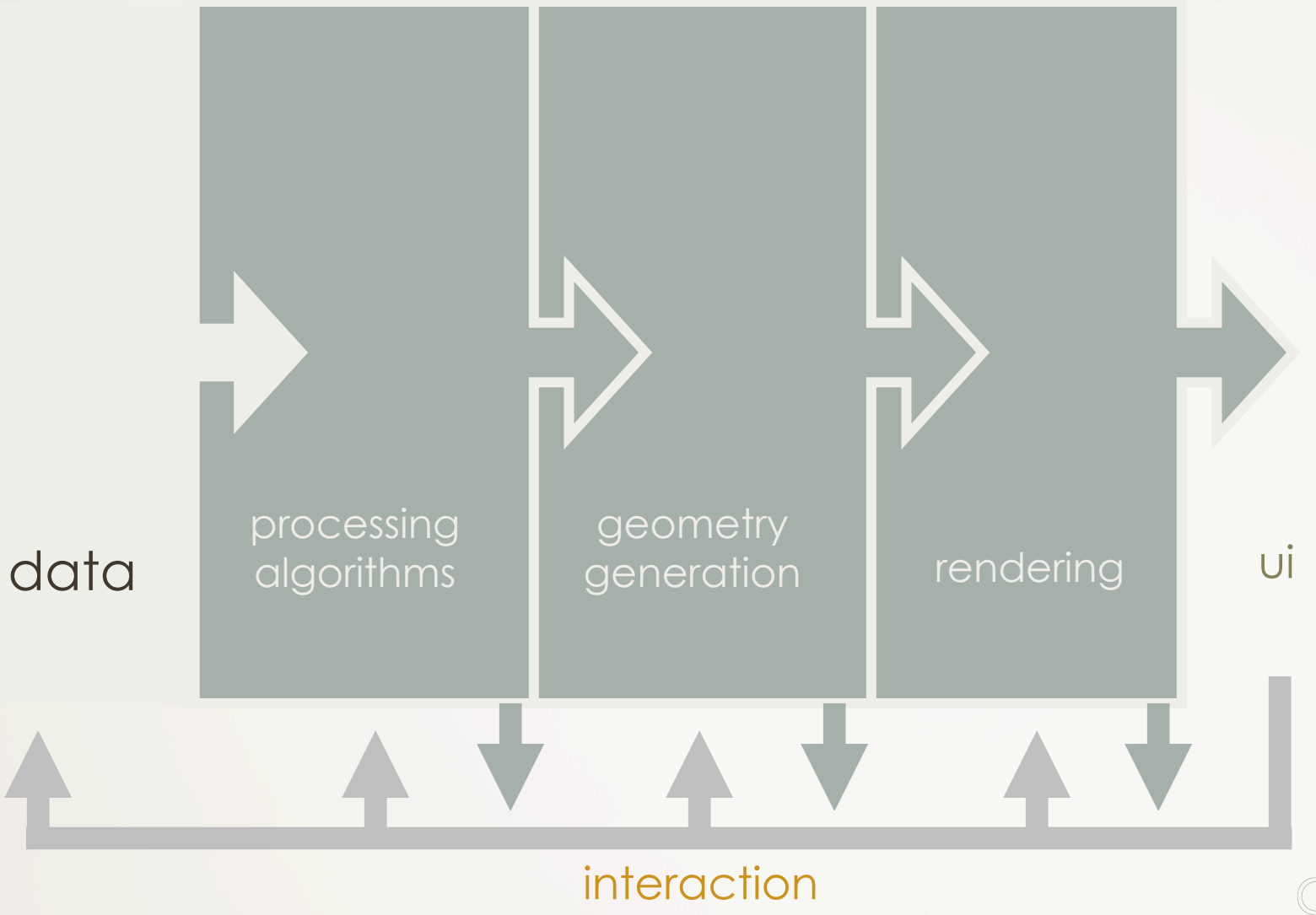
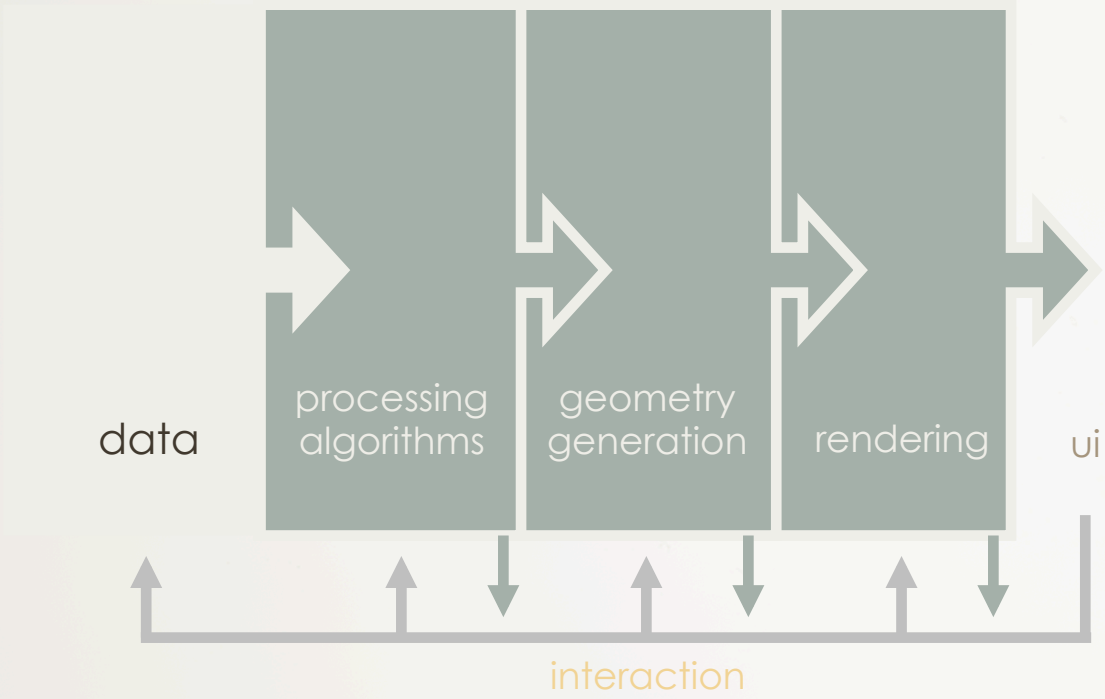
SECTION 3

tool taxonomy

USUAL VISUALIZATION ENGINE

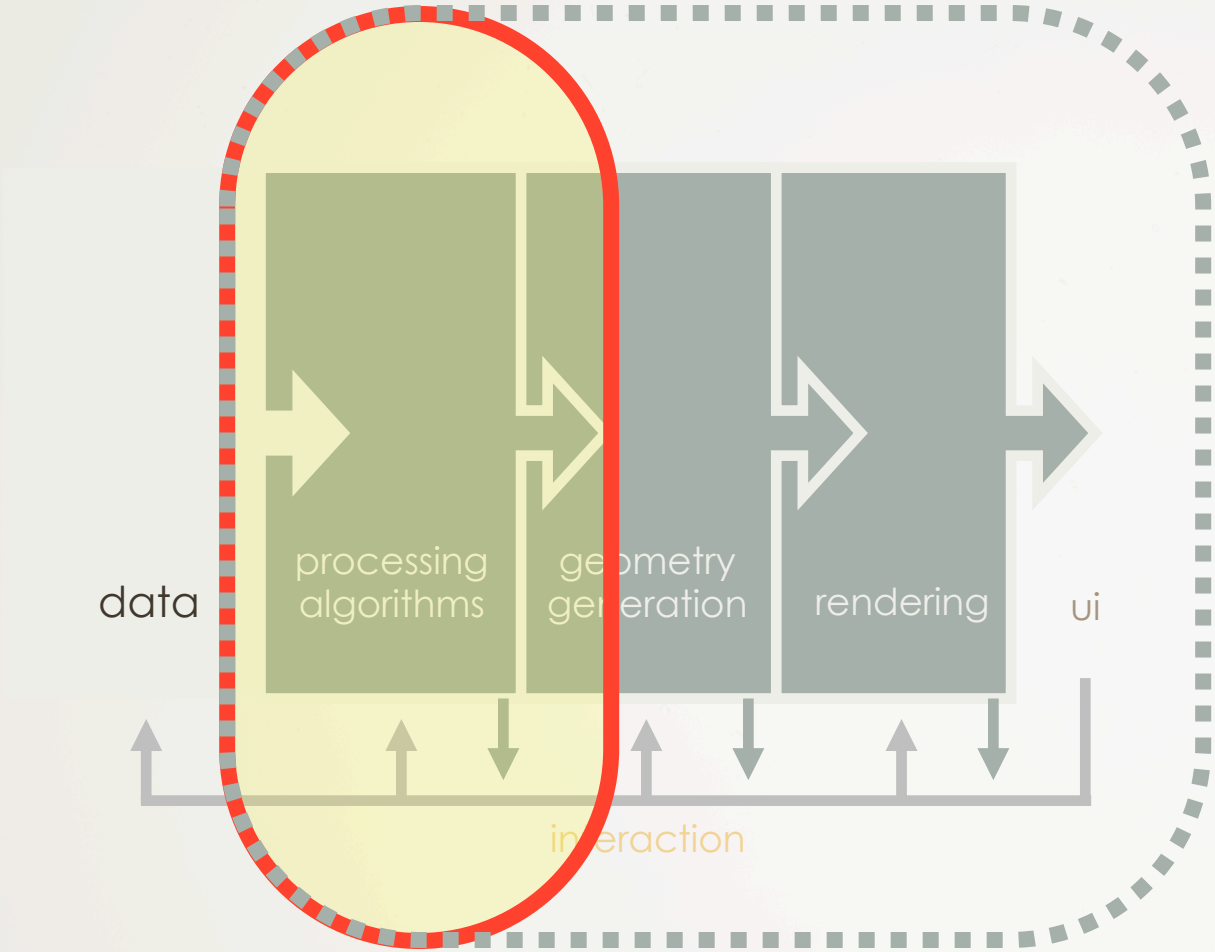


CENTER FOR DATA-DRIVEN DISCOVERY



CENTER FOR DATA-DRIVEN DISCOVERY

"THE" VISUALIZATION TOOLKIT



- VTK
  - c/c++
  - tcl/tk
  - python
  - java
- R

THE VISUALIZATION TOOLKIT

g.e. medical viz algorithms

- ☞ KITWARE

collection of *filters*

- MARCHING CUBES *(patented.. 1987-2005)*

educational

- ☞ VTK book

evolved/extended

- *object oriented*
- C++
- GL + Tk (UI)
  - now python

vtk.org

kitware.com

vtkpython
PYTHON MODULE

pyvtk
FILE MANIPULATION

visualization algorithms

scalar
vector
tensor
texture
volumetric

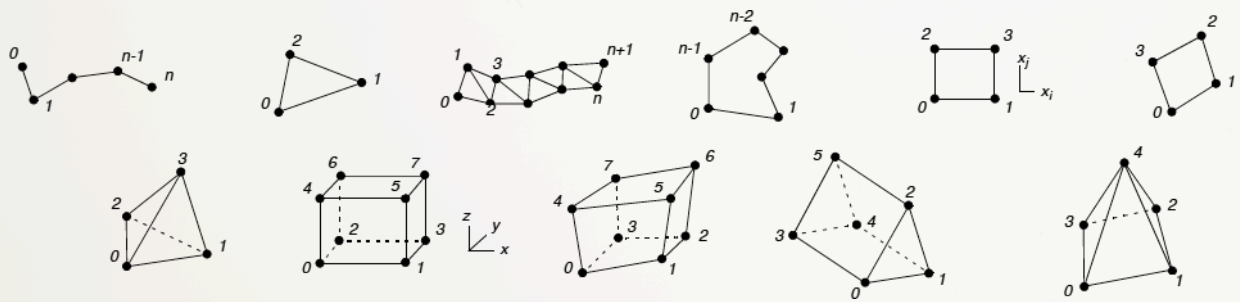
modeling techniques

implicit modeling
polygon reduction
mesh smoothing
cutting
contouring
Delaunay triangulation

imaging algorithms

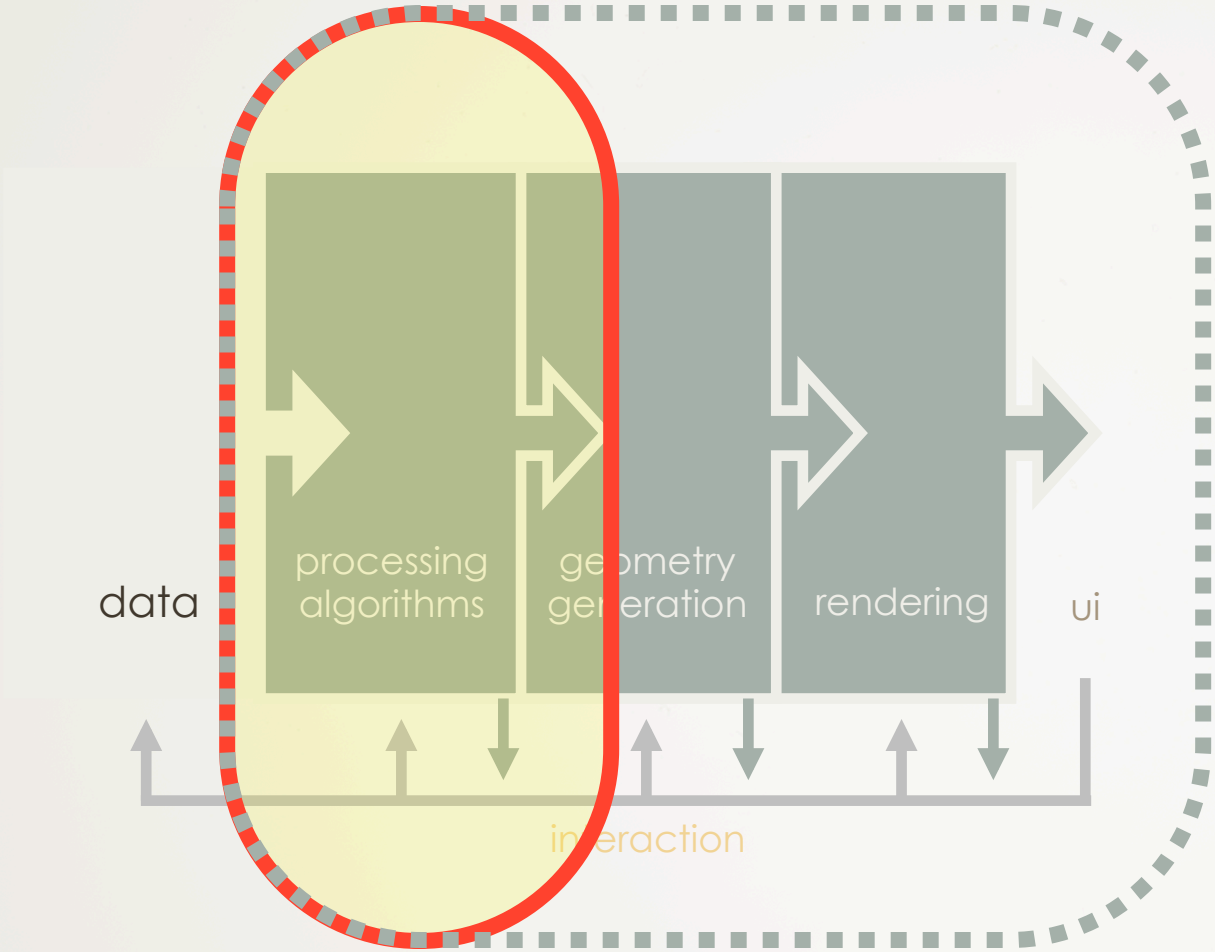
directly integrated
mix 2D imaging/3D graphics

