
Talk the Second
Matthew Turk

- Questions
- Collaborations
- Future directions
- `yt` Survival Guide

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Kinds of questions

What can we ask of our data?

Three basic categories:

- Simple questions
- Hard questions
- Impossible questions

- Simple questions
- Hard questions
- Impossible questions

Asking a (Simple) Question

The *data* and the *tools* already exist.

Steps

1. Ask the *physical* question
2. Formulate this question in terms of *data*
3. Position the question in terms of *tools*

Requires an understanding of *availability* and *methodology*.

(review of PopIII stars)

Two Questions:

1. Where are the hot bubbles located in my simulations?
2. What is the morphology of the fragmenting region?

Hot Bubbles

t = -3.415e+03 years
t = -1.700e+03 years
t = -1.009e+03 years
t = -3.198e+02 years
t = -8.555e+01 years
1e-12
1e-13
1e-14
1e-15
1e-16
Density [g cm^{-3}]

- The gas in some regions seems to be hotter than others
- How do I identify hot regions using their properties?
- How do I persuade `yt` to tell me about those regions?

“One red thread.”

Density [g/cm^{-3}]

10^{-18} 10^{-16} 10^{-14} 10^{-12} 10^{-10}

Temperature [K]

10^{3}

$cos(\theta)$ (Declination from L)

-1.0 -0.5 0.0 0.5 1.0

Density [g/cm^{-3}]

10^{-16} 10^{-14} 10^{-12} 10^{-10}

Temperature [K]

10^{3}

10^{4}

10^{3}

10^{2}

10^{1}

10^{0}

10^{-1}

Radius [AU]

10^{16} 10^{18} 10^{20} 10^{22}

S [ergs cm^{2}]

-6 -4 -2 0 2 4 6

Radial Velocity [km/s]

400 200 0 −200 −400

AU

−400 −200 0 200 400

AU

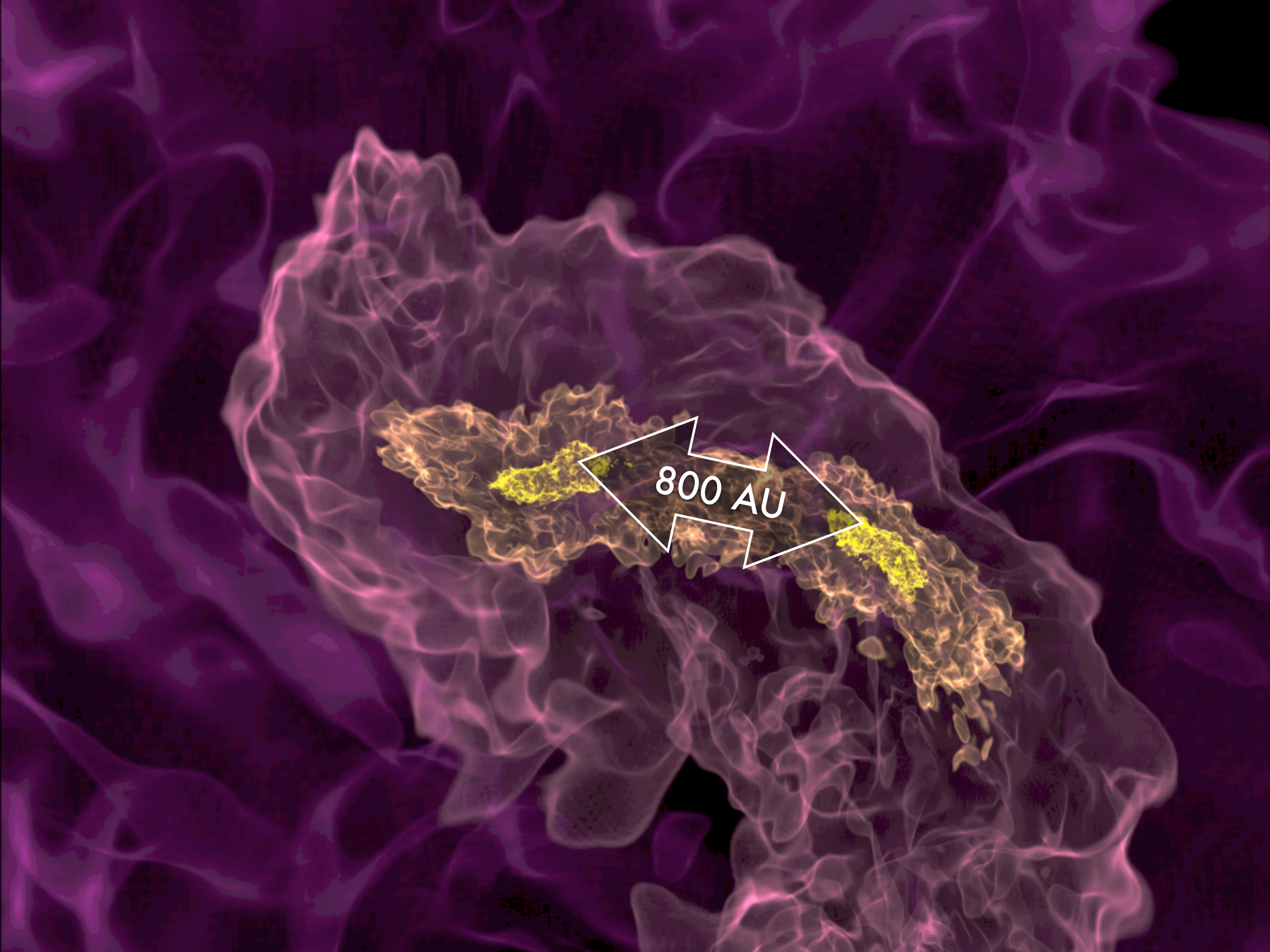
1e-07 1e-06 1e-05 1e-04 1e-03 1e-02 1e-01 1

Mass [$M_{\odot}$]

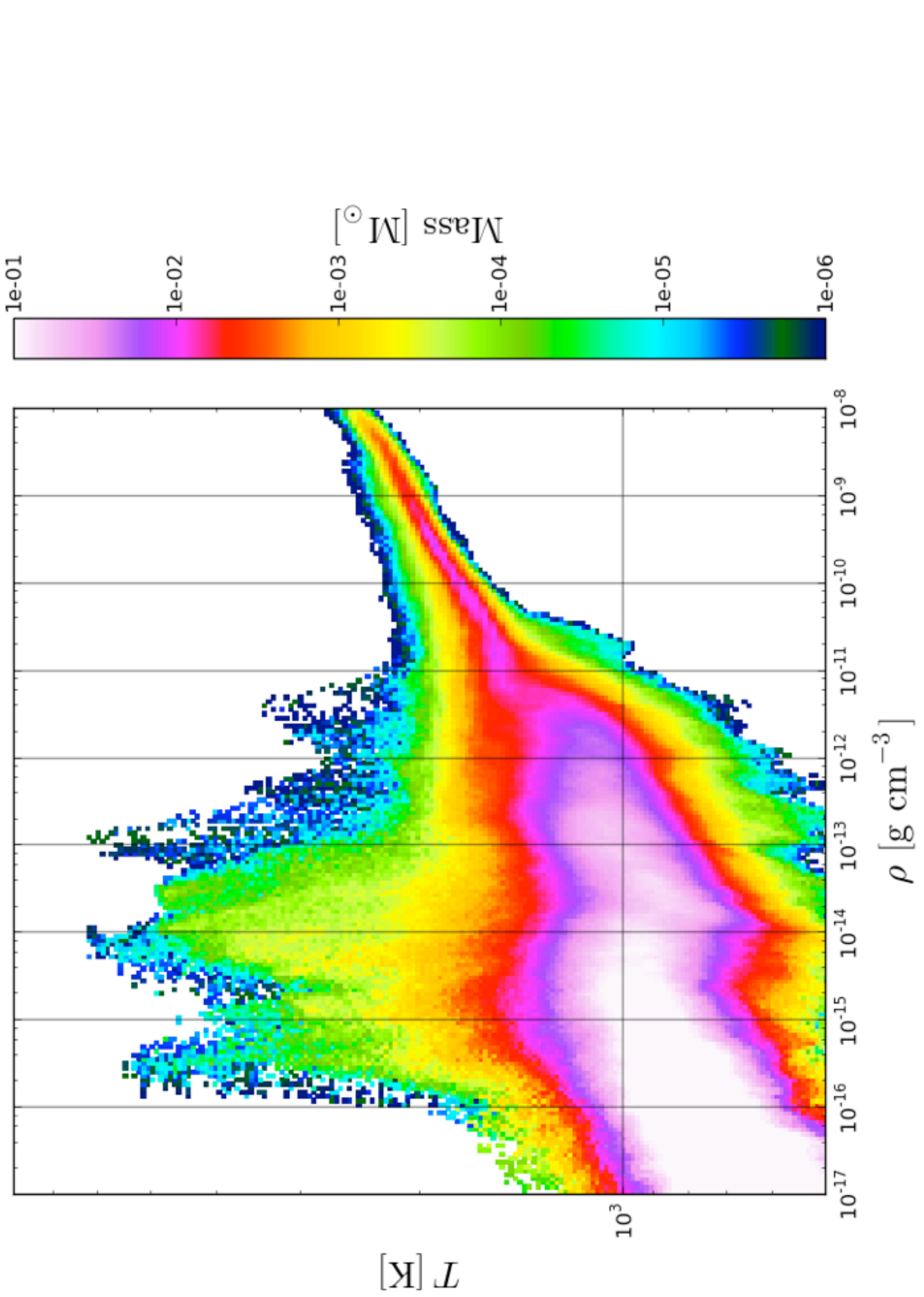
1e-07 1e-06 1e-05 1e-04 1e-03 1e-02 1e-01

