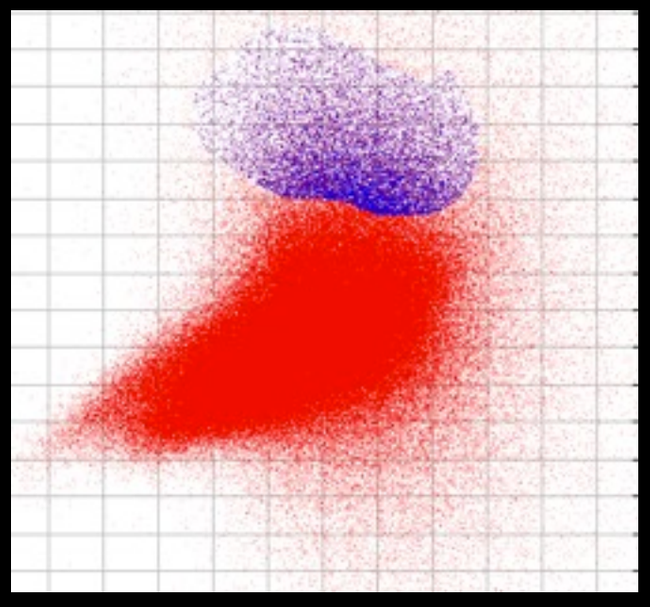

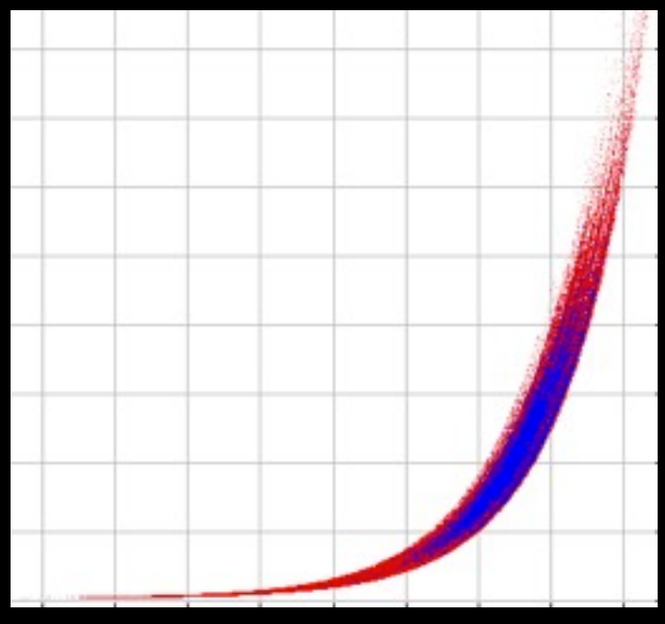

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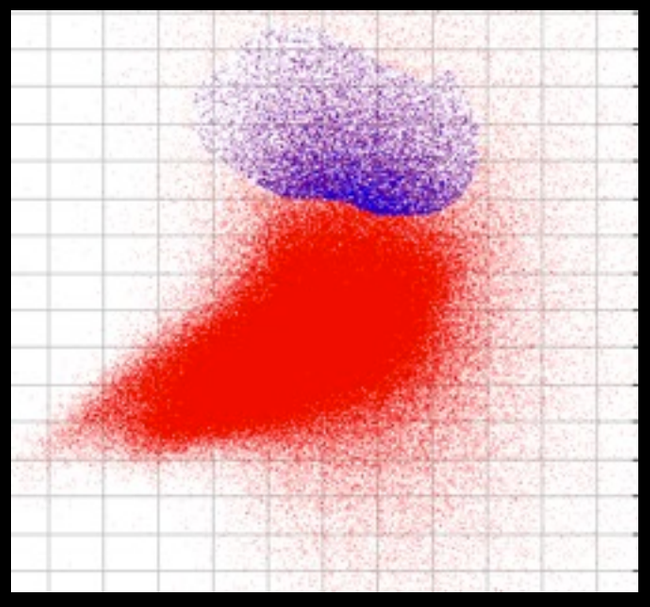