VTK



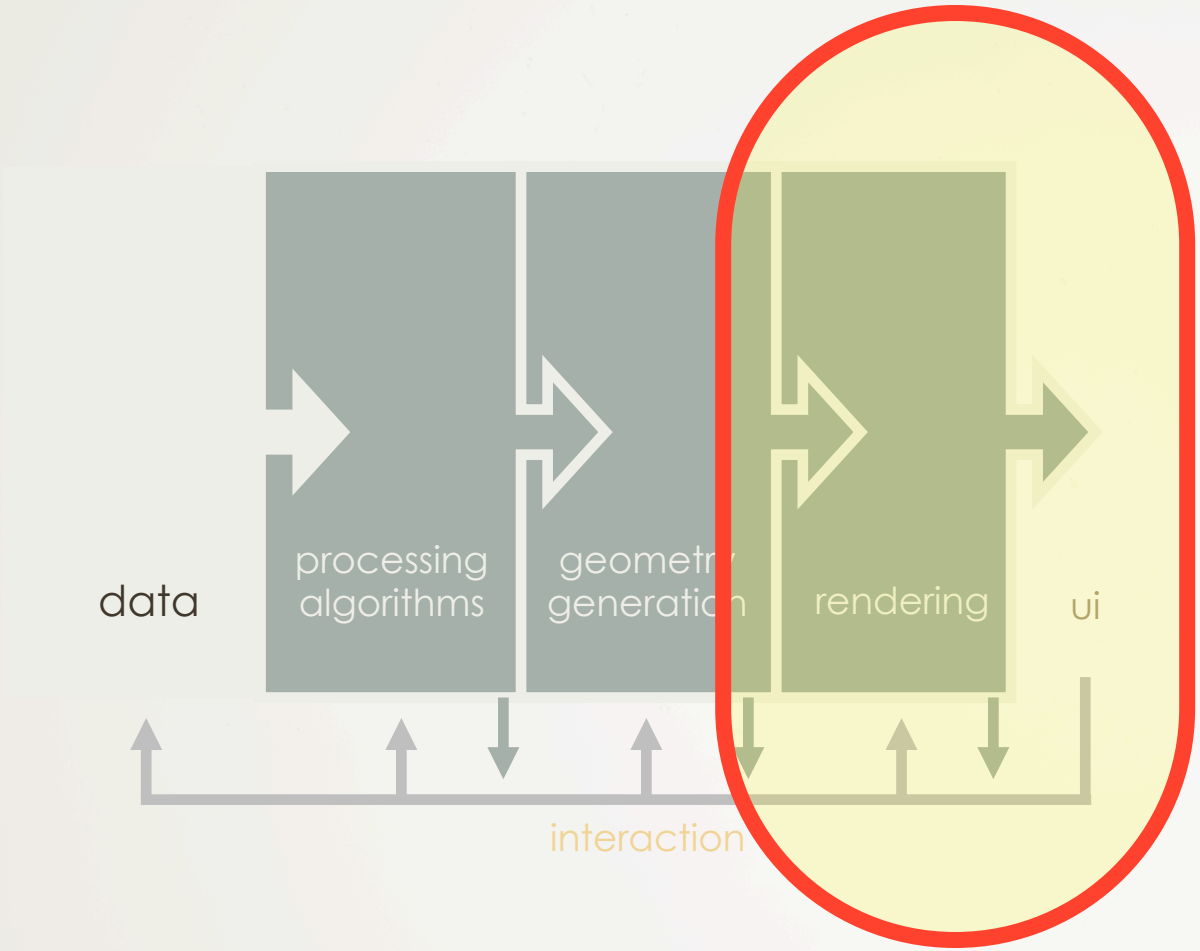
CENTER FOR DATA-DRIVEN DISCOVERY

"THE" VISUALIZATION TOOLKIT



- VTK
  - c/c++
  - tcl/tk
  - python
  - java
- R

INTERACTIVE RENDERERS

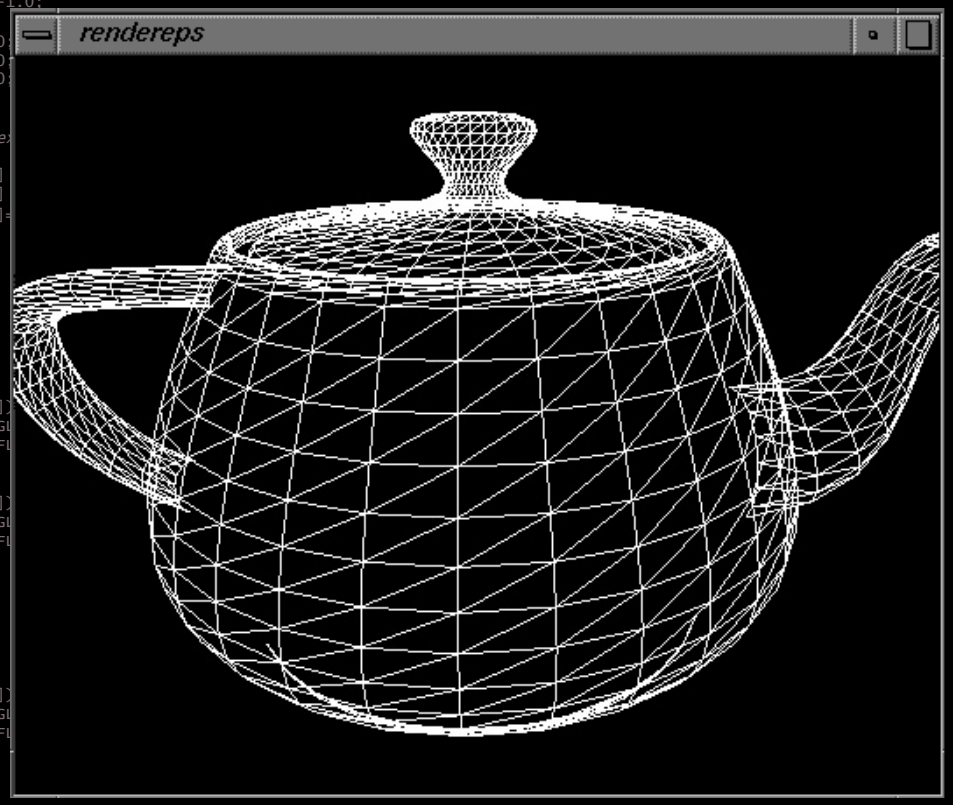


- OpenGL
  HIGHER LEVEL:
- OpenInventor
  - C++/GL
  - COIN
- Java3D
  - Java/GL
- *WebGL*
  - ➔ three.js

mesaGL
direct3D
openGL ES

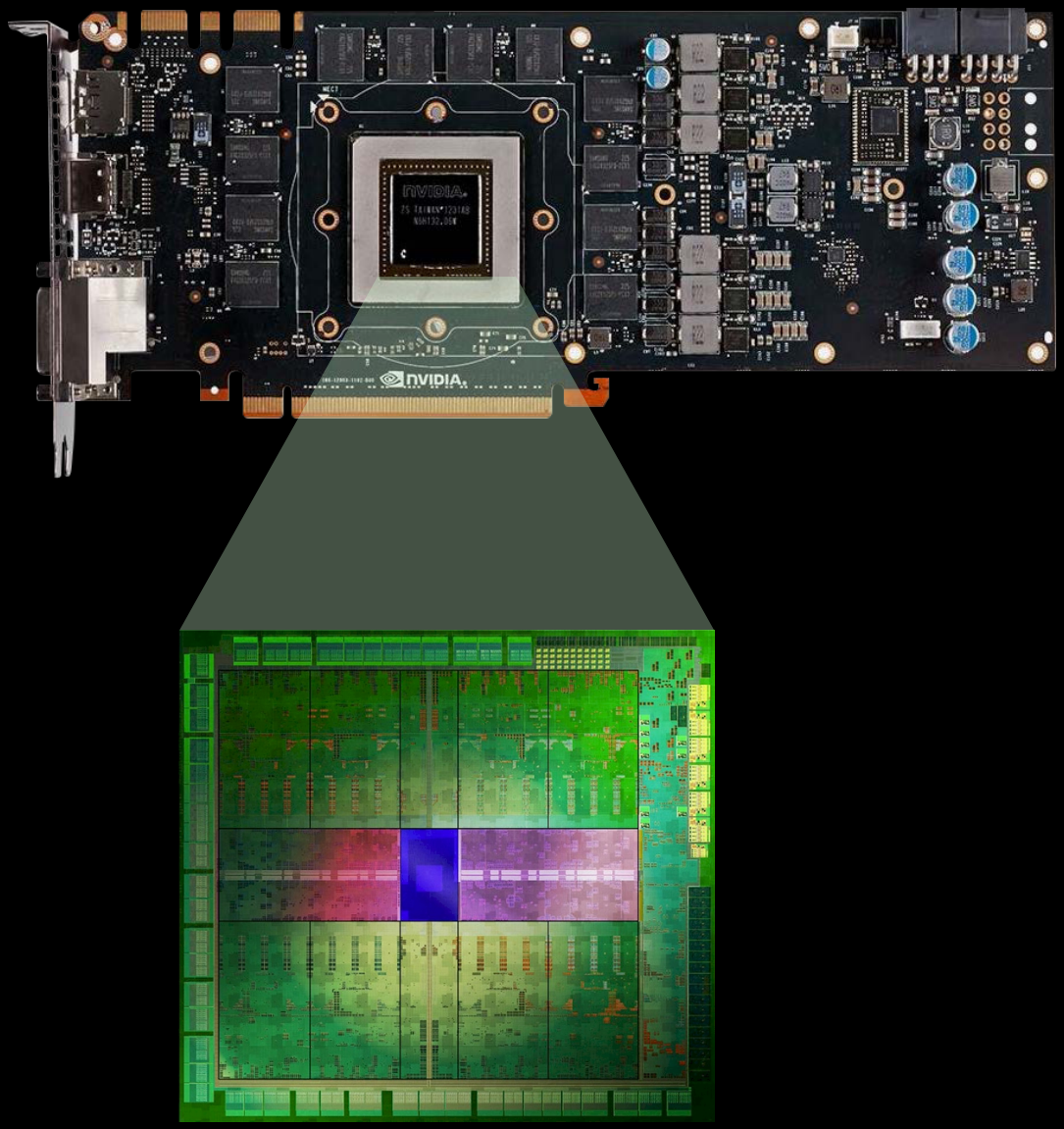
CENTER FOR DATA-DRIVEN DISCOVERY

```
glViewport(0, 0, w, h);



// First simple object
float* vert = new float[9];     // vertex array
float* col  = new float[9];     // color array

vert[0] =-0.3; vert[1] = 0.5; vert[2] =-1.0;
vert[3] =-0.8; vert[4] =-0.5; vert[5] =-1.0;
vert[6] = 0.2; vert[7] =-0.5; vert[8]= -1.0;

col[0] = 1.0; col[1] = 0.0; col[2] = 0.0;
col[3] = 0.0; col[4] = 1.0; col[5] = 0.0;
col[6] = 0.0; col[7] = 0.0; col[8] = 1.0;

// Second simple object
float* vert2 = new float[9];    // vertex

vert2[0] =-0.2; vert2[1] = 0.5; vert2[2]
vert2[3] = 0.3; vert2[4] =-0.5; vert2[5]
vert2[6] = 0.8; vert2[7] = 0.5; vert2[8]=

// Two VAOs allocation
glGenVertexArrays(2, &m_vaoID[0]);

// First VAO setup
glBindVertexArray(m_vaoID[0]);

glGenBuffers(2, m_vboID);

glBindBuffer(GL_ARRAY_BUFFER, m_vboID[0])
glBufferData(GL_ARRAY_BUFFER, 9*sizeof(GL
glVertexAttribPointer((GLuint)0, 3, GL_FL
glEnableVertexAttribArray(0);

glBindBuffer(GL_ARRAY_BUFFER, m_vboID[1])
glBufferData(GL_ARRAY_BUFFER, 9*sizeof(GL
glVertexAttribPointer((GLuint)1, 3, GL_FL
glEnableVertexAttribArray(1);

// Second VAO setup
glBindVertexArray(m_vaoID[1]);

glGenBuffers(1, &m_vboID[2]);

glBindBuffer(GL_ARRAY_BUFFER, m_vboID[2])
glBufferData(GL_ARRAY_BUFFER, 9*sizeof(GL
glVertexAttribPointer((GLuint)0, 3, GL_FL
glEnableVertexAttribArray(0);

glBindVertexArray(0);
```

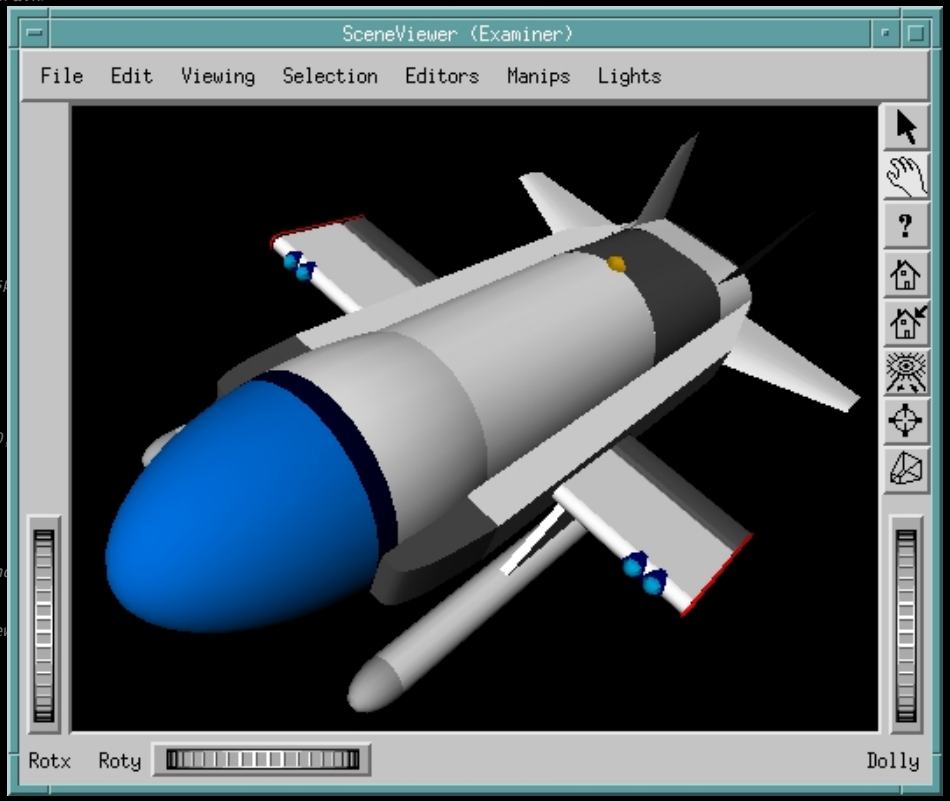


OPENGL/GLUT

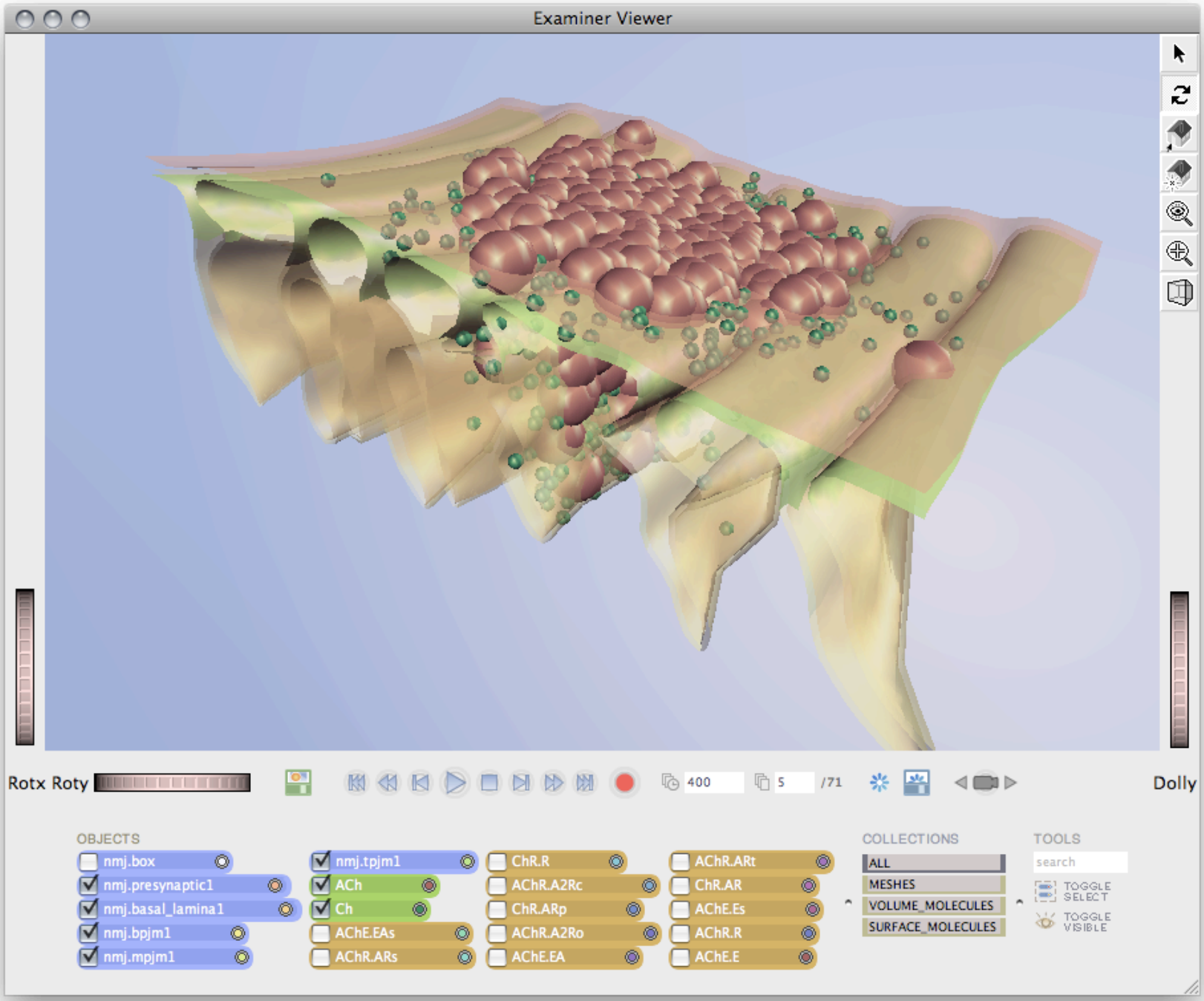
```
glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT);

glBindVertexArray(m_vaoID[0]);          // select first VAO
glDrawArrays(GL_TRIANGLES, 0, 3);       // draw first object

glBindVertexArray(m_vaoID[1]);          // select second VAO
glVertexAttrib3f((GLuint)1, 1.0, 0.0, 0.0); // set constant color attribute
glDrawArrays(GL_TRIANGLES, 0, 3);       // draw second object

glBindVertexArray(0);

SwapBuffers(pDC->m_hDC);
```