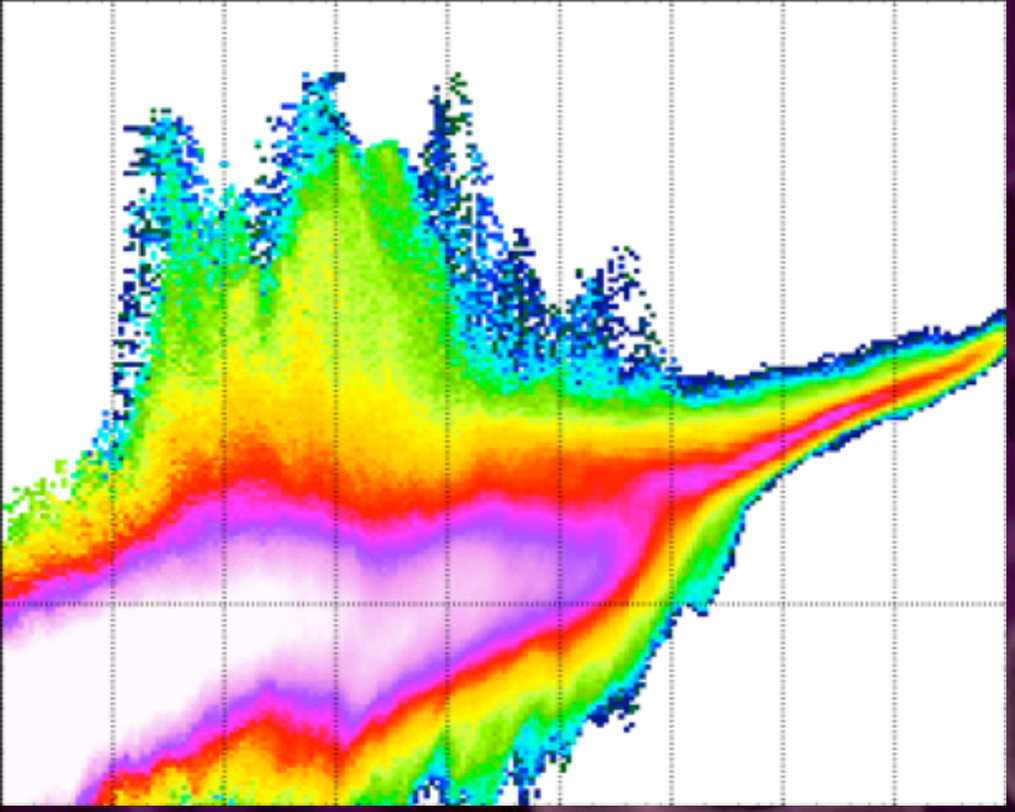
H_2/ρ

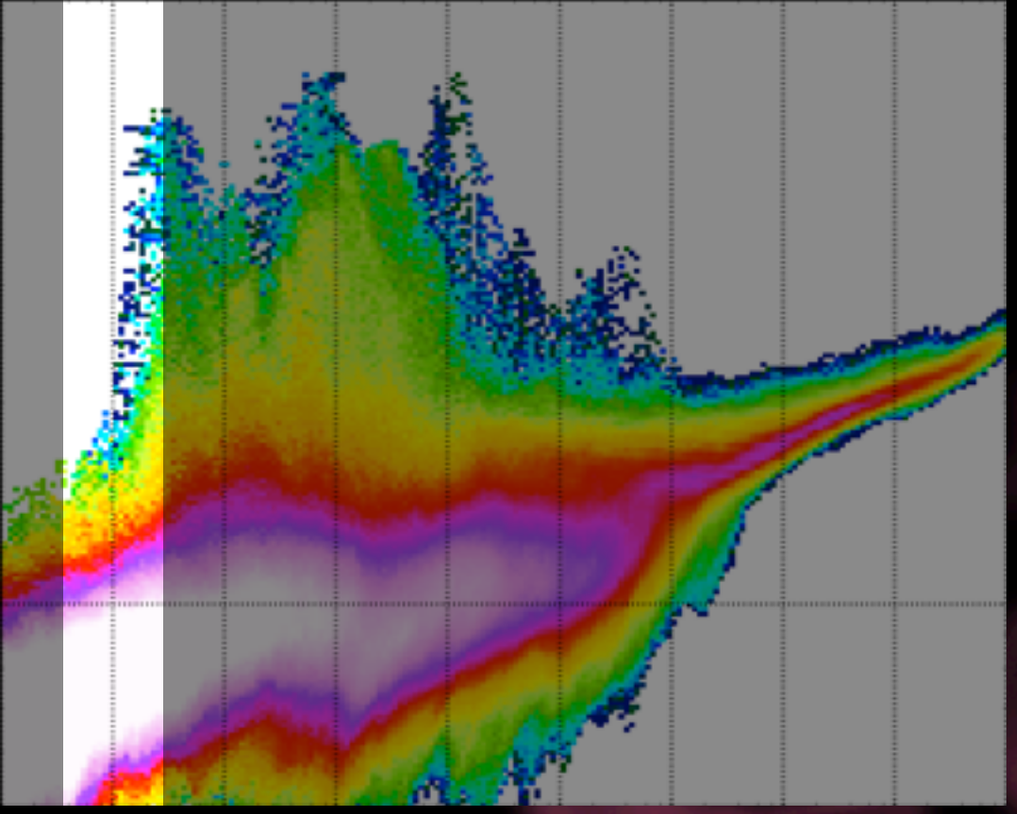
Morphology


800 AU

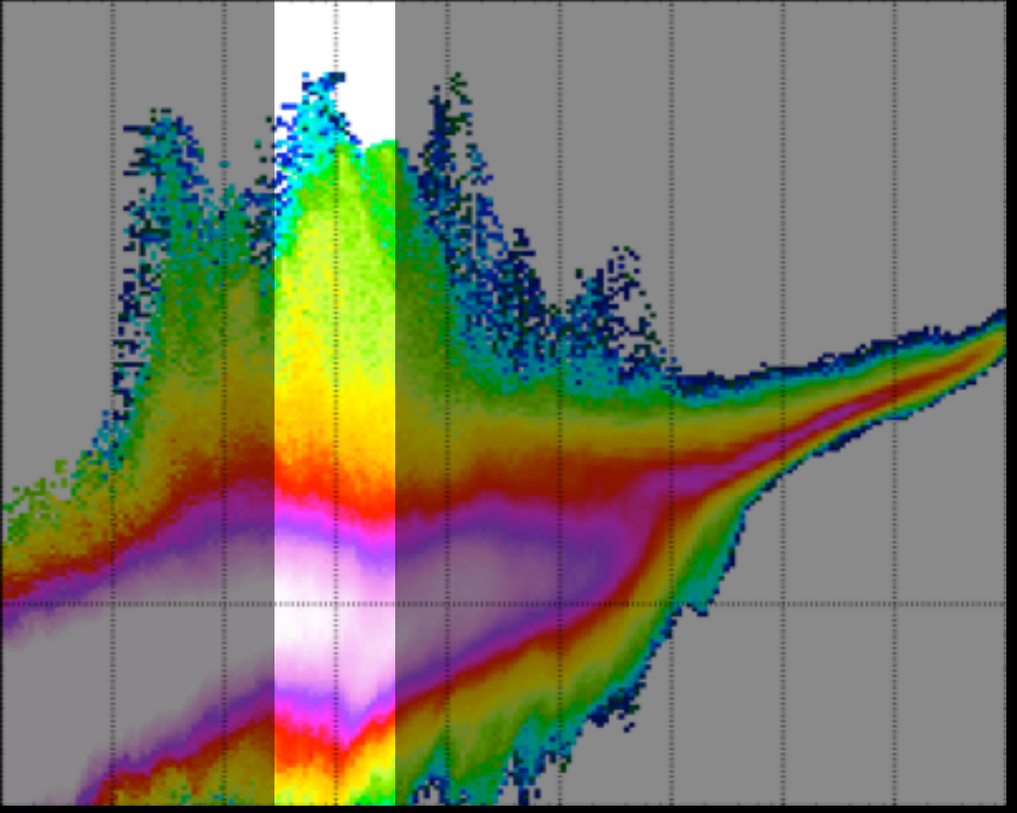
- The molecular cloud has split in two
- At what densities do the
- How do I persuade `yt` to tell me about those regions?


Mass [M$_\odot$]
1e-01
1e-02
1e-03
1e-04
1e-05
1e-06
T [K]
10^3
ρ [g cm^{-3}]
10^{-8}
10^{-9}
10^{-10}
10^{-11}
10^{-12}
10^{-13}
10^{-14}
10^{-15}
10^{-16}
10^{-17}