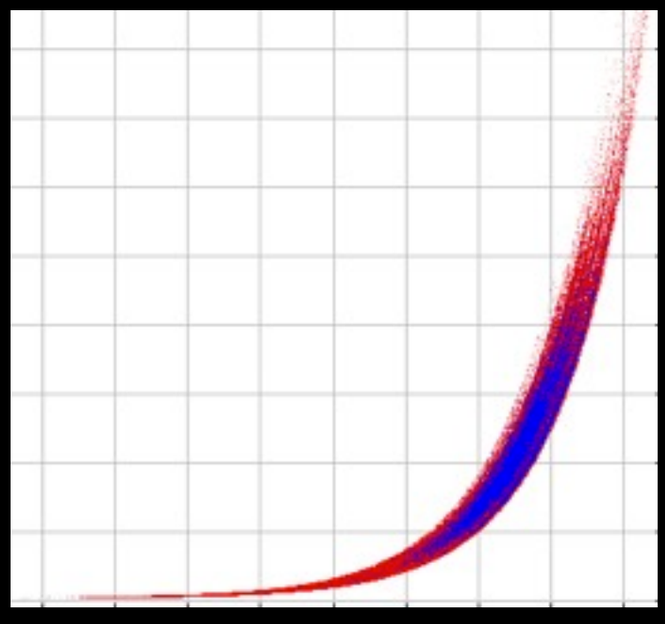

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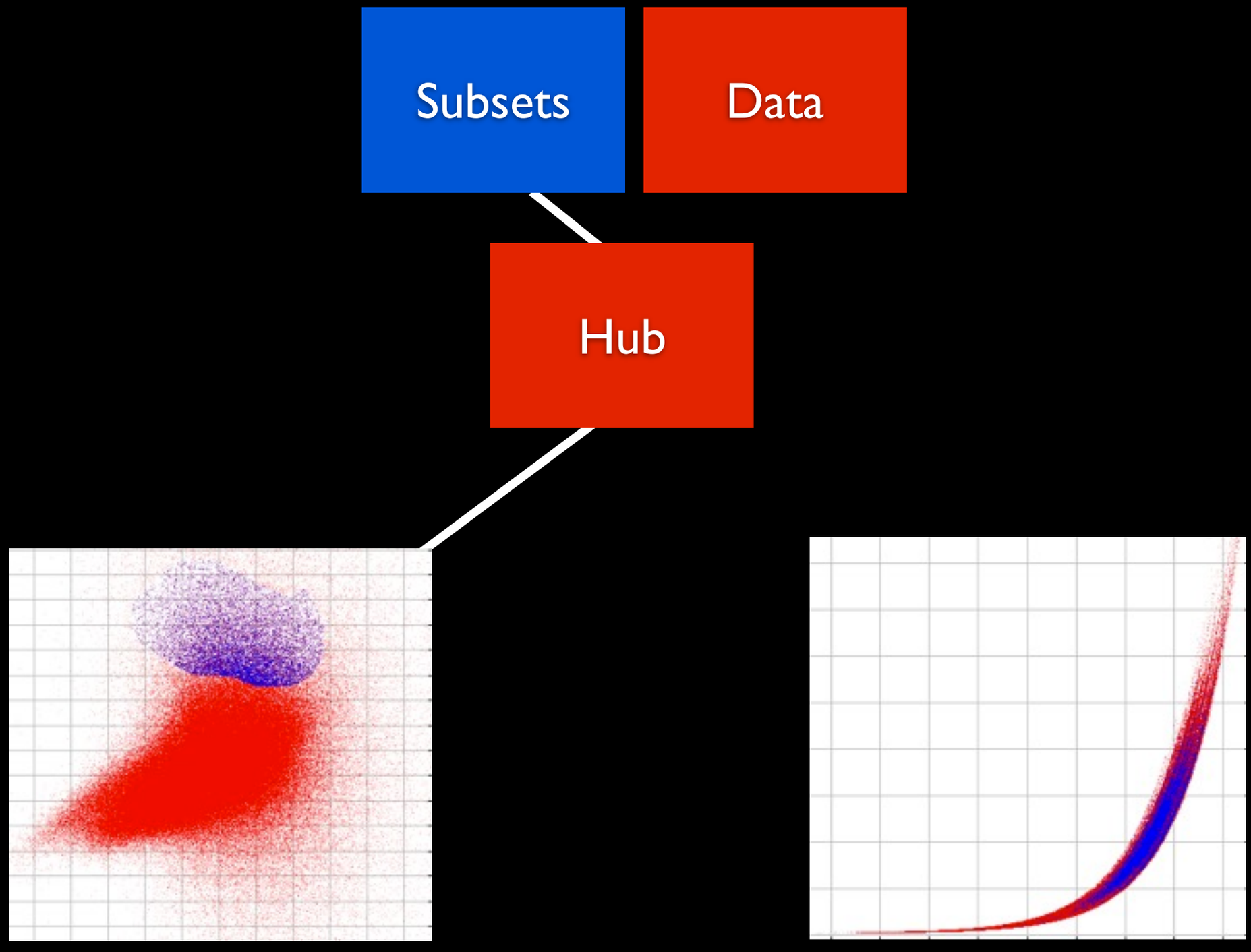