NVIDIA
NVIDIA

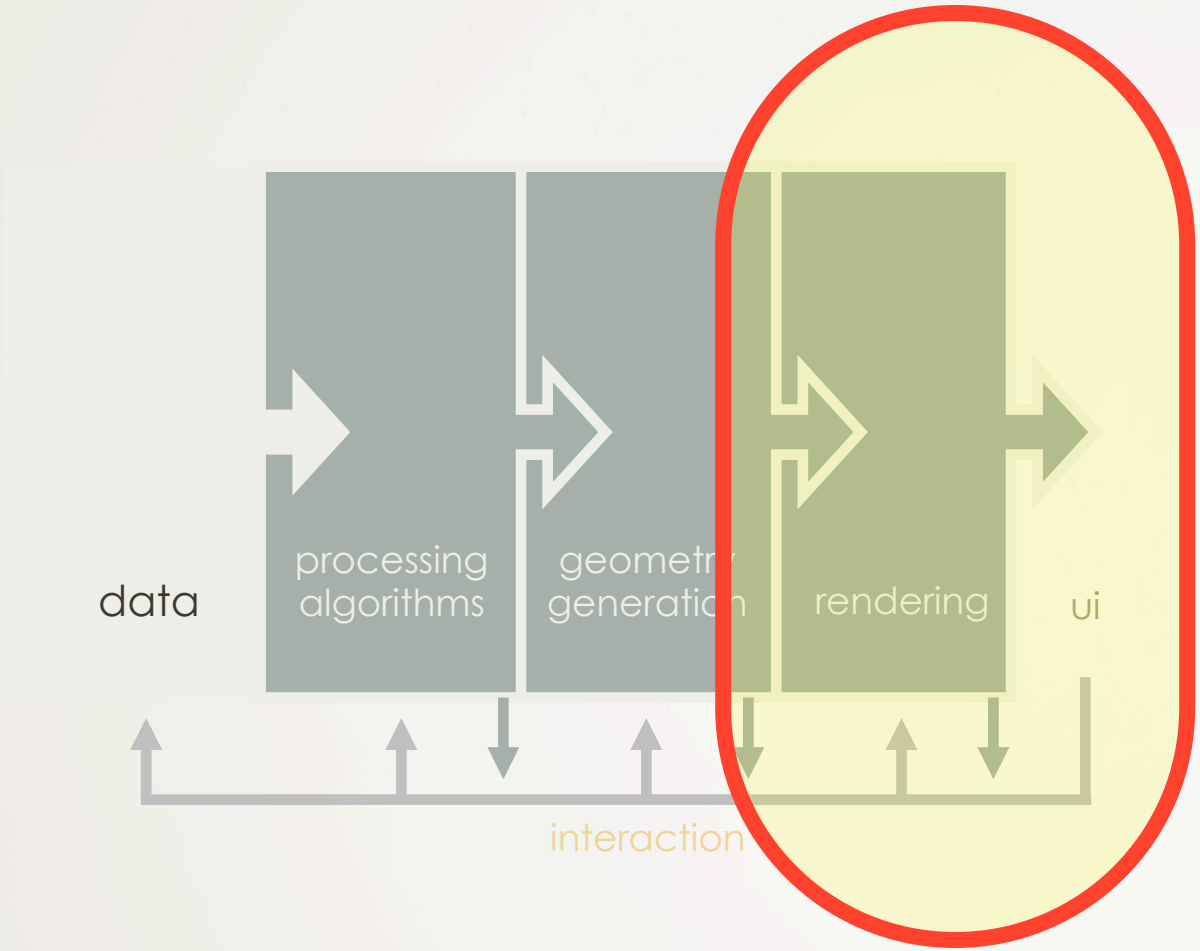
```
#include <Inventor/Qt/SoQt.h>
#include <Inventor/Qt/SoQtRenderArea.h>
#include <Inventor/nodes/SoCone.h>
#include <Inventor/nodes/SoDirectionalLight.h>
#include <Inventor/nodes/SoMaterial.h>
#include <Inventor/nodes/SoPerspectiveCamera.h>
#include <Inventor/nodes/SoSeparator.h>


int main(int , char **argv)
{
  // init Inventor
  QWidget *window = SoQt::init(argv[0]);
  if (window == NULL) exit(1);

  // create sceme root
  SoSeparator *root = new SoSeparator;
  root->ref();

  // create camera
  SoPerspectiveCamera *camera = new SoPers
  root->addChild(camera);

  // light
  root->addChild(new SoDirectionalLight);

  // material
  SoMaterial *material = new SoMaterial;
  material->diffuseColor.setValue(1.0, 0.0
  root->addChild(material);

  // cone
  root->addChild(new SoCone);

  // create window
  SoQtRenderArea *renderArea = new SoQtRen

  // set up camera
  camera->viewAll(root, renderArea->getVie

  // set up rendering window
  renderArea->setSceneGraph(root);
  renderArea->setTitle("Hello Cone");
  renderArea->show();

  // show window and enter main loop
  SoQt::show(window);
  SoQt::mainLoop();

  // release memory
  delete renderArea;
  root->unref();

  return 0;
}
```



OPEN INVENTOR


Examiner Viewer
Rotx Roty
400
5
/71
Dolly
OBJECTS
nmj.box
nmj.presynaptic1
nmj.basal_lamina1
nmj.bpjm1
nmj.mpjm1
nmj.tpjm1
ACh
Ch
AChE.EAs
AChR.ARs
ChR.R
AChR.A2Rc
ChR.ARp
AChR.A2Ro
AChE.EA
AChR.ARt
ChR.AR
AChE.Es
AChR.R
AChE.E
COLLECTIONS
ALL
MESHES
VOLUME_MOLECULES
SURFACE_MOLECULES
TOOLS
search
TOGGLE SELECT
TOGGLE VISIBLE

INTERACTIVE RENDERERS

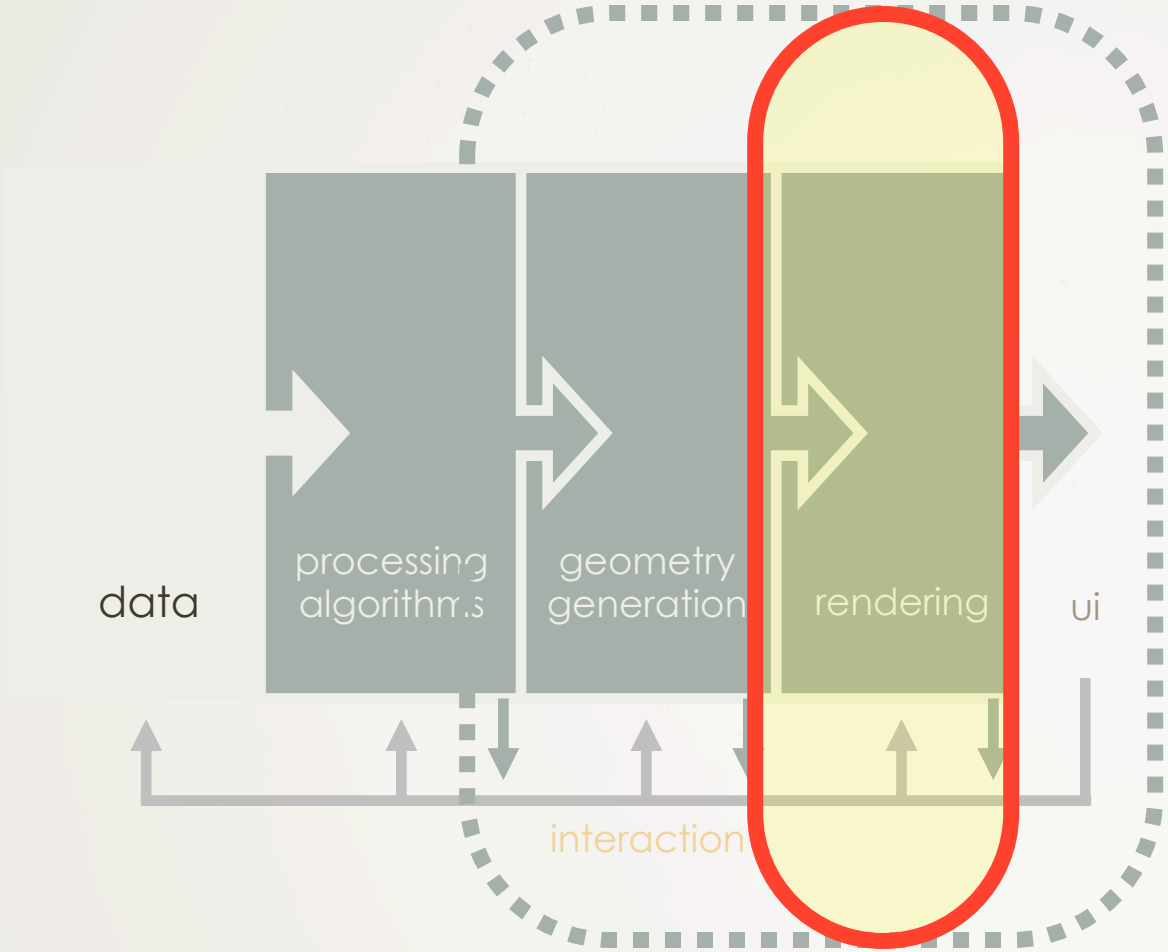


- OpenGL
  HIGHER LEVEL:
- OpenInventor
  - C++/GL
  - COIN
- Java3D
  - Java/GL
- *WebGL*
  - ➔ three.js