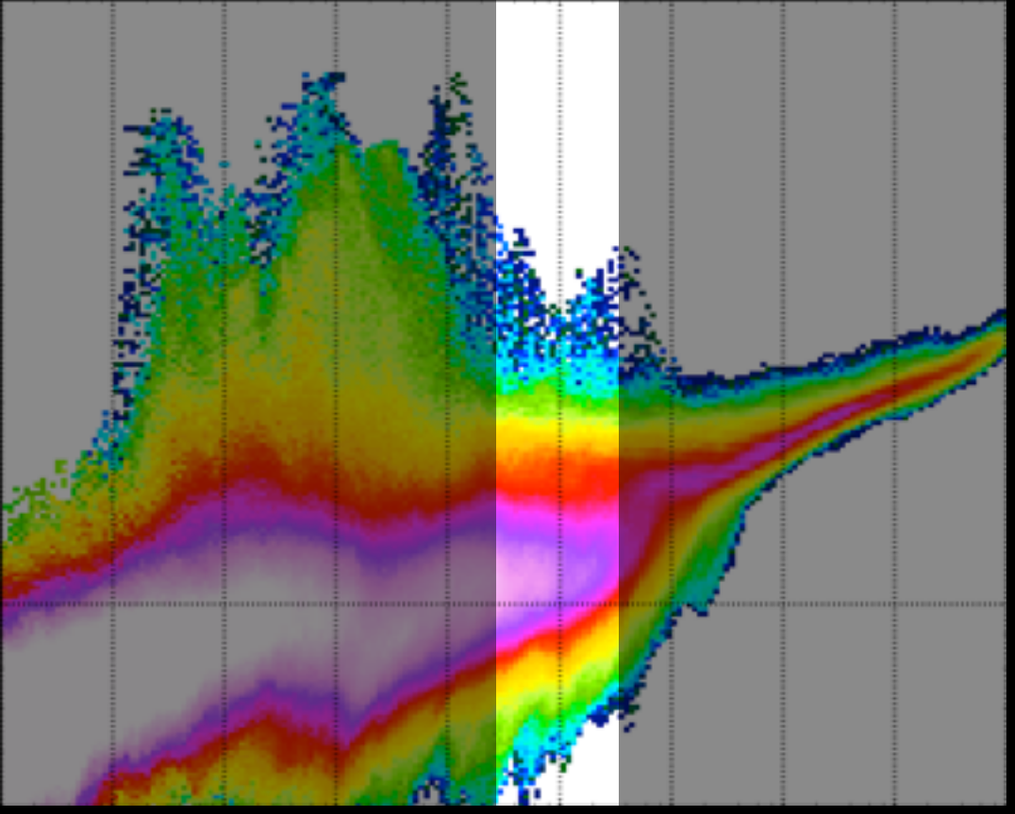


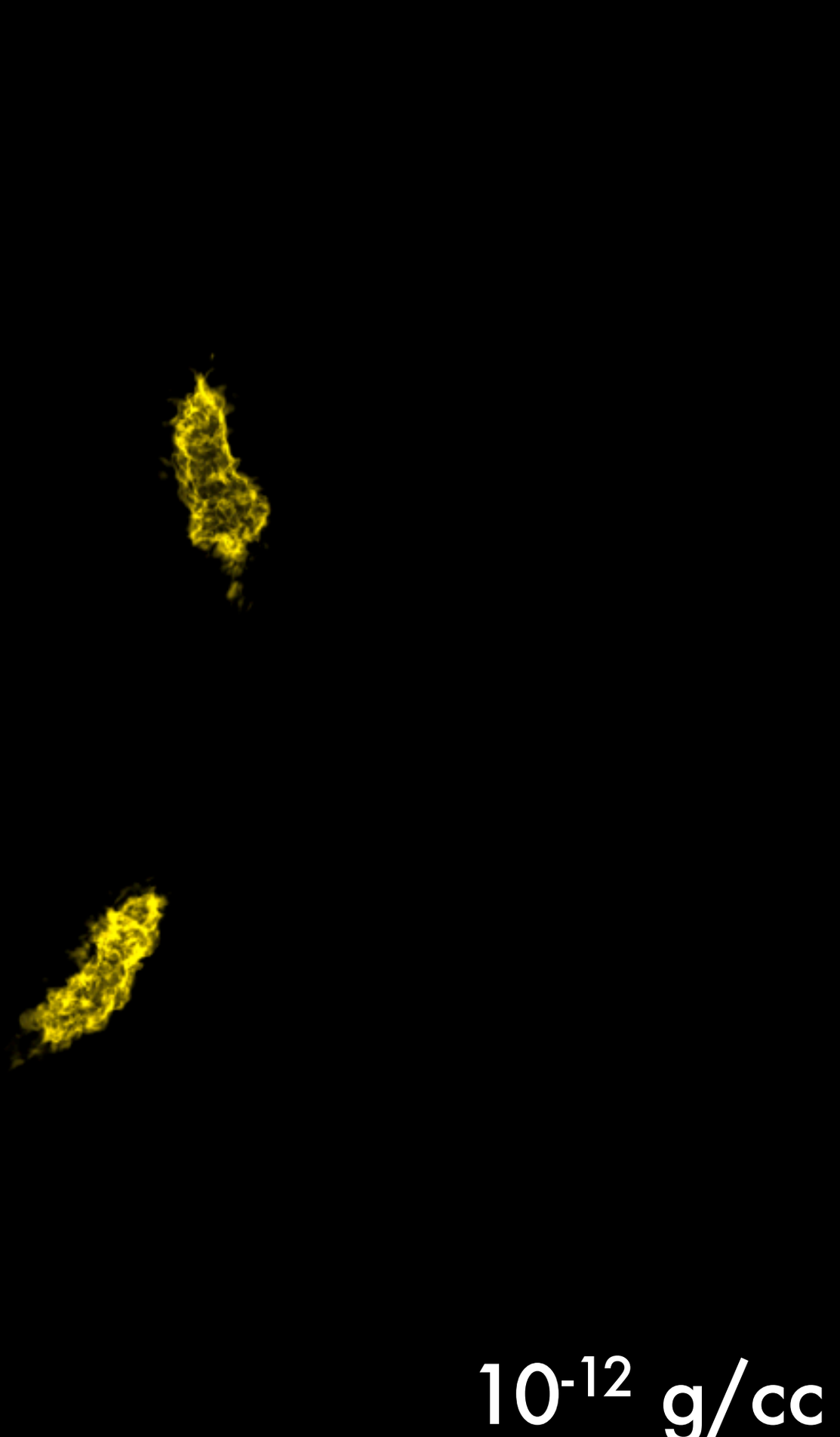


10^{-16} g/cc



10^{-14} g/cc





10^{-12} g/cc

Asking a (Hard) Question

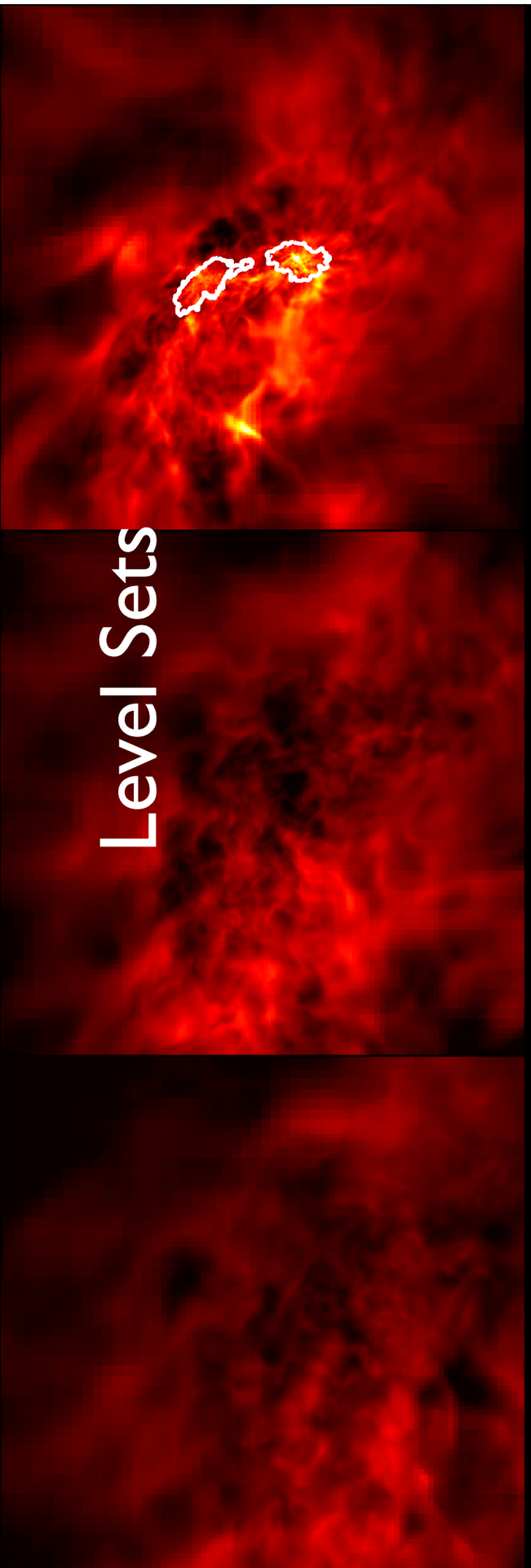
Steps