Multi-Data Linking

Subsets

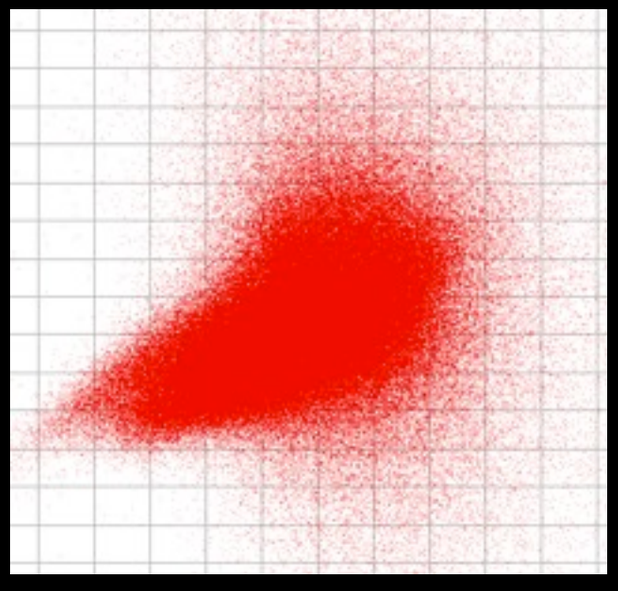
(Catalog) Data

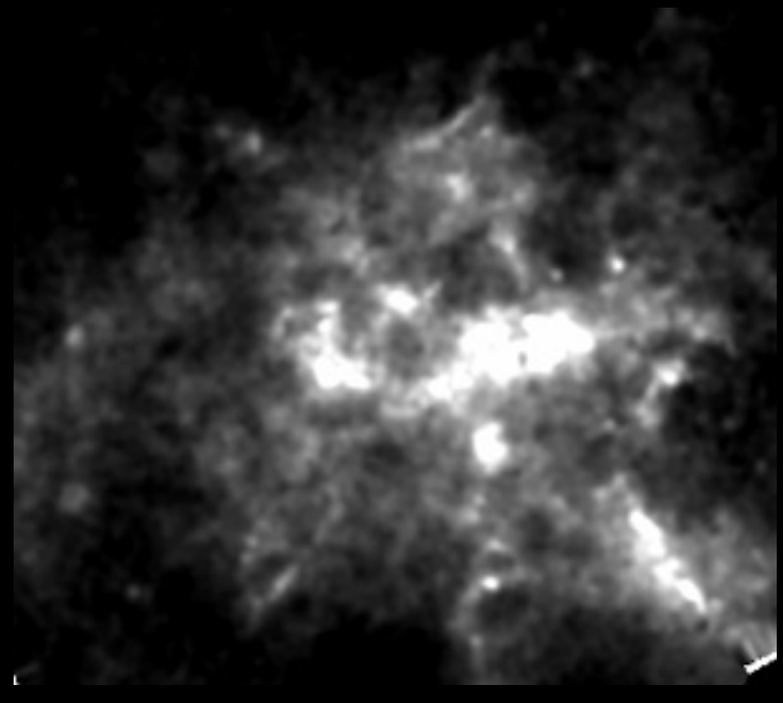
Subsets

(Image) Data

Hub

Data Bridge





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