mesaGL
direct3D
openGL ES

CENTER FOR DATA-DRIVEN DISCOVERY

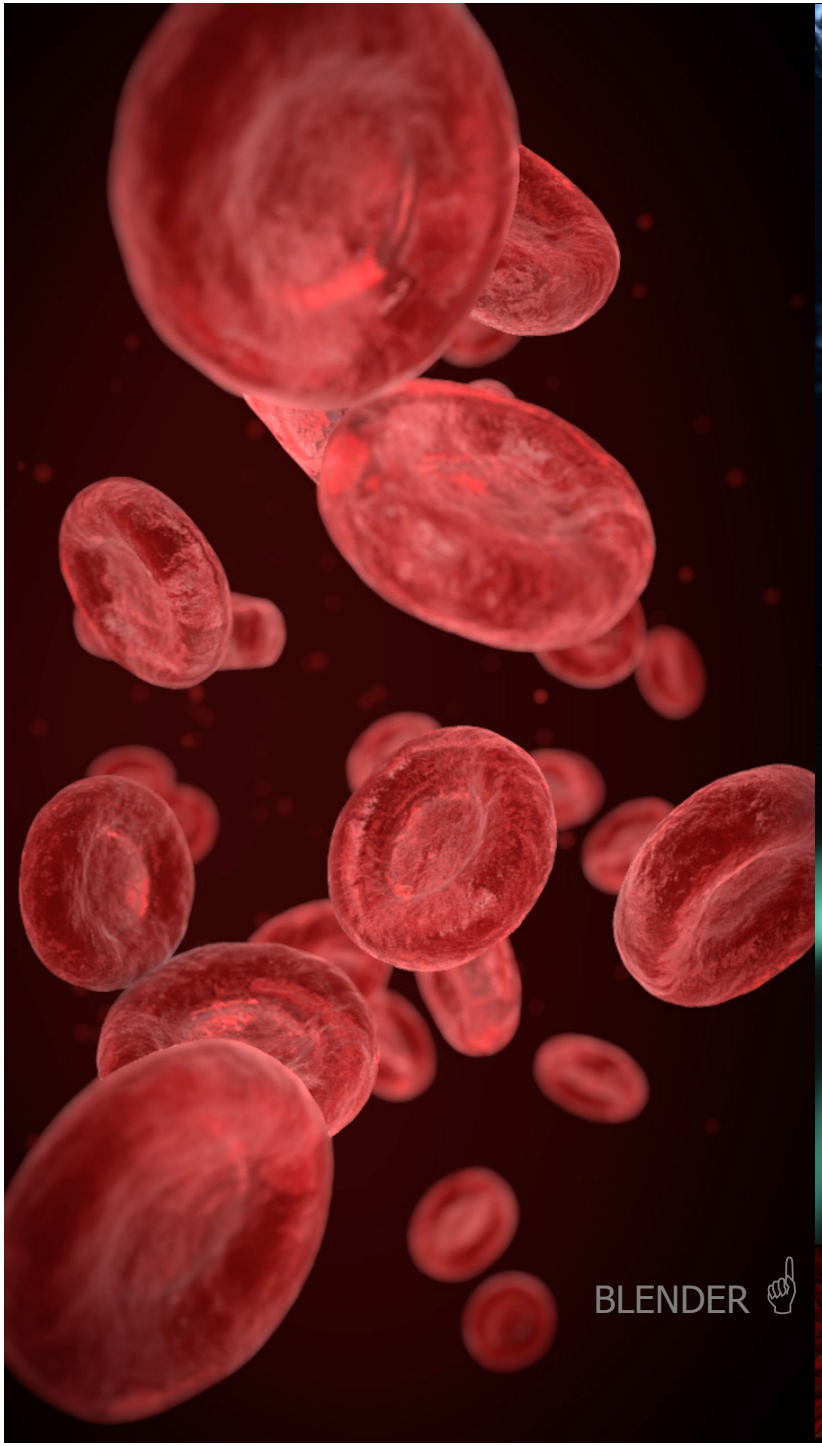
RAY TRACERS

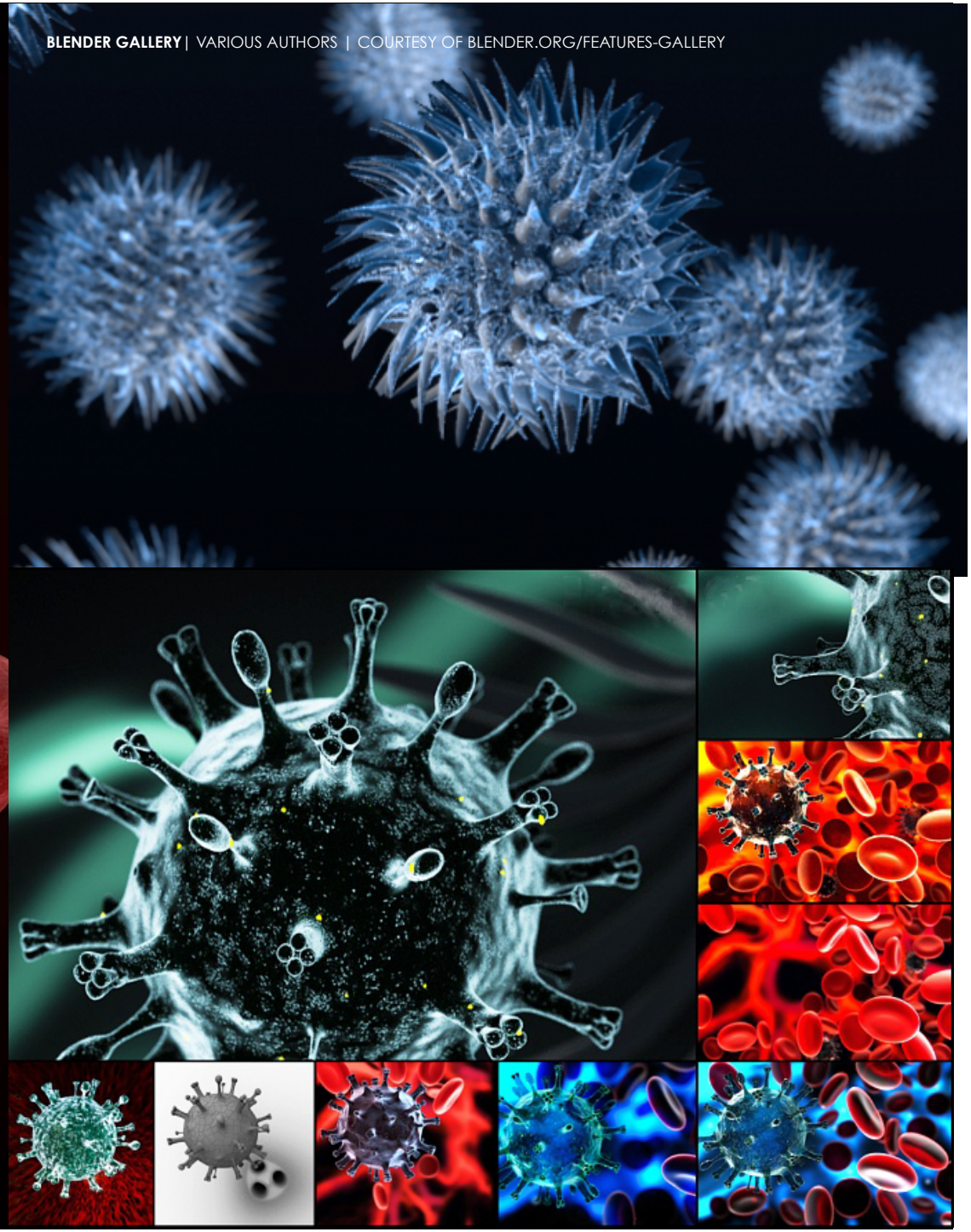


- POVRay
- RenderMan$$

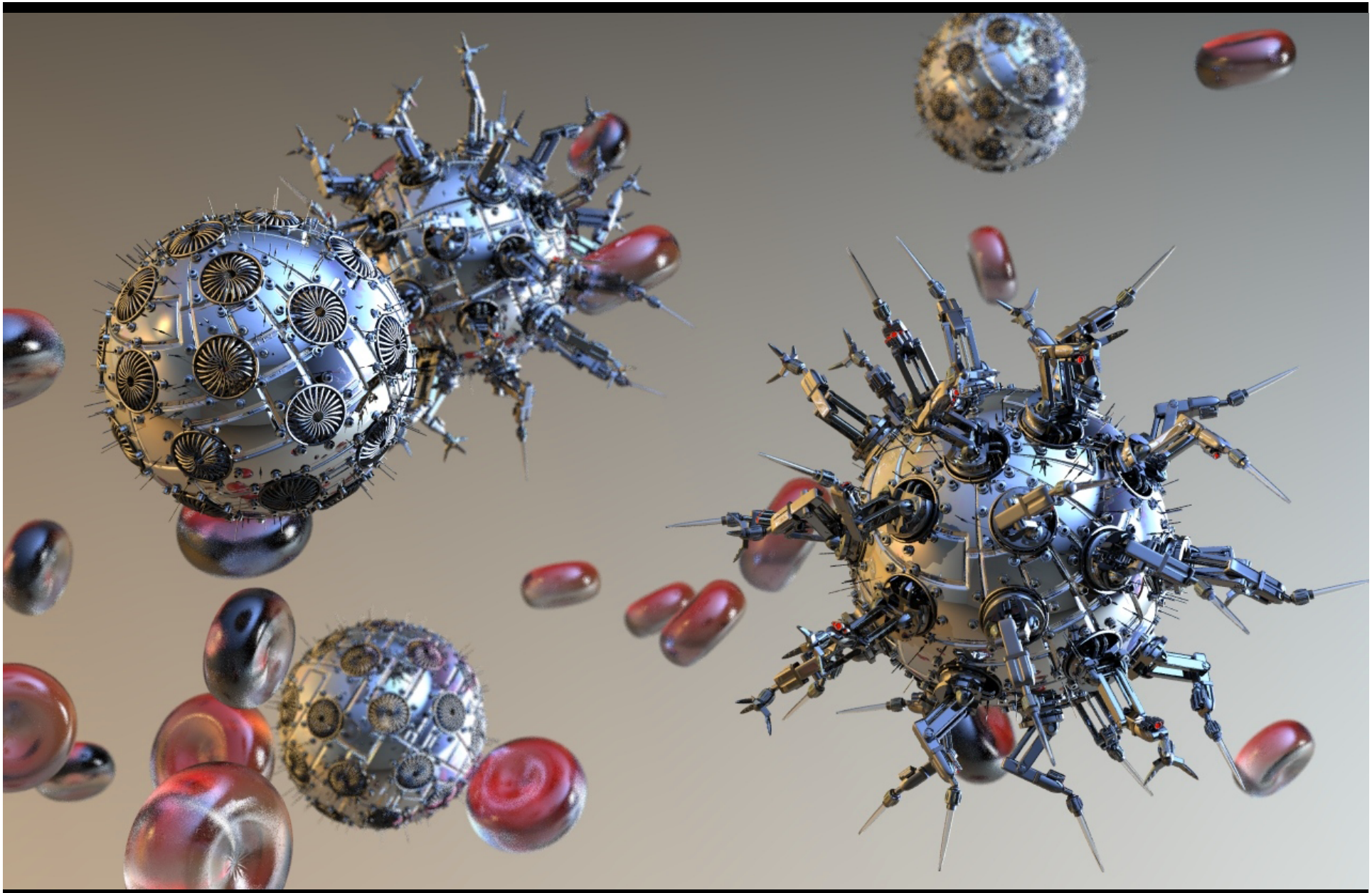
MODELLERS:

- Blender
- Maya$$



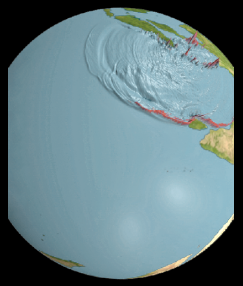


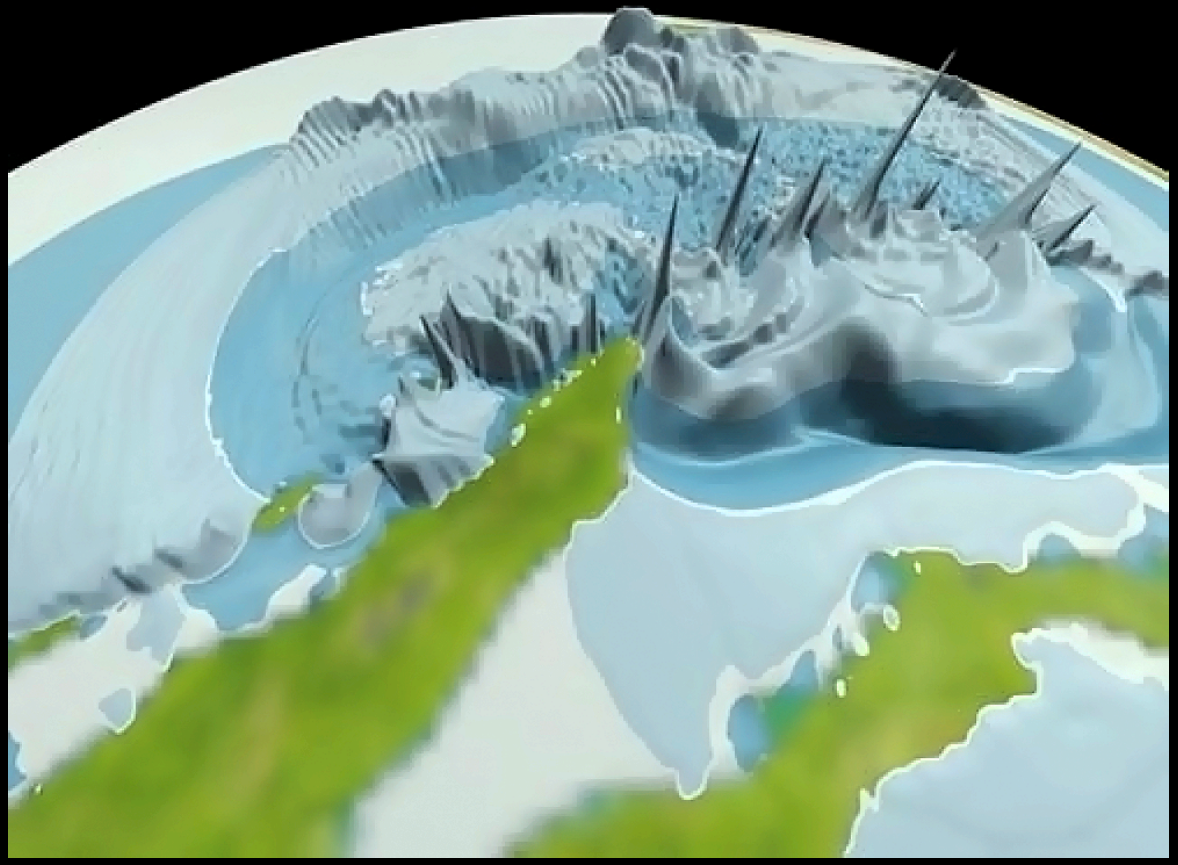
BLENDER GALLERY | VARIOUS AUTHORS | COURTESY OF BLENDER.ORG/FEATURES-GALLERY



POV-RAY GALLERY | NEWT | 2005 | COURTESY OF HOF.POVRAY.ORG

POVRAY

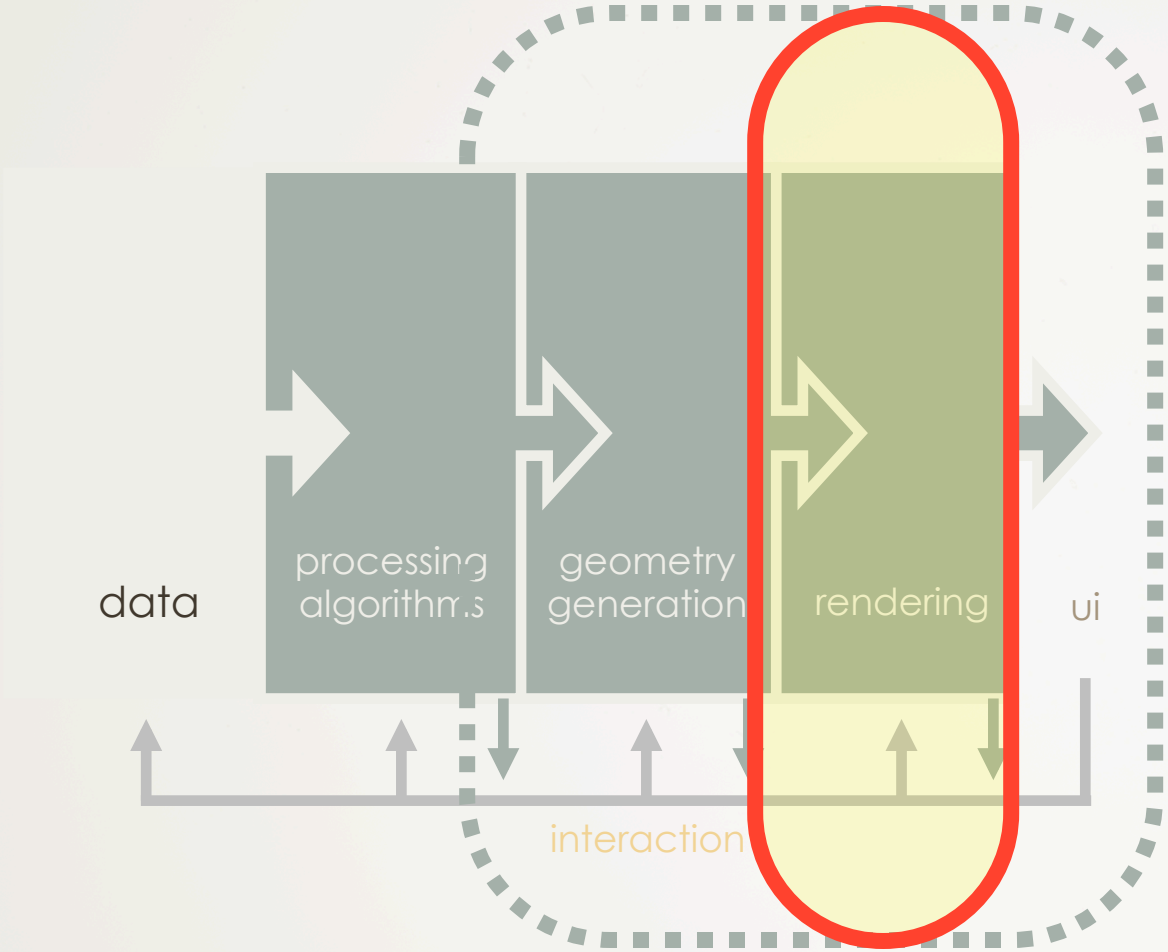




TSUNAMI RESEARCH | ROGER EDBERG | 2005 | COURTESY OF ARCTIC REGION SUPERCOMPUTING CENTER

RENDERMAN

RAY TRACERS

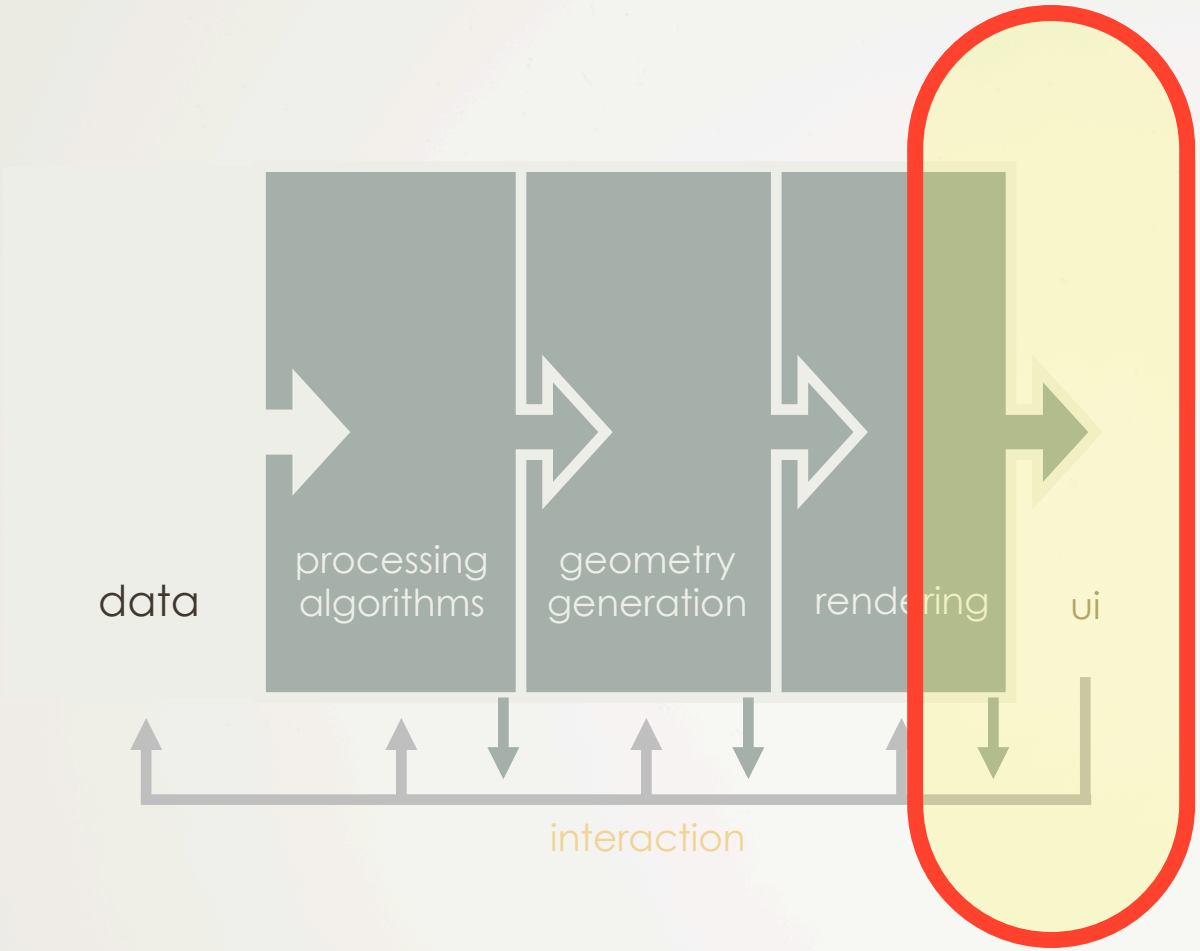


- POVRay
- RenderMan$$

MODELLERS:

- Blender
- Maya$$

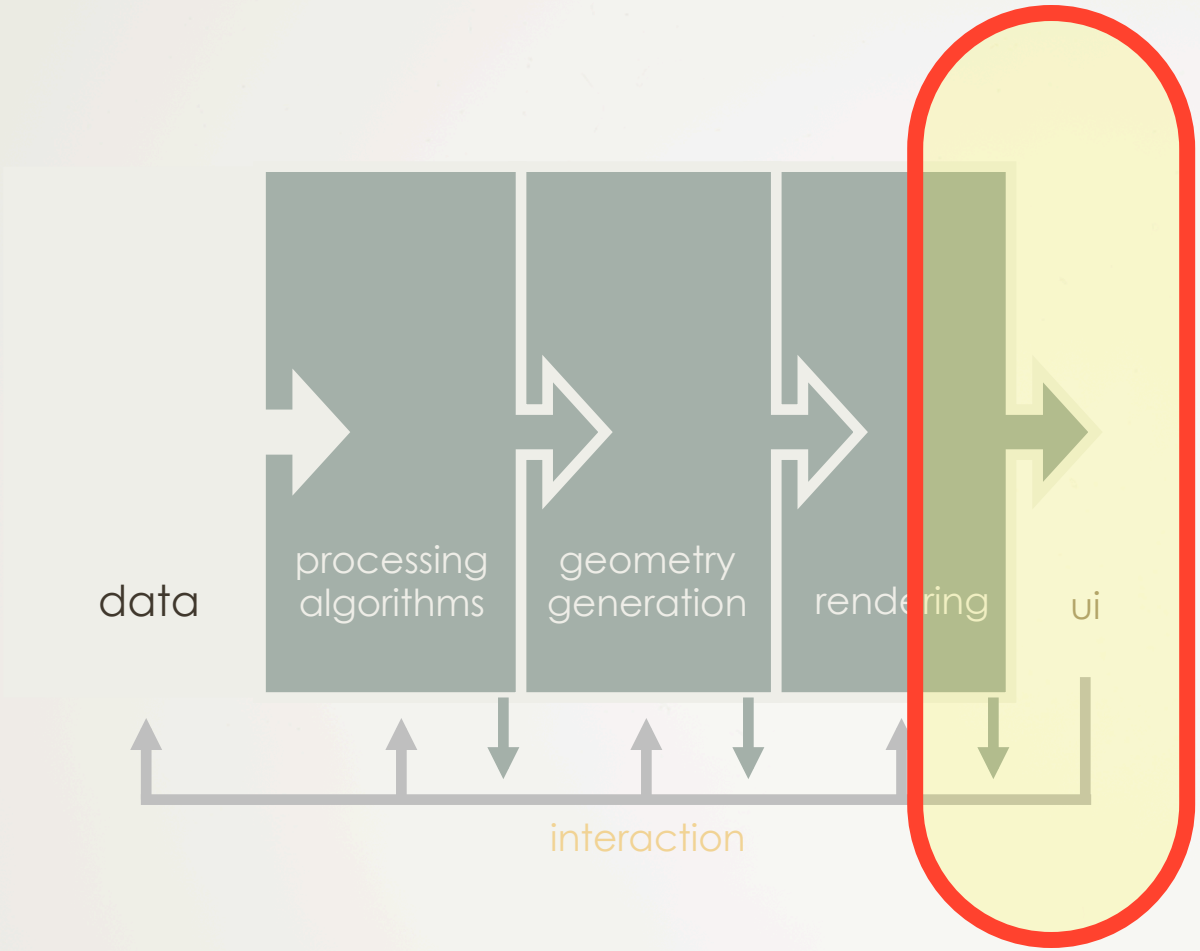
GUI TOOLKITS



- QT
  - python
- GTK+
  - python
- TK (TCL/TK)
- iOS, Android, Java Swing, Cocoa, Motiff..

CENTER FOR DATA-DRIVEN DISCOVERY

WEB BASED UI

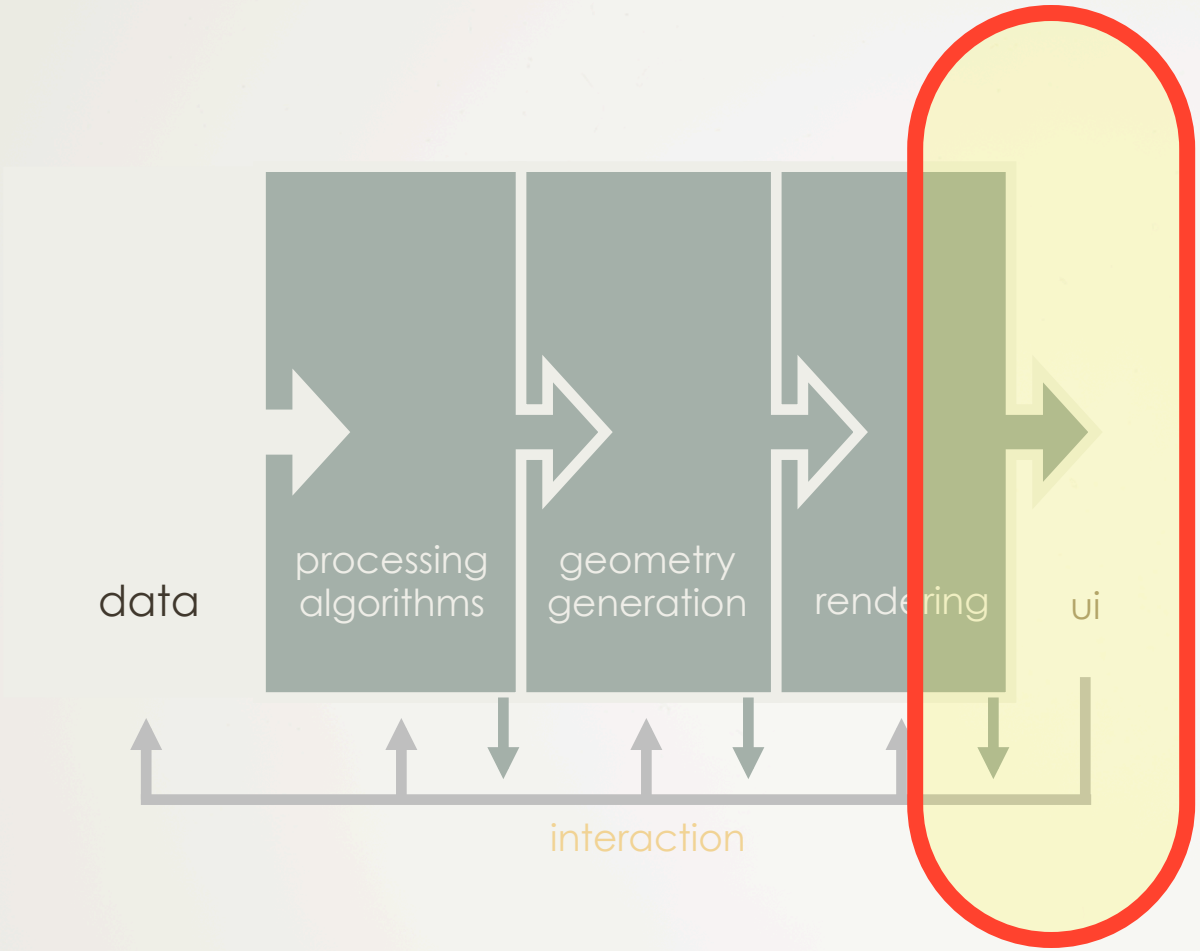


- *d*HTML: HTML5
  + CANVAS/SVG
  JavaScript
  + jQuery
  + jQueryUI
- Processing
  - *Java*
- Flash

MODERN PROGRAMMING LANGUAGES + GRAPHIC ENVIRONMENTS

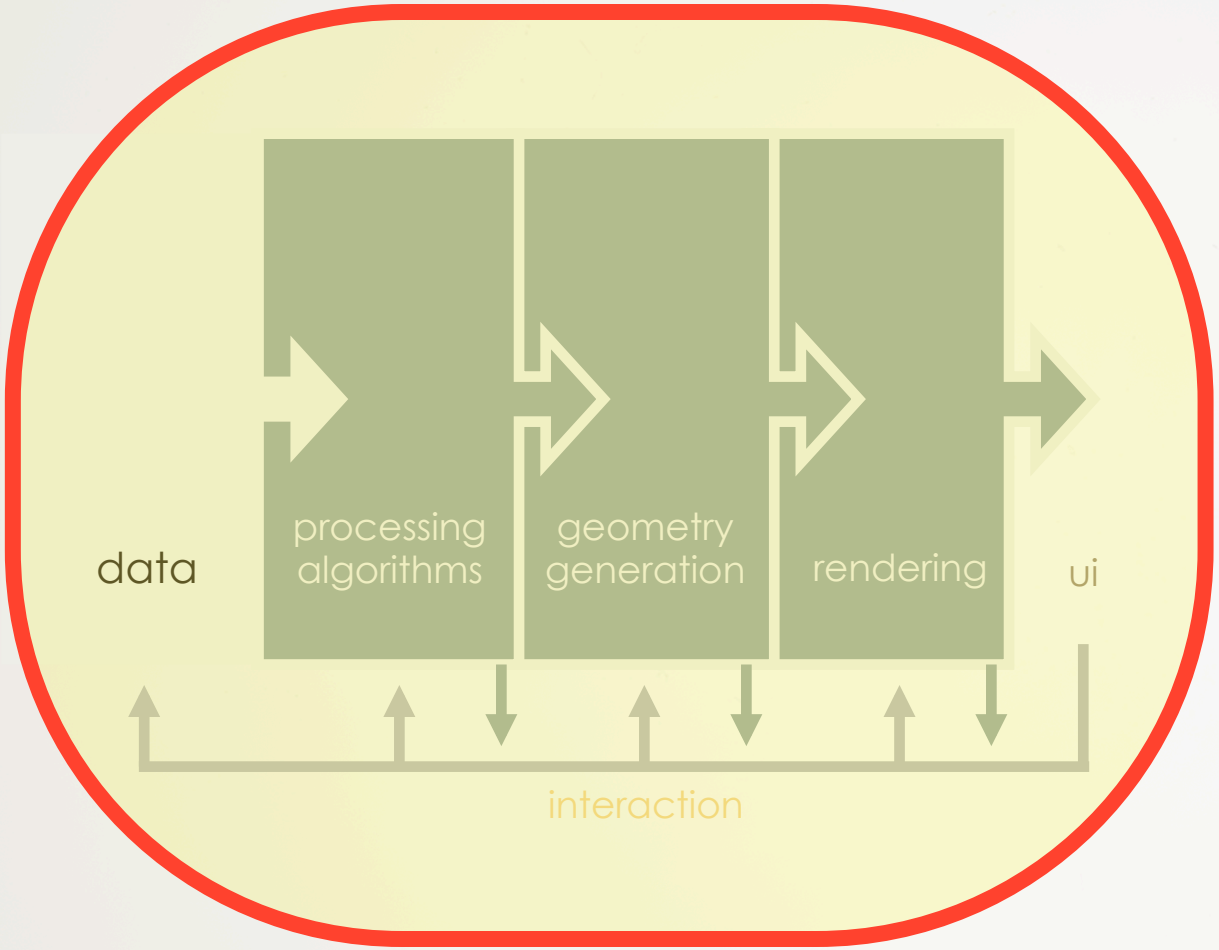
C++	cinder
JAVA	Processing
LUA	Löve (Moai, …)
OBECTIVE-C	Swift
JAVASCRIPT	*D3**
PYTHON	*kyvy?*

WEB BASED UI



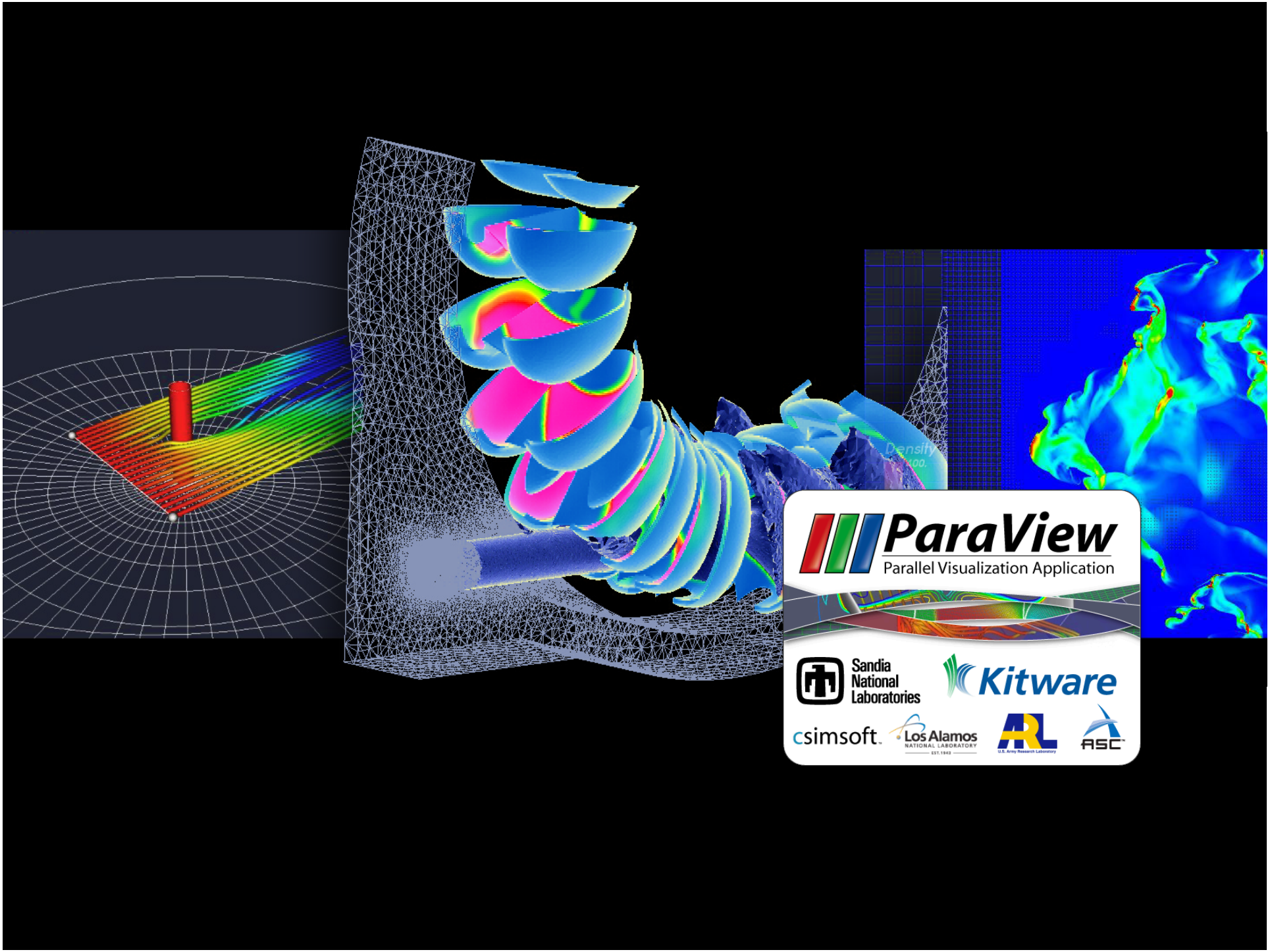
- *d*HTML: HTML5
  + CANVAS/SVG
  JavaScript
  + jQuery
  + jQueryUI
- Processing
  - *Java*
- Flash