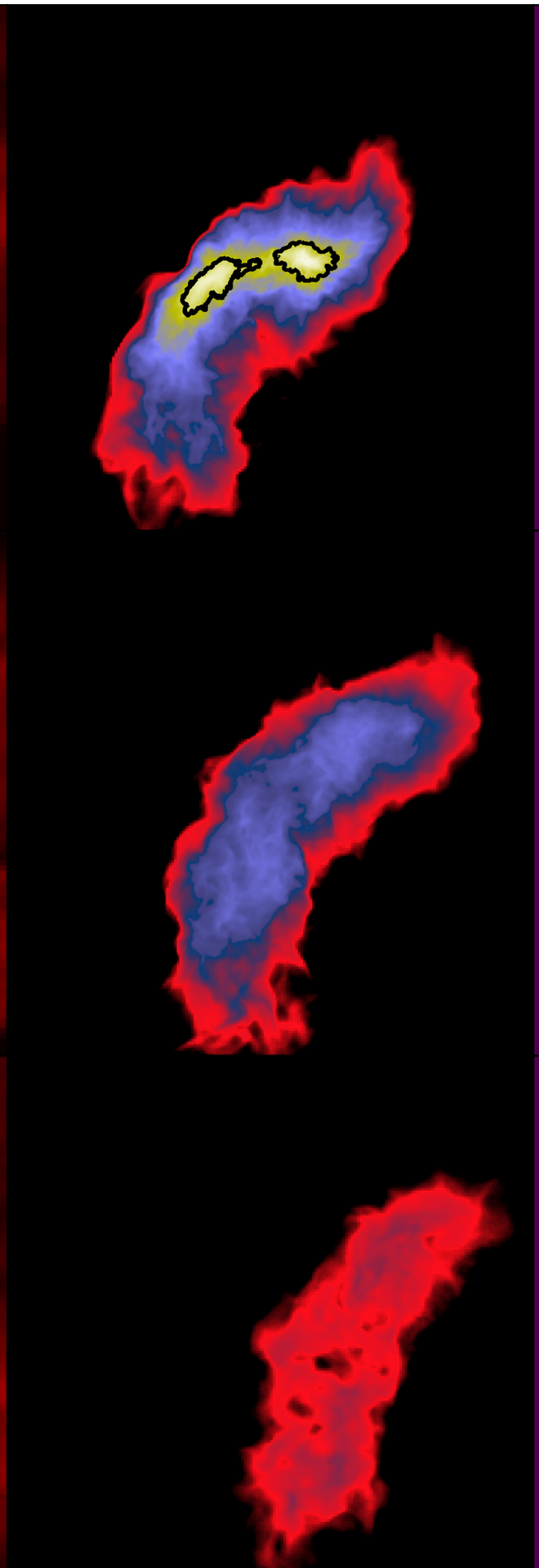
1. Ask the *physical* question
2. Formulate this question in terms of *data*
3. Ask why existing tools do not satisfy this answer
4. Iterate on algorithms and implementations