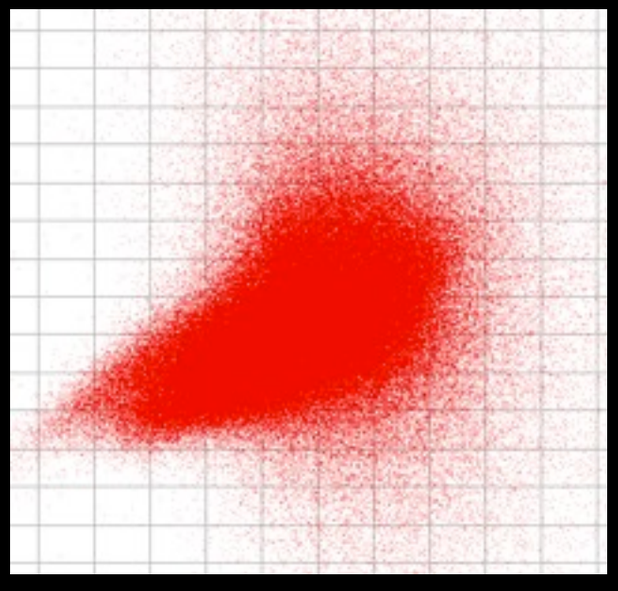
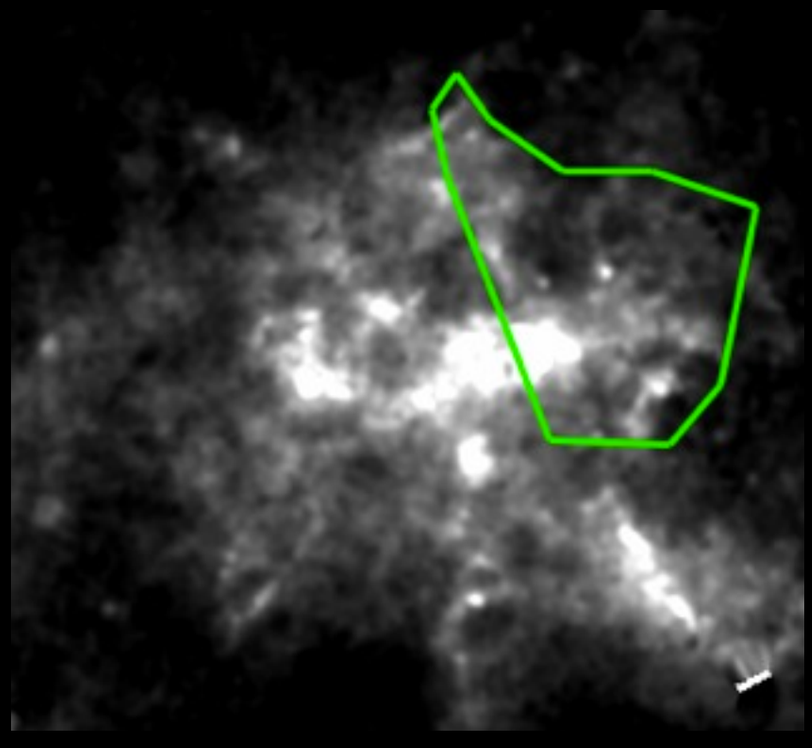
Data Bridge





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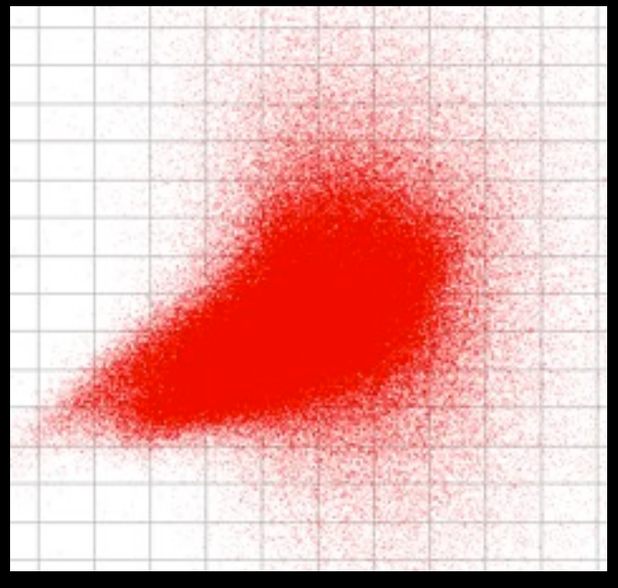