VISUALIZATION SYSTEMS



- Paraview[VTK]
- LLNL VisIt[VTK]
- Ensight[$]

- tableau[$]
  - D3[WWW]
- Many Eyes[WWW]
  - *Wiki based*
- Modrian[R], TomCat, Mollegro


ParaView
Parallel Visualization Application
Sandia National Laboratories
Kitware
csimsoft
Los Alamos
ARL
ASC

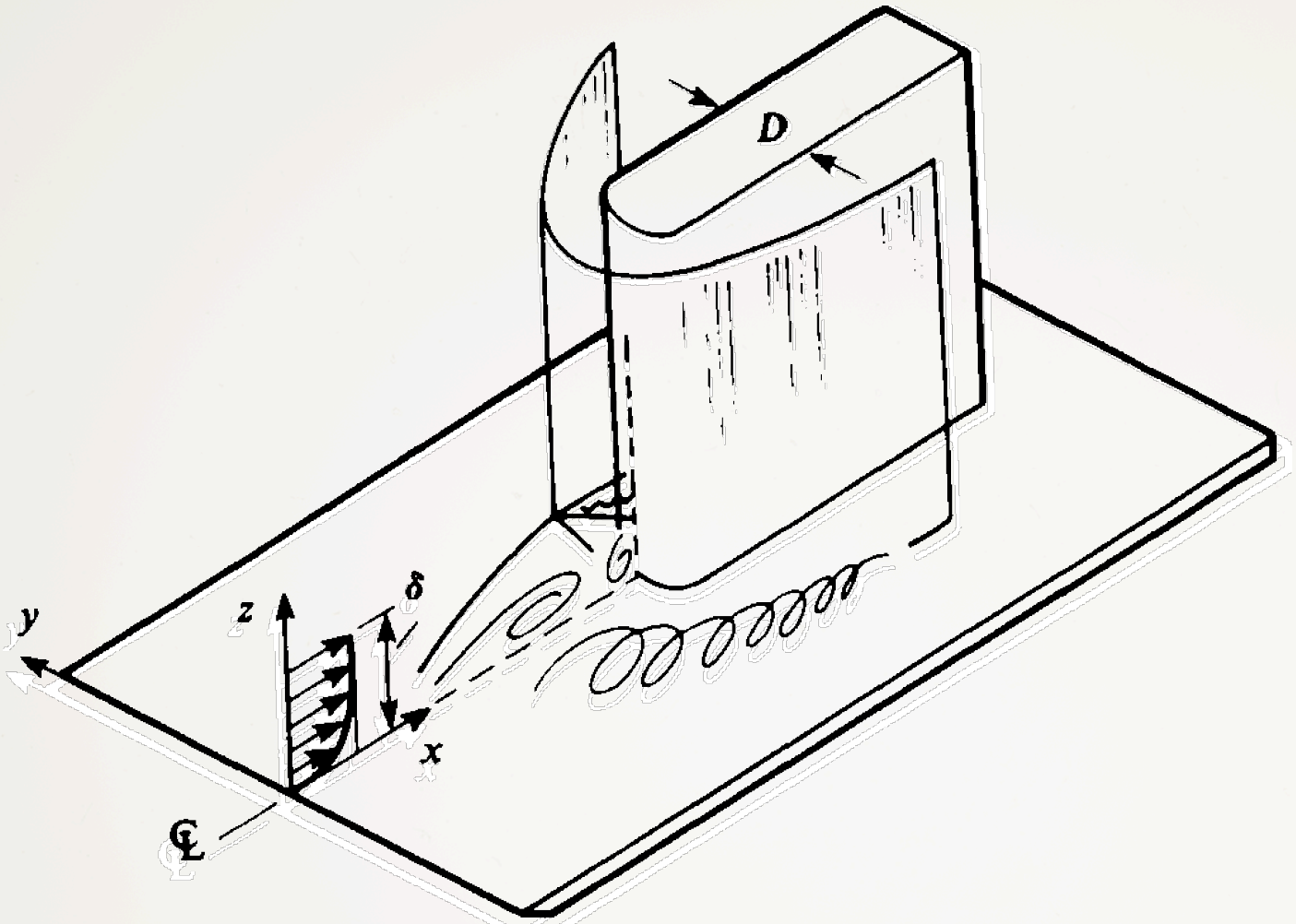


FIGURE 1. Blunt fin on a flat plate.

CENTER FOR DATA-DRIVEN DISCOVERY

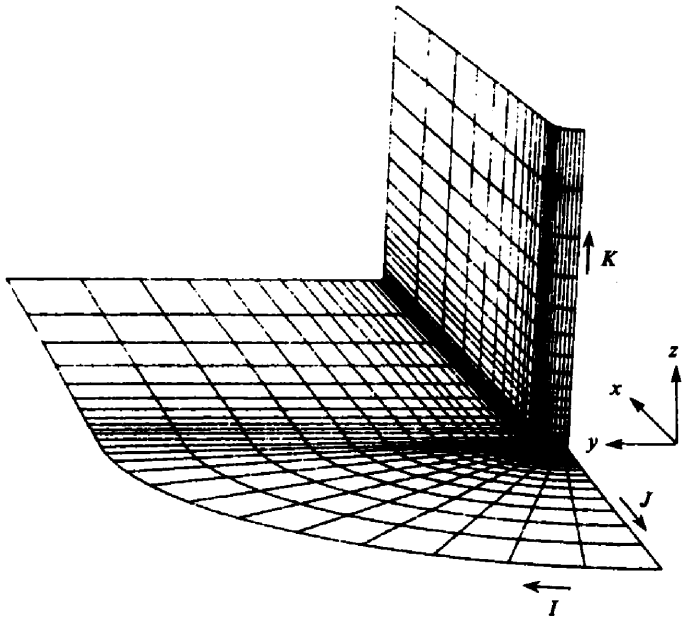


FIGURE 2. Mesh distribution on blunt fin and flat plate.

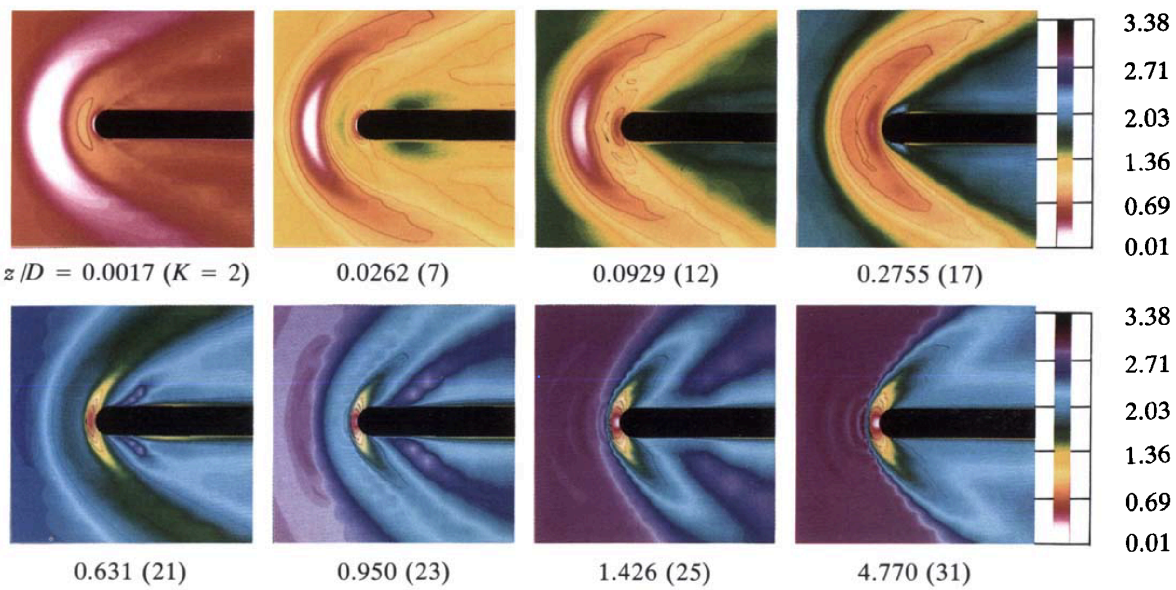
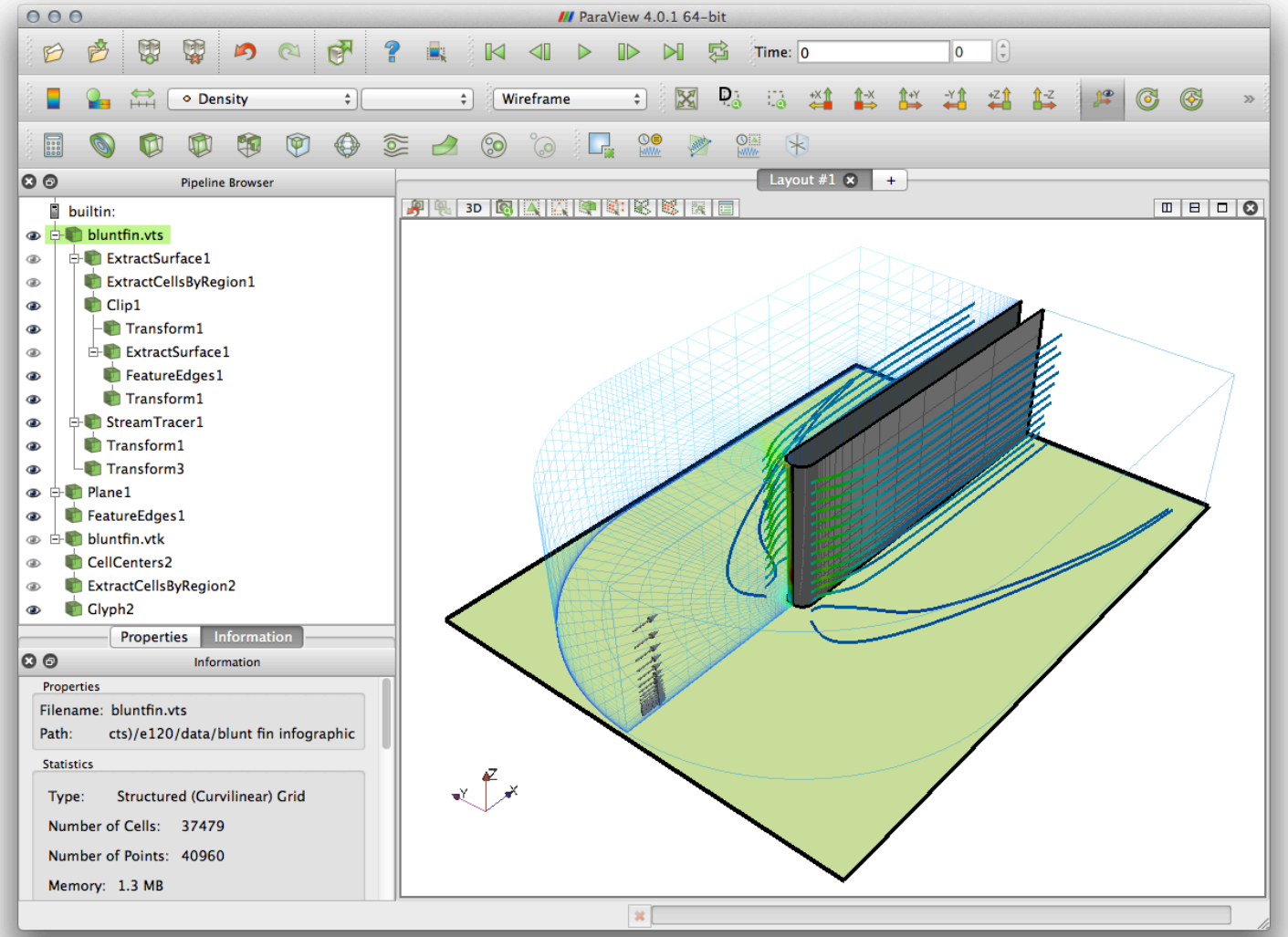
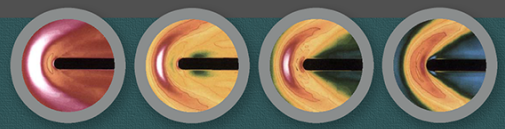
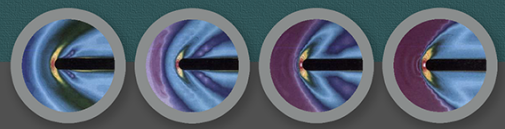


FIGURE 20. Mach number at various z = constant planes.


ParaView 4.0.1 64-bit
Time: 0
Density
Wireframe
Pipeline Browser
builtin:
bluntfin.vts
ExtractSurface1
ExtractCellsByRegion1
Clip1
Transform1
ExtractSurface1
FeatureEdges1
Transform1
StreamTracer1
Transform1
Transform3
Plane1
FeatureEdges1
bluntfin.vtk
CellCenters2
ExtractCellsByRegion2
Glyph2
Properties
Information
Information
Properties
Filename: bluntfin.vts
Path: cts)/e120/data/blunt fin infographic
Statistics
Type: Structured (Curvilinear) Grid
Number of Cells: 37479
Number of Points: 40960
Memory: 1.3 MB
Layout #1
3D



MACH NUMBER AT VARIOUS



CONSTANT (Z=) PLANES

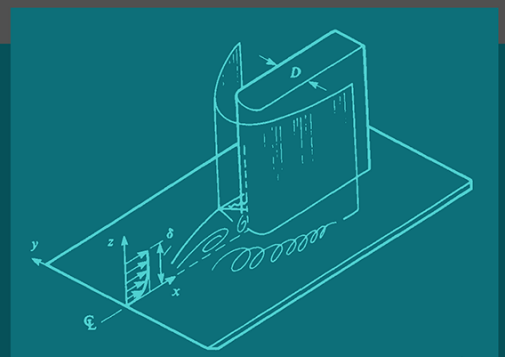
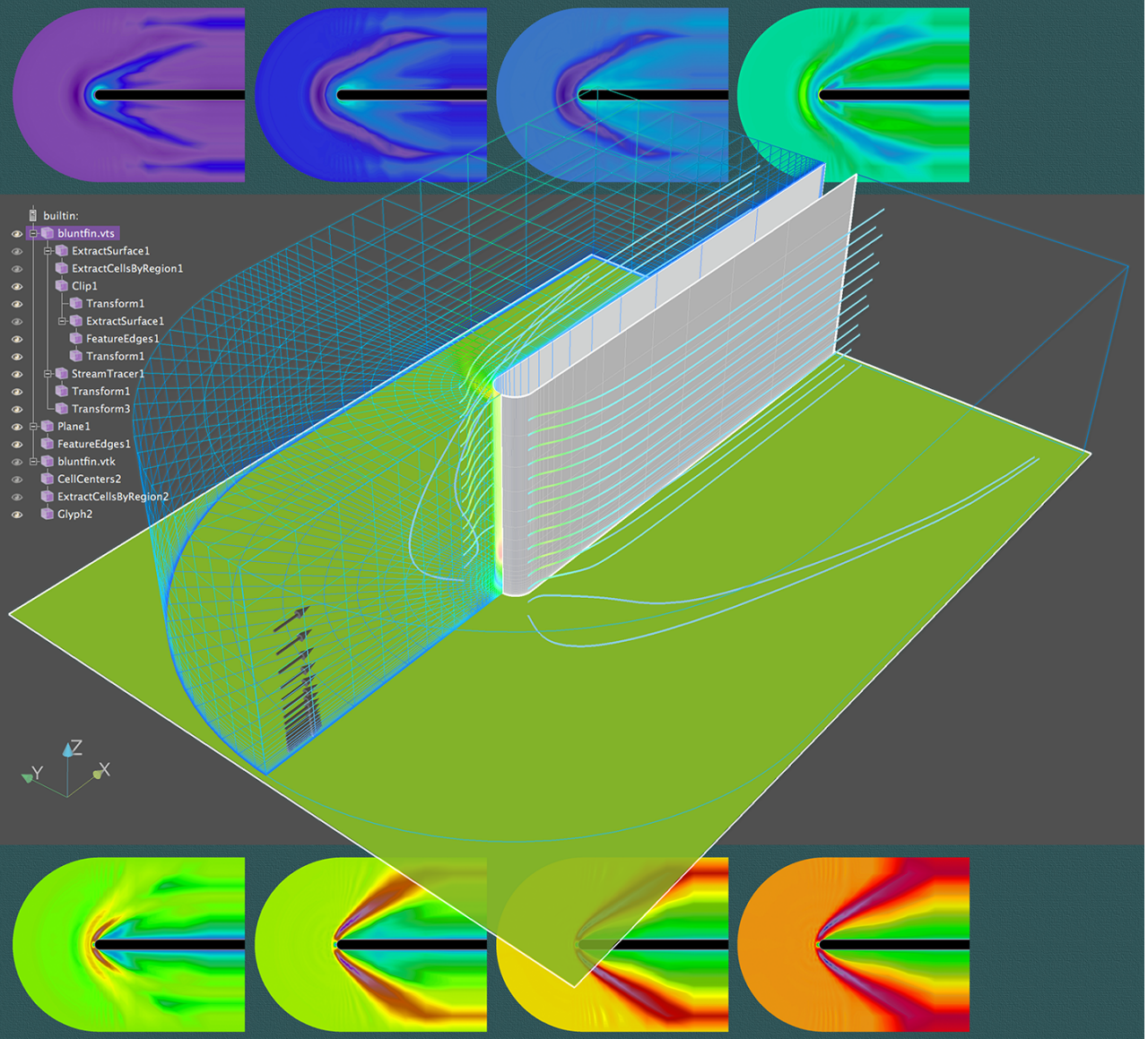


FIGURE 1. Blunt fin on a flat plate.