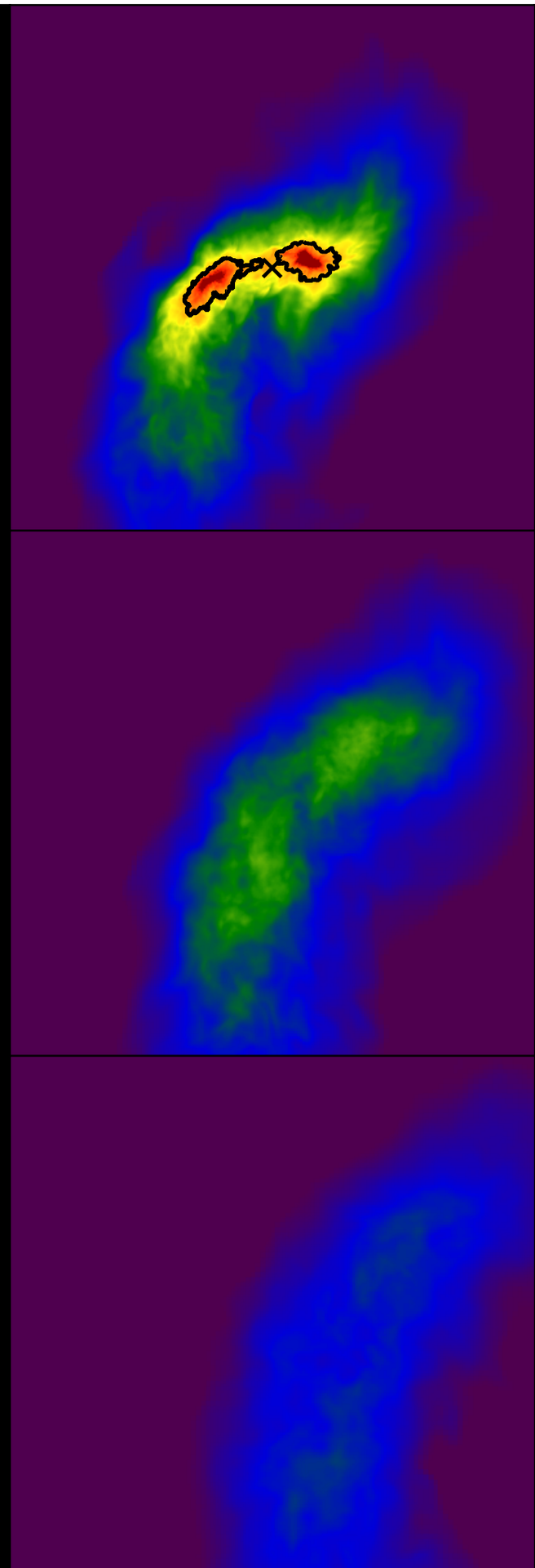
- The cloud has broken up!
- How do I identify one region that's not connected to another?
- The clouds it broke into aren't regular shapes.
- Let's try to identify connected sets.

Level

Sets







Density [g cm^{-3}]

1e-15 1e-14 1e-13 1e-12

H_2 mass fraction

1e-02 1e-01

Temperature [K]

800 960 1120 1280 1440

- Identify connected sets in grids
- Connect sets across grids
- Coalesce

Impossible Questions

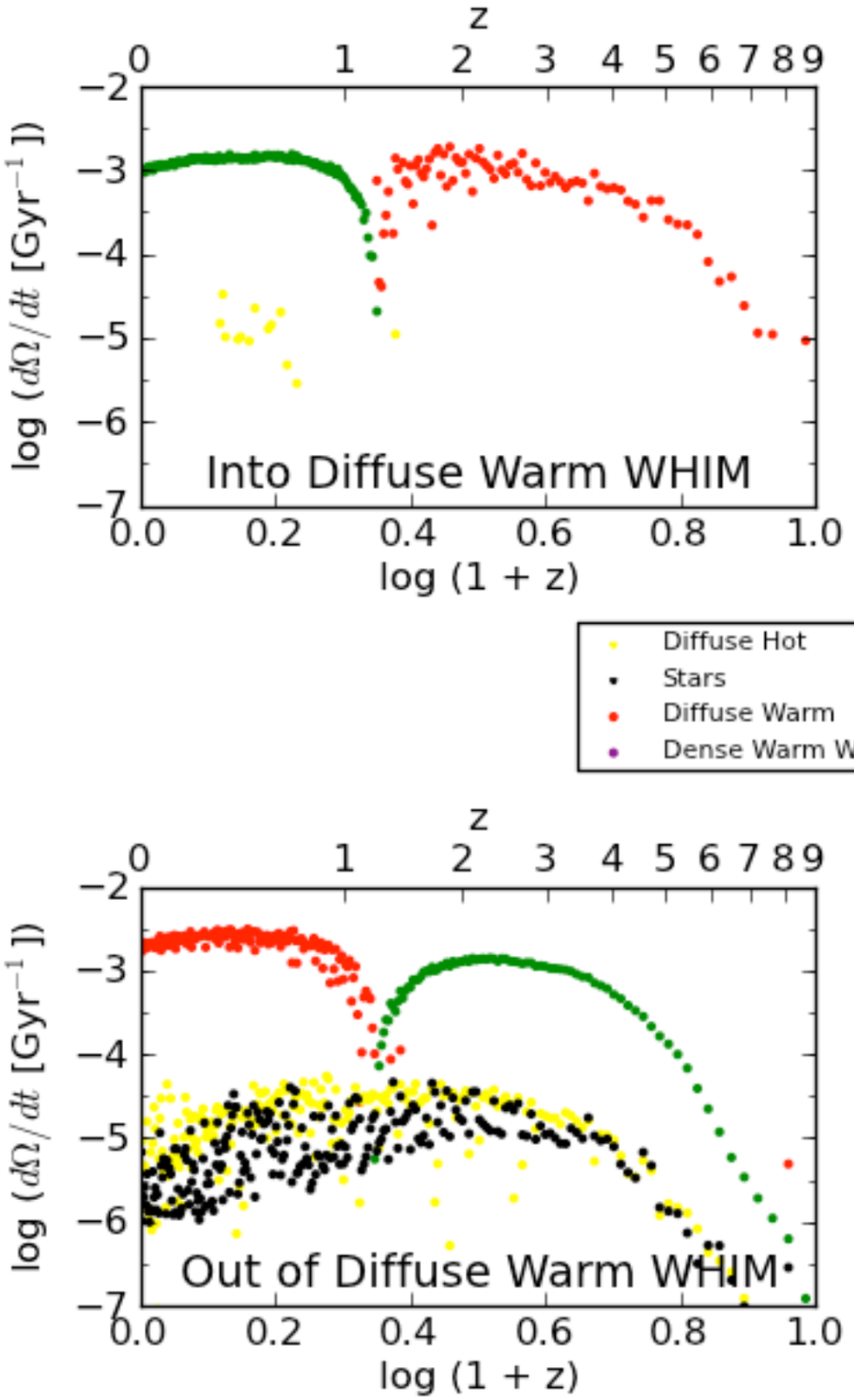
“All those moments will be lost in time...
Like tears in rain...”