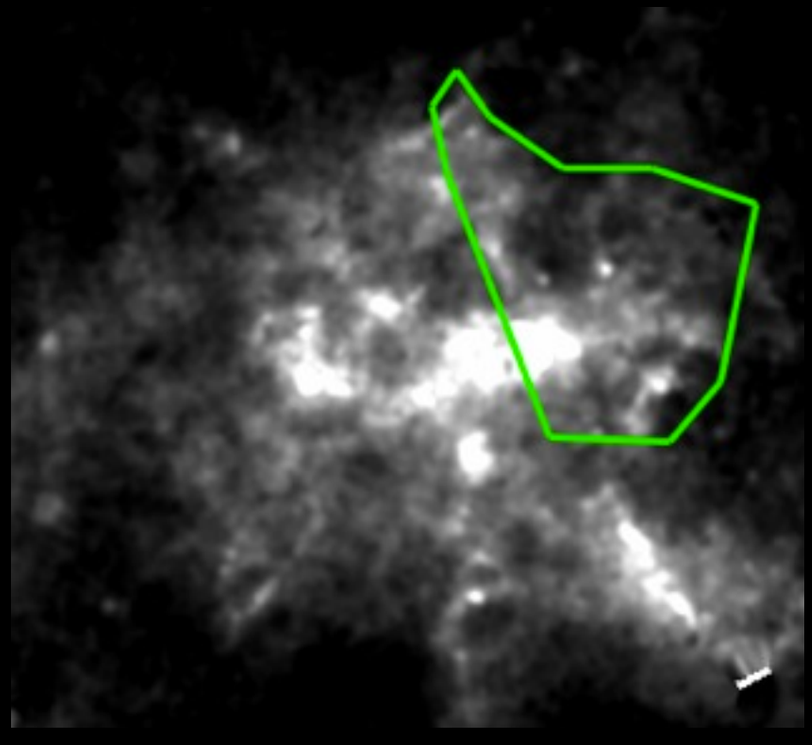

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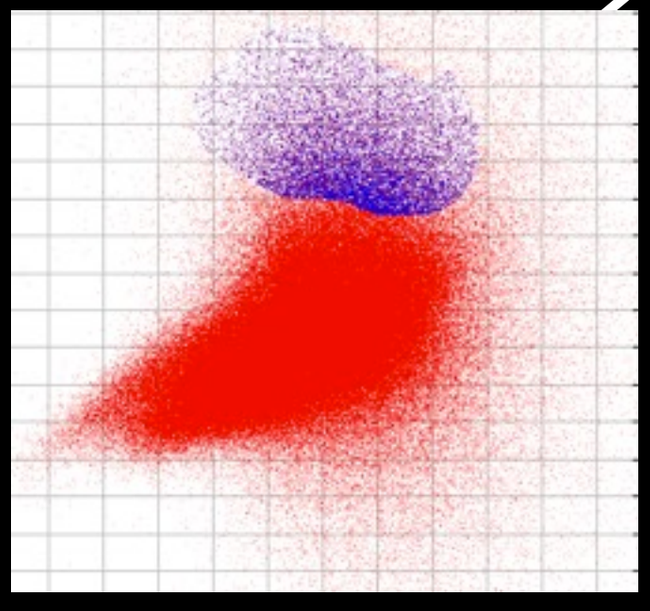

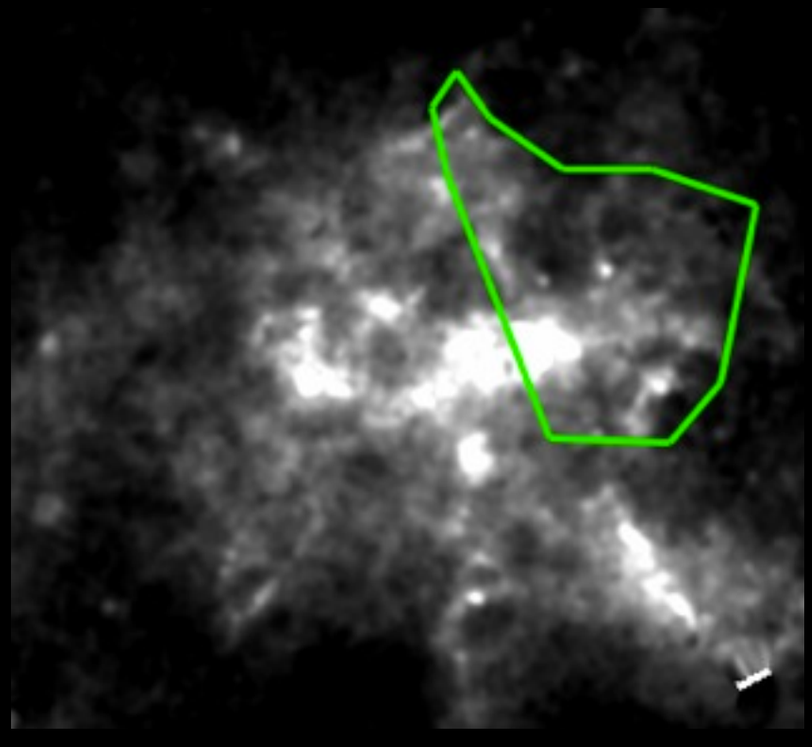

Next Steps

- UI design
- 3D selection (Borkin PhD Thesis)
- Topcat/ds9/etc clients via SAMP
- Extension to big data