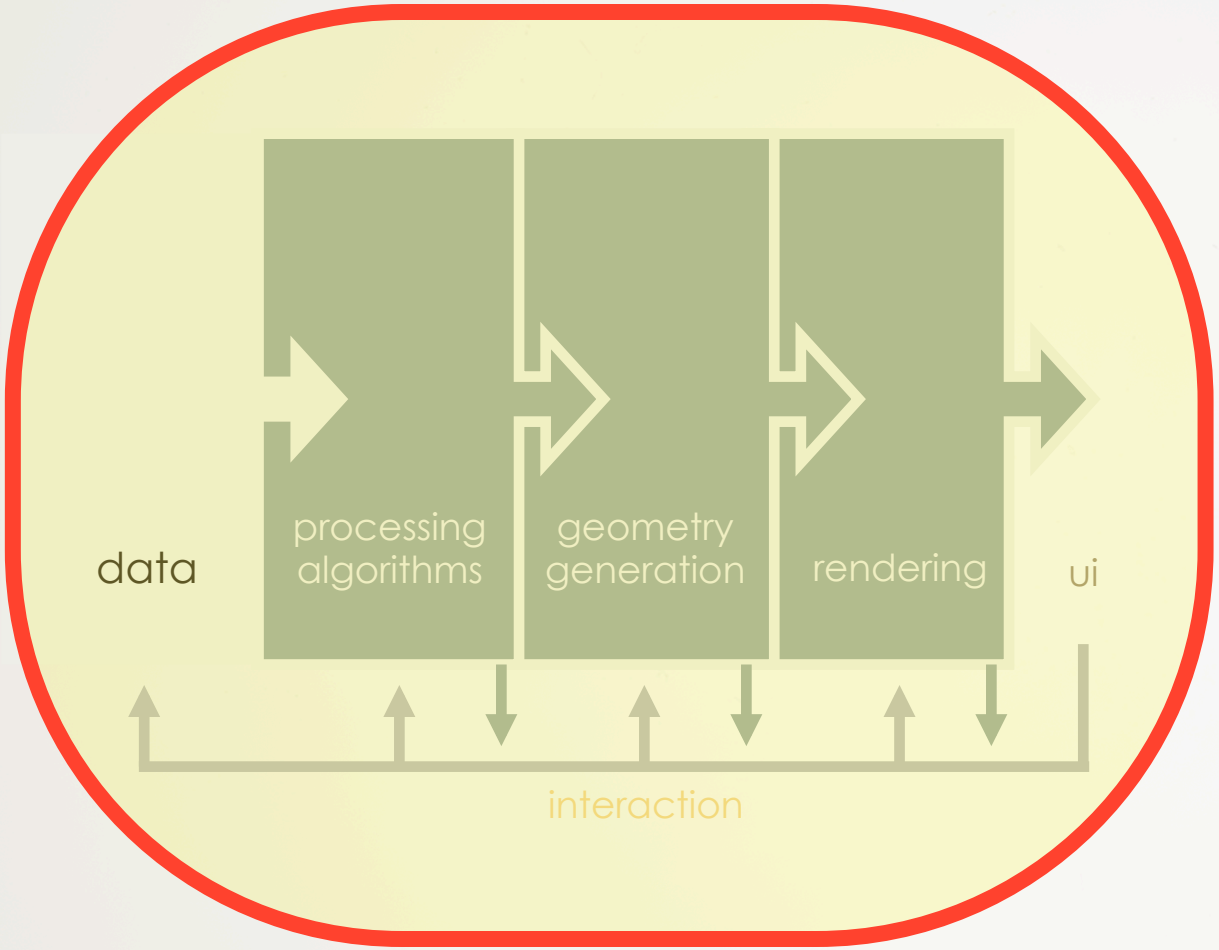
BLUNT-FIN-INDUCED SHOCK-WAVE AND TURBULENT BOUNDARY-LAYER INTERACTION

visualized with

PARAVIEW



VISUALIZATION SYSTEMS



- Paraview[VTK]
- LLNL VisIt[VTK]
- Ensight[$]

- tableau[$]
  - D3[WWW]
- Many Eyes[WWW]
  - *Wiki based*
- Modrian[R], TomCat, Mollegro

INFOVIS PACKAGES

mondrian (*R based*)
rosuda.org/Mondrian

xmdv
davis.wpi.edu/~xmdv

molegro data modeller *(bio)*

topcat *(astro)*

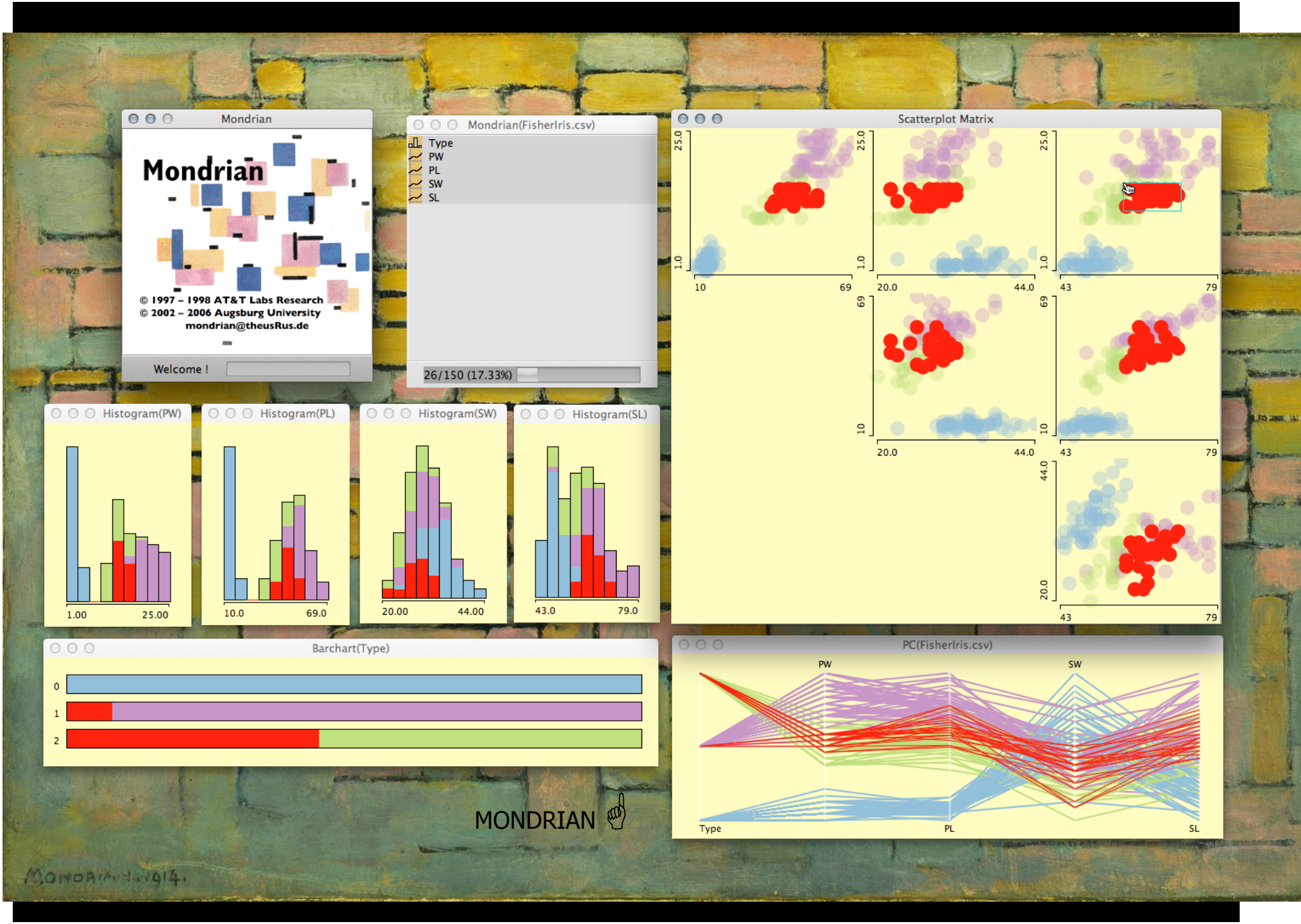
many eyes *(online wiki)*

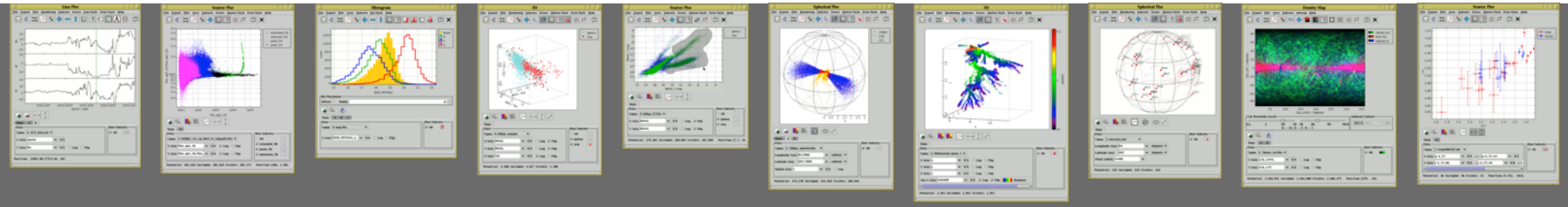
tableau$

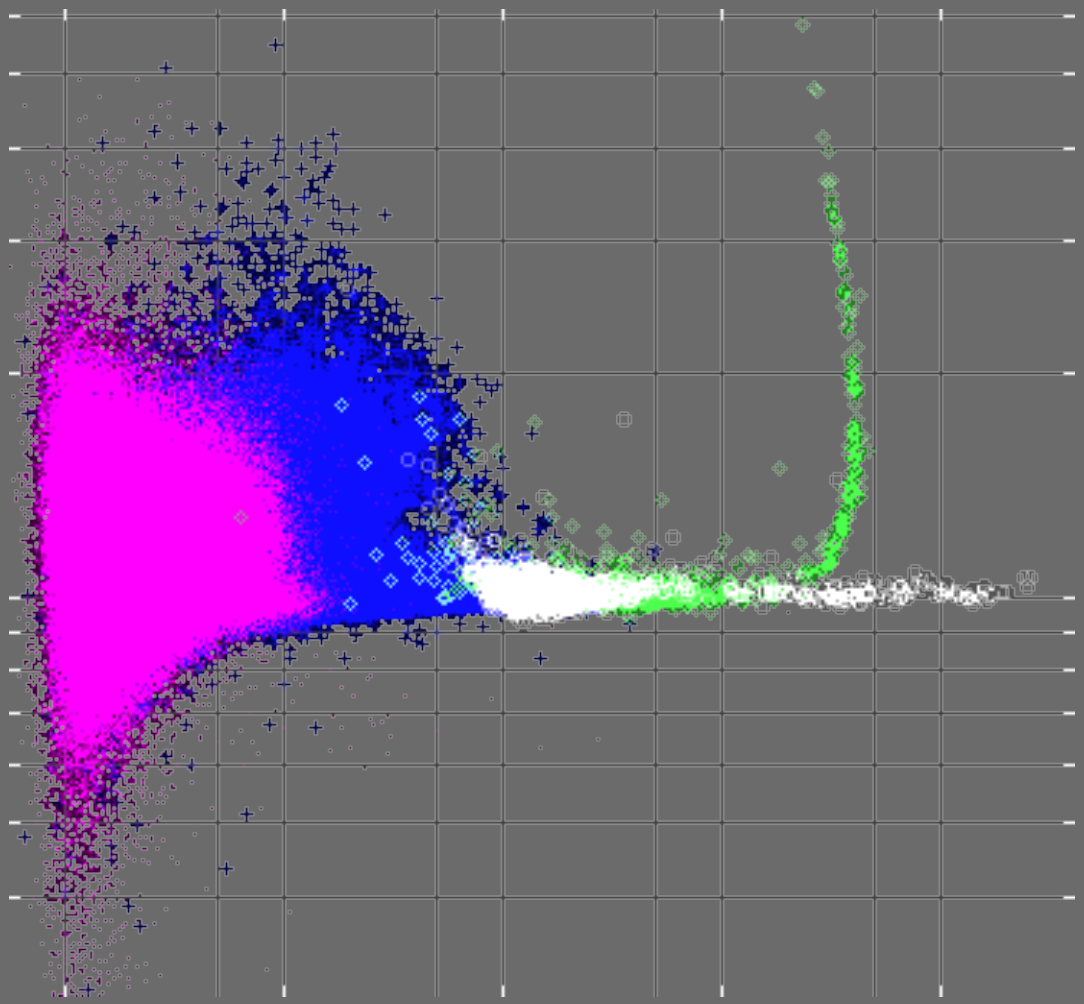
ORIGINS: PROTOVIS/POLARIS +DATACUBES (STANFORD)

OPENSOURCE WEB COUNTERPART: D3.JS

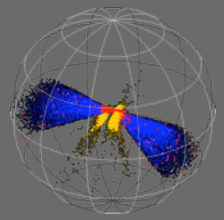
WWW.INFOVIS-WIKI.NET

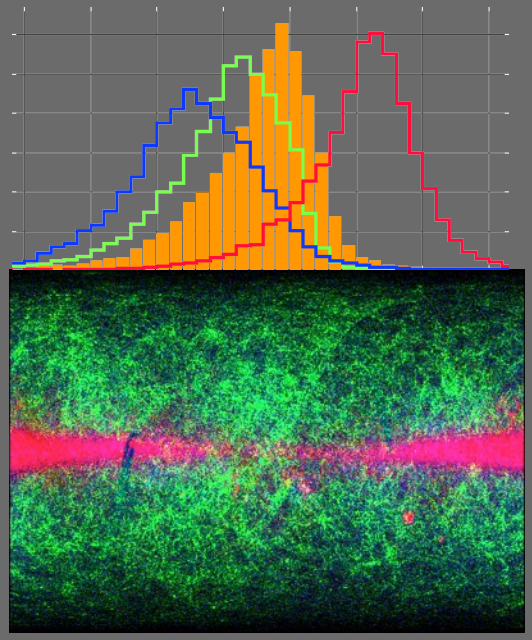

Mondrian
Mondrian
© 1997 – 1998 AT&T Labs Research
© 2002 – 2006 Augsburg University
mondrian@theusRus.de
Welcome !
Mondrian(FisherIris.csv)
Type
PW
PL
SW
SL
26/150 (17.33%)
Scatterplot Matrix
Histogram(PW)
1.00
25.00
Histogram(PL)
10.0
69.0
Histogram(SW)
20.00
44.00
Histogram(SL)
43.0
79.0
Barchart(Type)
0
1
2
PC(FisherIris.csv)
PW
SW
Type
PL
SL
MONDRIAN