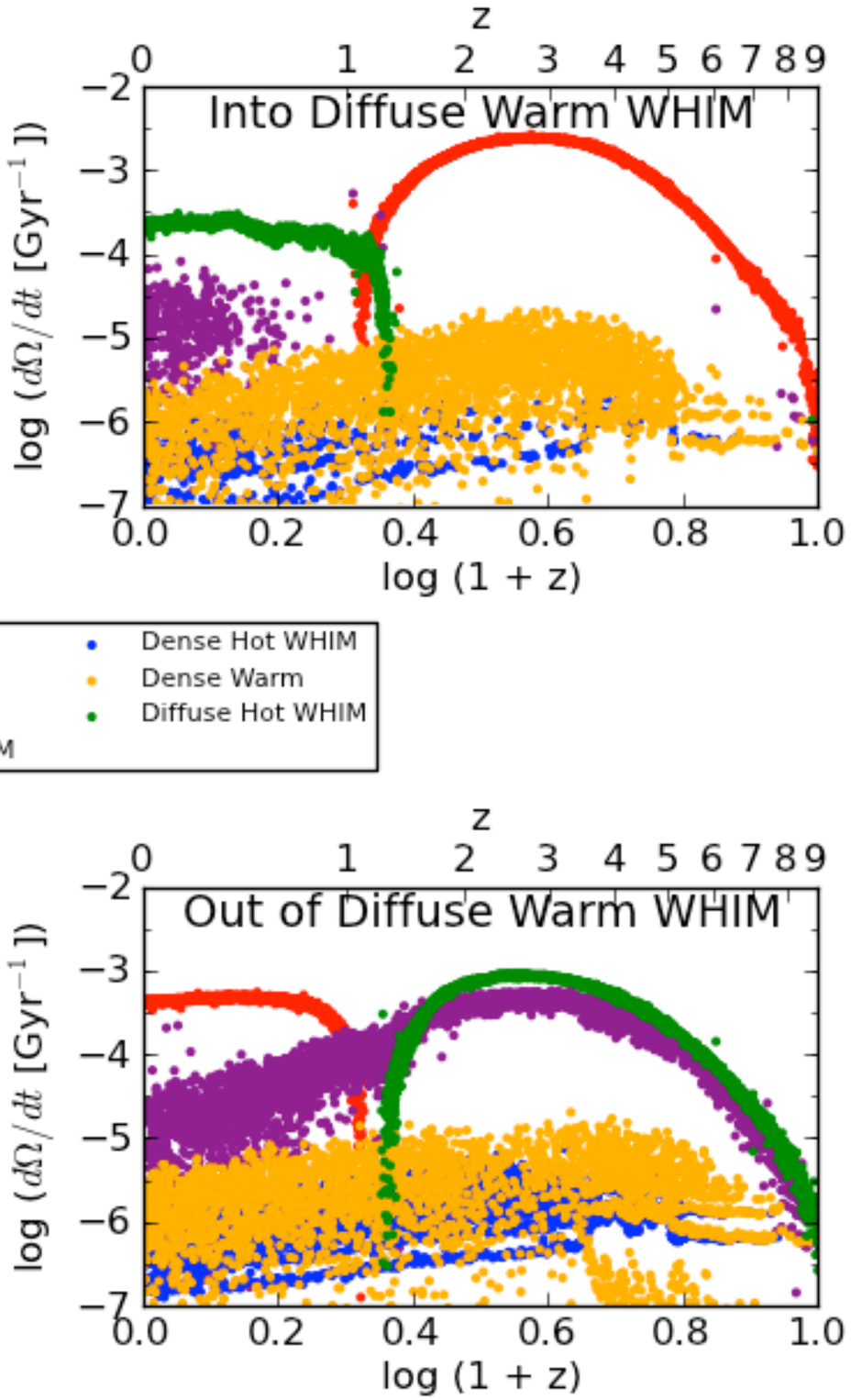
– Roy Batty

Design questions in advance.

In situ can only sip from the firehose.

On Disc → In-situ





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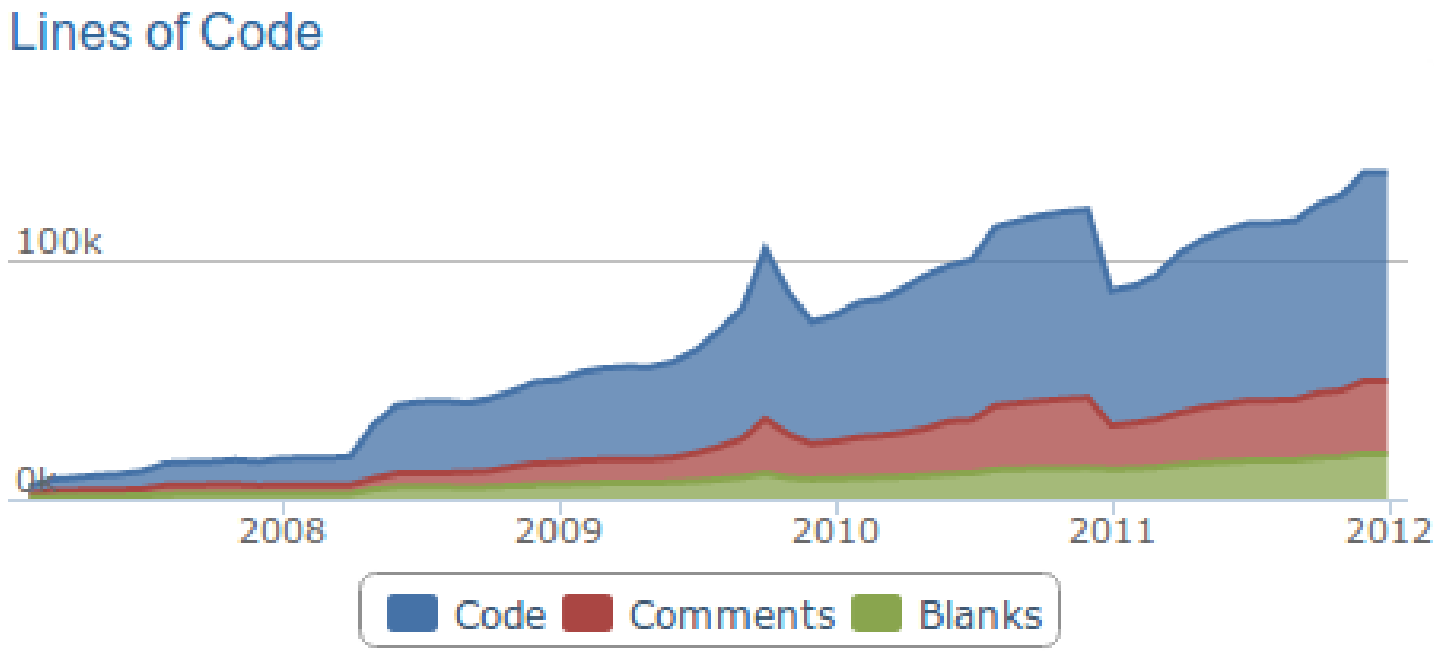
Project Collaborations

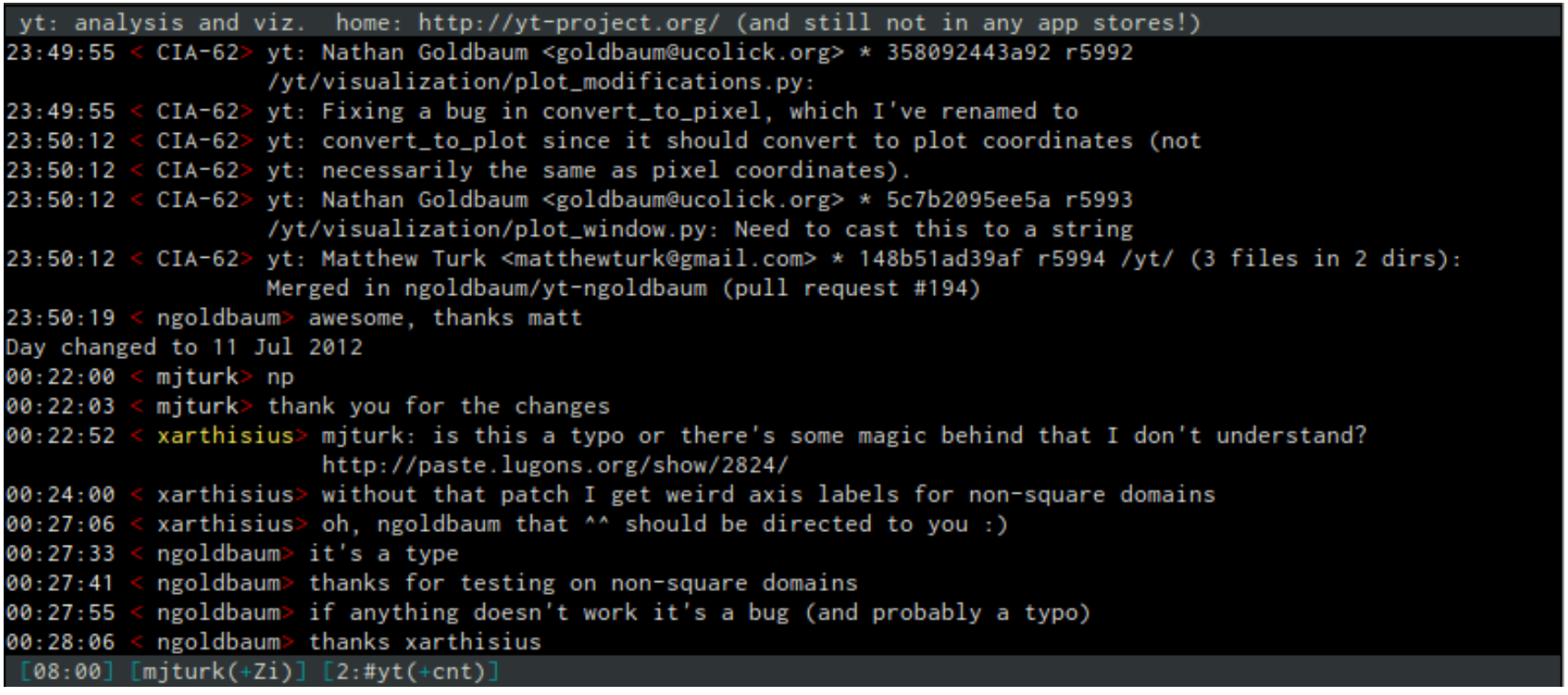
“Co-opetition”

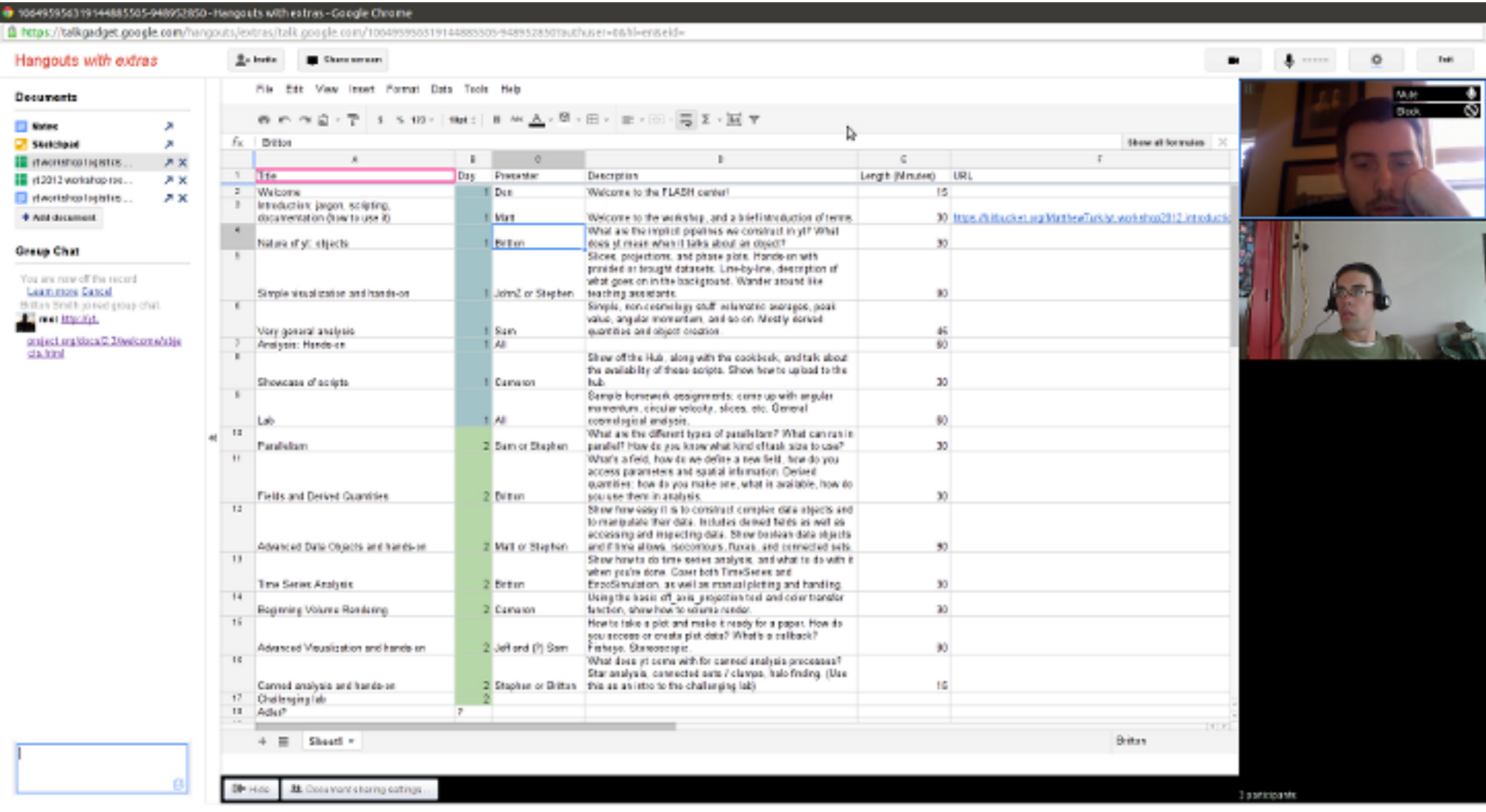
What has worked for `yt`?

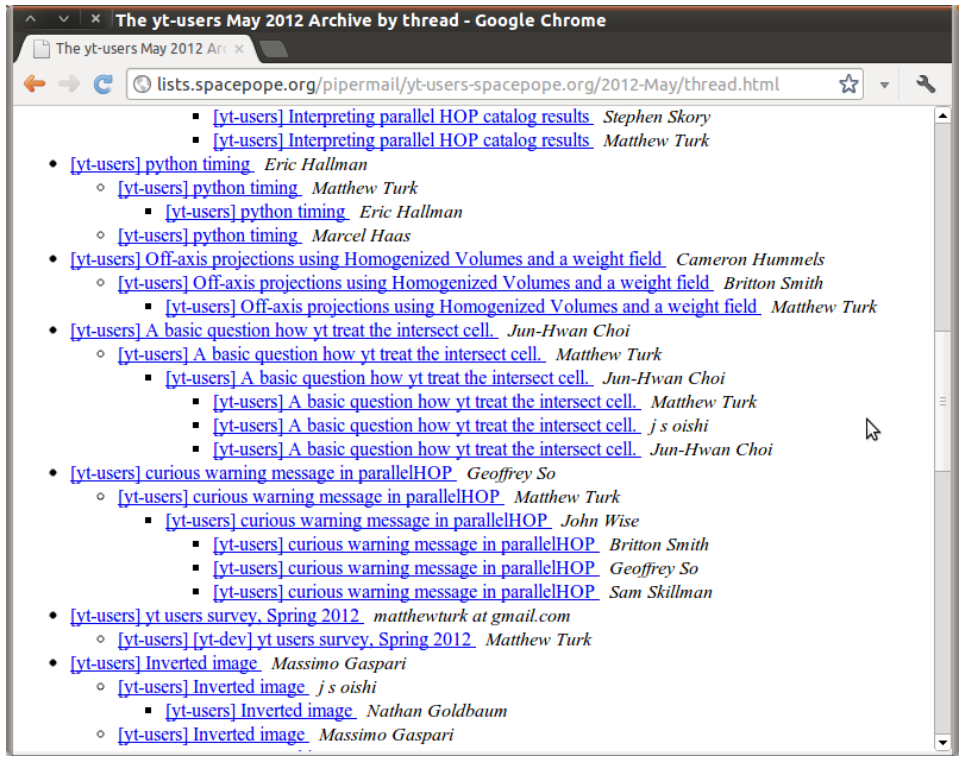
- Communication
- Investment
- Rewards
- Letting Go