TOPCAT





MANYEYES

Many Eyes

Log in

An experiment brought to you by IBM Research and the IBM Cognos software group

Visualization | Search

Visualizations : UN Climate Strategy Word Map

Uploaded by: lilylaurence
Created at: Dec 11 2012
Description:
Tags: climate sustainability un

Explore
- Visualizations
- Data sets
- Comments
- Topic centers

Participate
- Create a visualization
- Upload a data set
- Create a topic center
- Register

Learn more
- Quick start
- Visualization types
- Data format and style
- About Many Eyes
- FAQ
- Blog

Contact us
- Contact
- Report a bug

Legal
- Terms of use
- Privacy
- Provide Feedback

Popular tags:

Visualizations | Data sets

2008 2009 2010 2011 2012 A Obama budget census country crime education election energy facebook food government health internet lyrics media music network obama obesity people politics population president race smoking social speech spending state states twitter unemployment us world

See more »

Select a phrase

Showing 37 of 517 terms

word1	and	word2
word1	's	word2
word1	of the	word2
word1	the	word2
word1	a	word2
word1	at	word2
word1	is	word2
word1	[space]	word2

or enter your own

* * Submit

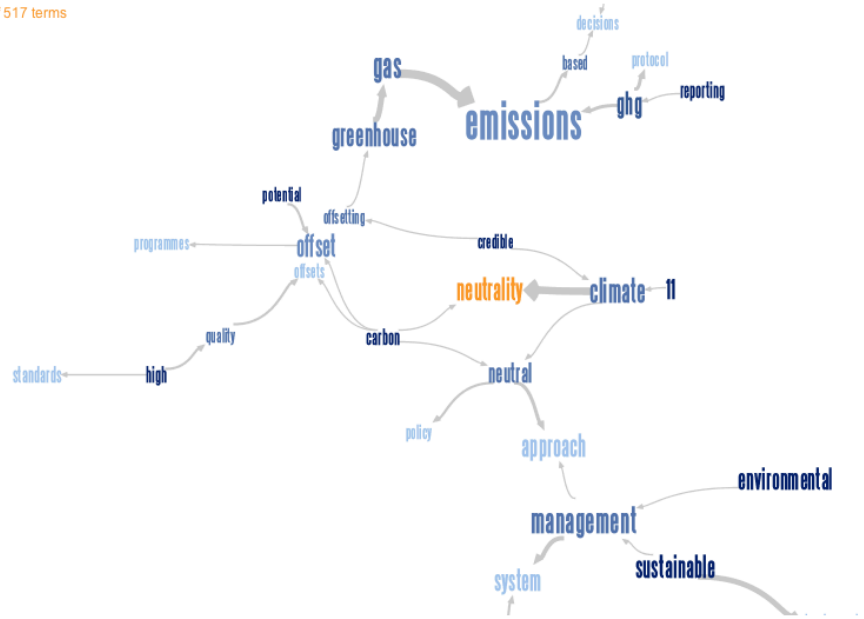
Filters

Show top: 50

Hide common words ☑

Zoom

In Out Reset



Data file: UN climate strategy paper

Data source: UN website

This data set has not yet been rated

full image | share this | watch this | add to topic center | rate this

Comments (1)

Currently showing

UN Climate Strategy Word Map

lilylaurence saved this snapshot
Posted Dec 11 2012
See view for this comment

This visualization was featured Thursday December 13 2012, 08:15 AM

This visualization has not yet been rated

Part of these topic centers

Being watched by

Learn more

About Phrase Net

Post a comment as Anonymous

Include a snapshot of this visualization?

Yes No

doi:10.1111/j.1469-1809.1936.tb02137.x
sometimes
hide
without
techniques
R.A
flower
iris
species
set
Wikipedia
visualized
distinguish
Multiple
clustering
pasture
information
became
actual
many
learning
developed
good
Spectramap
picked
biplot
free
Sir
person
Contents
obtained
Fisher's
contains
Edgar
separation
centimeters
support
rather
makes
three
using
Use
Width
explain
American
Based
petal
dataset
obvious
difference
classification
used
Length
Species
morphologic
See
Gaspé
clusters
also
collected
Data
versicolor
discriminant
example
Problems
Four
case
encyclopedia
cluster
Annals
Anderson's
apparatus
Two
multivariate
separable
object
width
measured
Taxonomic
Eugenics
Fisher
length
data
linear
model
unsupervised
Scatterplot
Missouri
Fishers
sepal
Irises
k-means
mining
sample
known
machine
Measurements
consists
called
related
test
iris
Botanical
variation
Problem
uncommon
day
use
setosa
Petal
time
flowers
Garden
Sepal
One
ELKI
Bulletin
combination
supervised
introduced
four
quantify
Aylmer
analysis
samples
machines
typical
edit
features
Society
links
External
since
References
two
result
Peninsula
Ronald
vector
however
Anderson
virginica

IBM's WORDLE ☝

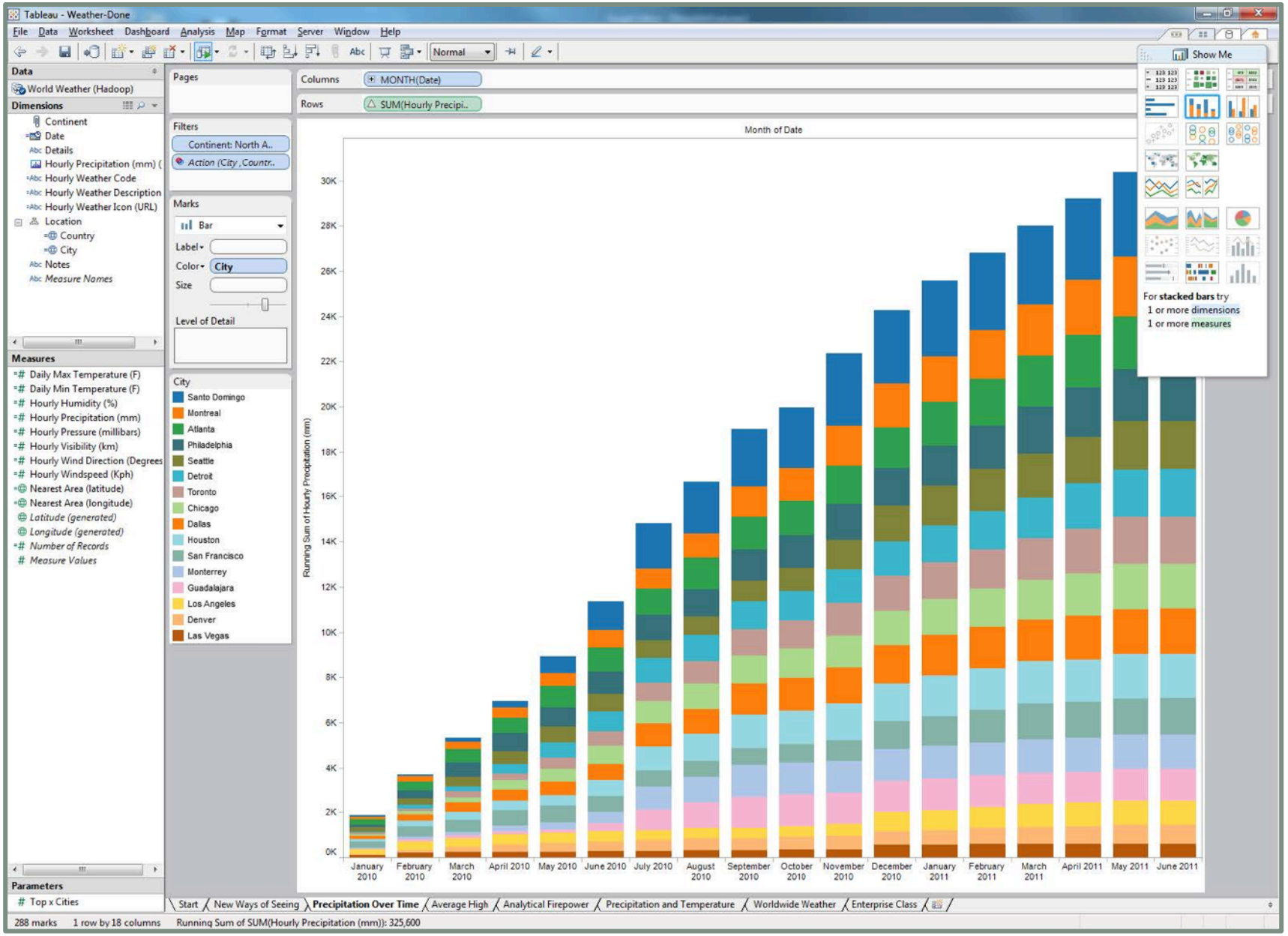


Tableau - Weather-Done
File Data Worksheet Dashboard Analysis Map Format Server Window Help
Normal
Show Me
Data
World Weather (Hadoop)
Dimensions
Continent
Date
Details
Hourly Precipitation (mm) (
Hourly Weather Code
Hourly Weather Description
Hourly Weather Icon (URL)
Location
Country
City
Notes
Measure Names
Measures
Daily Max Temperature (F)
Daily Min Temperature (F)
Hourly Humidity (%)
Hourly Precipitation (mm)
Hourly Pressure (millibars)
Hourly Visibility (km)
Hourly Wind Direction (Degrees
Hourly Windspeed (Kph)
Nearest Area (latitude)
Nearest Area (longitude)
Latitude (generated)
Longitude (generated)
Number of Records
Measure Values
Parameters
Top x Cities
Pages
Filters
Continent: North A..
Action (City, Countr..
Marks
Bar
Label
Color City
Size
Level of Detail
City
Santo Domingo
Montreal
Atlanta
Philadelphia
Seattle
Detroit
Toronto
Chicago
Dallas
Houston
San Francisco
Monterrey
Guadalajara
Los Angeles
Denver
Las Vegas
Columns MONTH(Date)
Rows SUM(Hourly Precipi..
Month of Date
Running Sum of Hourly Precipitation (mm)
0K 2K 4K 6K 8K 10K 12K 14K 16K 18K 20K 22K 24K 26K 28K 30K
January 2010 February 2010 March 2010 April 2010 May 2010 June 2010 July 2010 August 2010 September 2010 October 2010 November 2010 December 2010 January 2011 February 2011 March 2011 April 2011 May 2011 June 2011
For stacked bars try
1 or more dimensions
1 or more measures
Start New Ways of Seeing Precipitation Over Time Average High Analytical Firepower Precipitation and Temperature Worldwide Weather Enterprise Class
288 marks 1 row by 18 columns Running Sum of SUM(Hourly Precipitation (mm)): 325,600

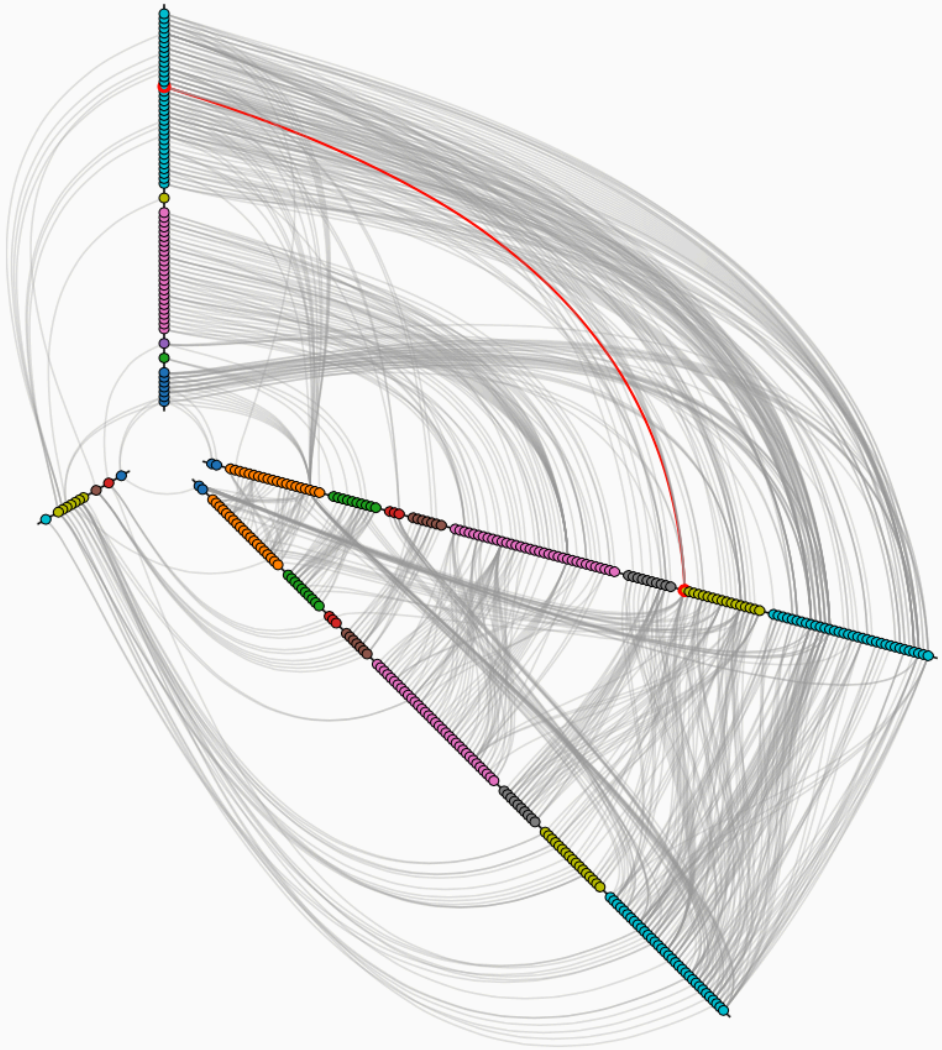
TABLEAU

Mike Bostock

Hive Plots

March 18, 2012

flare.vis.operator.layout.BundledEdgeRouter → flare.util.Arrays



This **hive plot**, a type of node-link diagram, shows the dependency graph of the Flare visualization toolkit.

Each dot represents a class, and each line represents an import statement from one class to another. Related classes share the same color.

Mouseover for more details, and scroll down to read more about the use of hive plots to visualize networks.

Built with d3.js.

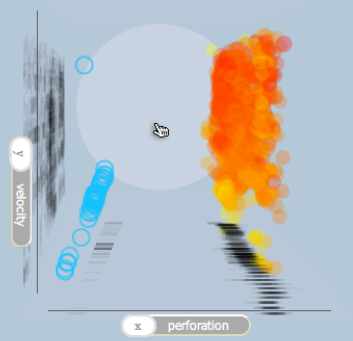
Many methods of graph drawing, such as force layouts, do not assign intrinsically-meaningful positions to nodes: the position is only approximate, in the hope that related nodes appear nearby. While intuitive, these methods arguably make poor use of the most effective visual channel (that is, *position*), and in the worst case produce an indecipherable hairball.

D3JS

iVu-pkg.README.html

IVu package v.0.0

Welcome. If you can see a chart here:



Optimal Transportation Meshfree (OTM) method for simulating extremely large deformation and ballistic limit impact problems. The method combines concepts from Optimal Transportation theory with material-point sampling and local max-ent meshfree approximation. The proposed OTM method generalizes the Lagrangian Reproducing differential formulation of optimal mass transport problems to problems including arbitrary geometries, initial conditions, constitutive behavior, and multibody contact. A grid based material-point erosion algorithm is also proposed for simulating discontinuous material failure phenomena. Three dimensional OTM simulations with material-point erosion algorithm for metallic plates of different thicknesses of plates have been performed to study the performance with the same configurations have been conducted to validate the OTM method.

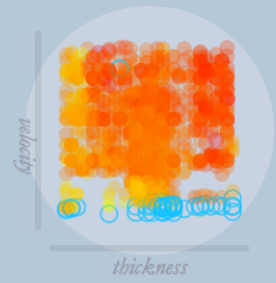
experiment_hsrt_db
otm_hsrt_shc_db
otm_hsrt_hera_db
otm_hsrt_coyote_db
otm_hsrt_lobo_db
otm_hsrt_glory_db

VARS DATA PLAY BOOK VIEW PAGE

z thickness r perforation

color perforation

We have presented an Optimal Transportation Meshfree (OTM) method which enables the prediction of terminal ballistics. The theoretical basis of the OTM method guarantees the exact conservation of mass, linear and angular momentum. The proposed material point erosion algorithm greatly extends the applicability of the OTM method. The performance and accuracy of the proposed method has been tested by three dimensional ballistic limit impact simulations and in-house experiments. The agreement between numerical and experimental results is excellent.



then the package is intact and working.

iVu