Lines of Code
100k
0k
2008
2009
2010
2011
2012
Code
Comments
Blanks

Bifurcate Communication


yt: analysis and viz. home: http://yt-project.org/ (and still not in any app stores!)
23:49:55 < CIA-62> yt: Nathan Goldbaum <goldbaum@ucolick.org> * 358092443a92 r5992
/yt/visualization/plot_modifications.py:
23:49:55 < CIA-62> yt: Fixing a bug in convert_to_pixel, which I've renamed to
23:50:12 < CIA-62> yt: convert_to_plot since it should convert to plot coordinates (not
23:50:12 < CIA-62> yt: necessarily the same as pixel coordinates).
23:50:12 < CIA-62> yt: Nathan Goldbaum <goldbaum@ucolick.org> * 5c7b2095ee5a r5993
/yt/visualization/plot_window.py: Need to cast this to a string
23:50:12 < CIA-62> yt: Matthew Turk <matthewturk@gmail.com> * 148b51ad39af r5994 /yt/ (3 files in 2 dirs):
Merged in ngoldbaum/yt-ngoldbaum (pull request #194)
23:50:19 < ngoldbaum> awesome, thanks matt
Day changed to 11 Jul 2012
00:22:00 < mjturk> np
00:22:03 < mjturk> thank you for the changes
00:22:52 < xarthisius> mjturk: is this a typo or there's some magic behind that I don't understand?
http://paste.lugons.org/show/2824/
00:24:00 < xarthisius> without that patch I get weird axis labels for non-square domains
00:27:06 < xarthisius> oh, ngoldbaum that ^^ should be directed to you :)
00:27:33 < ngoldbaum> it's a type
00:27:41 < ngoldbaum> thanks for testing on non-square domains
00:27:55 < ngoldbaum> if anything doesn't work it's a bug (and probably a typo)
00:28:06 < ngoldbaum> thanks xarthisius
[08:00] [mjturk(+Zi)] [2:#yt(+cnt)]


Hangouts with extras
Documents
Group Chat
File Edit View Insert Format Data Tools Help
Britton
Title
Day
Presenter
Description
Length (Minutes)
URL
Welcome
Introduction: jargon, scripting, documentation (how to use it)
Nature of yt: objects
Simple visualization and hands-on
Very general analysis
Analysis: Hands-on
Showcase of scripts
Lab
Parallelism
Fields and Derived Quantities
Advanced Data Objects and hands-on
Time Series Analysis
Beginning Volume Rendering
Advanced Visualization and hands-on
Canned analysis and hands-on
Challenging lab
Adler?
Sheet1
Britton
Hide
Document sharing settings...
1 participant


The yt-users May 2012 Archive by thread - Google Chrome
The yt-users May 2012 Ar
lists.spacepope.org/pipermail/yt-users-spacepope.org/2012-May/thread.html
[yt-users] Interpreting parallel HOP catalog results Stephen Skory
[yt-users] Interpreting parallel HOP catalog results Matthew Turk
[yt-users] python timing Eric Hallman
[yt-users] python timing Matthew Turk
[yt-users] python timing Eric Hallman
[yt-users] python timing Marcel Haas
[yt-users] Off-axis projections using Homogenized Volumes and a weight field Cameron Hummels
[yt-users] Off-axis projections using Homogenized Volumes and a weight field Britton Smith
[yt-users] Off-axis projections using Homogenized Volumes and a weight field Matthew Turk
[yt-users] A basic question how yt treat the intersect cell. Jun-Hwan Choi
[yt-users] A basic question how yt treat the intersect cell. Matthew Turk
[yt-users] A basic question how yt treat the intersect cell. Jun-Hwan Choi
[yt-users] A basic question how yt treat the intersect cell. Matthew Turk
[yt-users] A basic question how yt treat the intersect cell. j s oishi
[yt-users] A basic question how yt treat the intersect cell. Jun-Hwan Choi
[yt-users] curious warning message in parallelHOP Geoffrey So
[yt-users] curious warning message in parallelHOP Matthew Turk
[yt-users] curious warning message in parallelHOP John Wise
[yt-users] curious warning message in parallelHOP Britton Smith
[yt-users] curious warning message in parallelHOP Geoffrey So
[yt-users] curious warning message in parallelHOP Sam Skillman
[yt-users] yt users survey, Spring 2012 matthewturk at gmail.com
[yt-users] [yt-dev] yt users survey, Spring 2012 Matthew Turk
[yt-users] Inverted image Massimo Gaspari
[yt-users] Inverted image j s oishi
[yt-users] Inverted image Nathan Goldbaum
[yt-users] Inverted image Massimo Gaspari

Investment

~~Investment~~

Pride

(Show 5 Mpc density movie)

Case Study: Volume Rendering

Meeting a need.

(Pragmatic development)

Timeline

1. Late 2009: Developed stacked cutting planes
2. Late 2009: Homogenized Volumes
3. Early 2010: Image plane parallelism
4. Mid 2010: Multivariate transfer functions
5. Early 2011: kD-tree
6. Early 2012: Threading

As responsibility and pride grew,
development blossomed as well.

Rewards

De facto and *de jure*

De facto rewards

- Utilization of developed tools
- Respect from community
- Involvement in projects
- Invitations to speak

De jure rewards

- Funding
- Additional publications
- Citations

The reward structure in astrophysics does not favor builders.

Letting Go

Too much control leads to smothering growth.

Allow projects to pass between people.

Encourage *pride*, but not *ownership*.

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Geometry

Generic geometric selection of points, cells and data


Grids
Chunks

IO Library

Regularization occurs inside `yt` natively.
Serialize this to disk.

Tighter Integration

Initialization

```
sim = NewMesh([64, 64, 64])
sim.add_fluid("density")
sim.add_fluid("hydrogen", color=True, frac=0.76)
sim.set_temperature(100)
sim.set_density(1e-3)
sphere = add_sphere([0.5, 0.5, 0.5], 0.1)
sphere.set_temperature(1000)
sphere.set_density(1e0)
sim.run()
```

Simulation Control

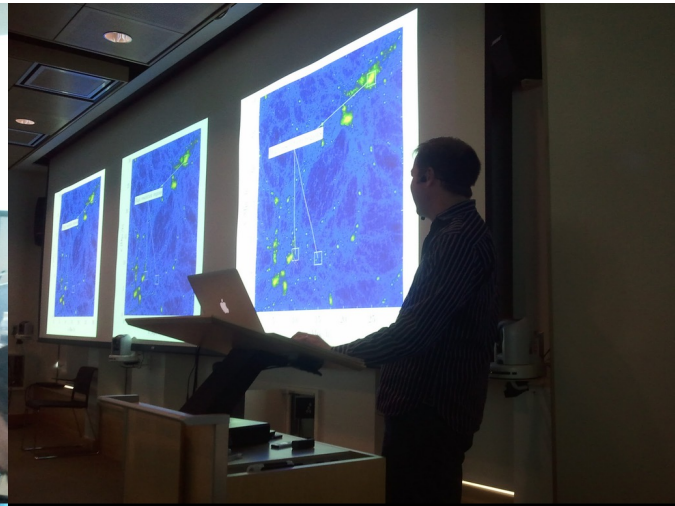
```
sim.add_module("hydro_HLLC")
sim.add_module("chemistry_high_density")
sim.run()
```

Collaboration

hub.yt-project.org

Better Outreach


The University of Chicago
The Flash Center for
Computational Science
yt WORKSHOP
(1.24 - 26, 2011)
Searle CI-Conference
240 a&b




What is volume rendering / silhouts projection?
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Survival Guide

`http://yt-project.org/`: Docs, bug reports, help

```
yt help
yt plot
yt upload_image
yt serve
yt mapserver
```