

# **Virtual Research Environment for CLUES**

**Kristin Riebe, Arman Khalatyan**

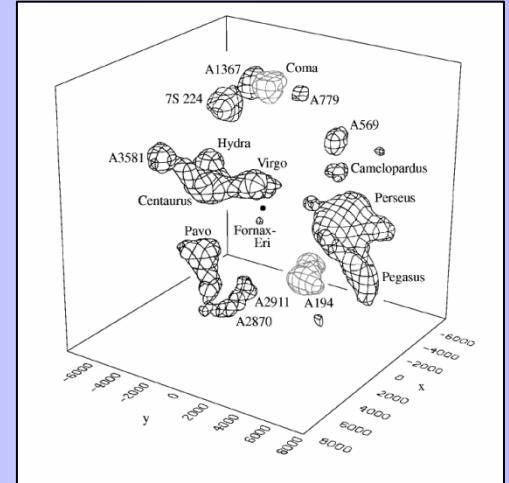
**AIP, e-Science  
AG Herbsttagung Bonn  
2010**

# Outline

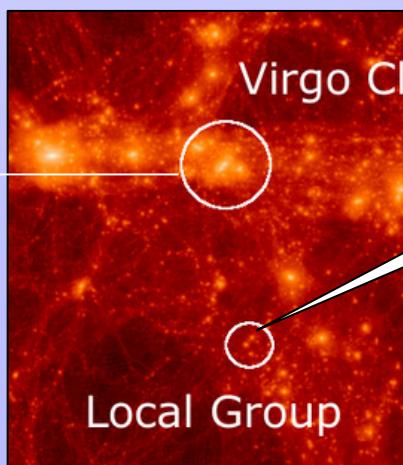
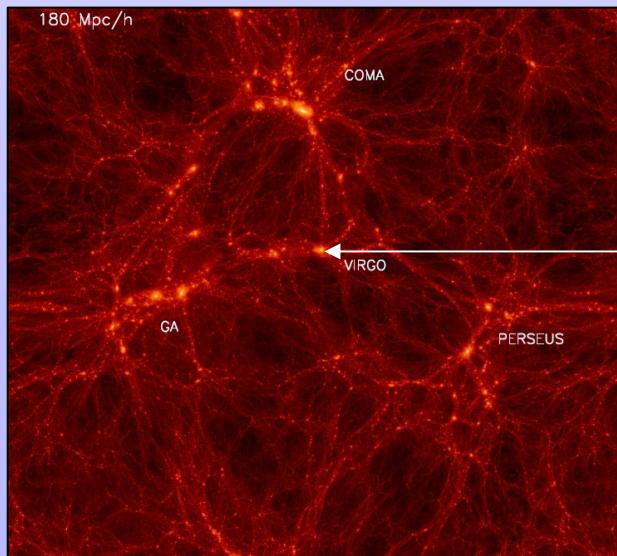
- Introduction: CLUES project
- Virtual Research Environment for CLUES
  - CLUES Website
  - CoSiMM  
(Collaborative Simulation Metadata Management)
  - CLUES Halo Database
- Outlook

# CLUES project

- Constrained Local UniversE Simulations
- ~ 40 scientists from > 10 countries
- reproduce local universe:
  - cosmological simulations
  - constrained initial conditions
- resimulate with higher resolution



contours of clusters  
in the local universe  
(Hudson 1993)



Simulation snapshots:  
color codes density  
(dark matter, CLUES  
collaboration)

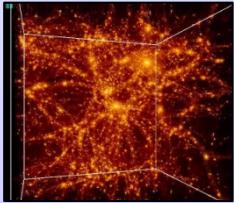
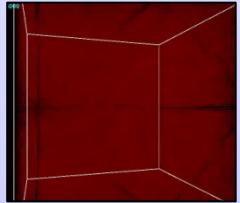
# Workflow



$\Lambda$ CDM Modell

$H_0$	$= 71 \pm 4 \text{ km s}^{-1}$
$\Omega_0$	$= 0.29 \pm 0.07$
$\Omega_b$	$= 0.047 \pm 0.006$
$\sigma_8$	$= 0.9 \pm 0.1$
$t_0$	$= 13.4 \pm 0.3 \text{ Gyr}$

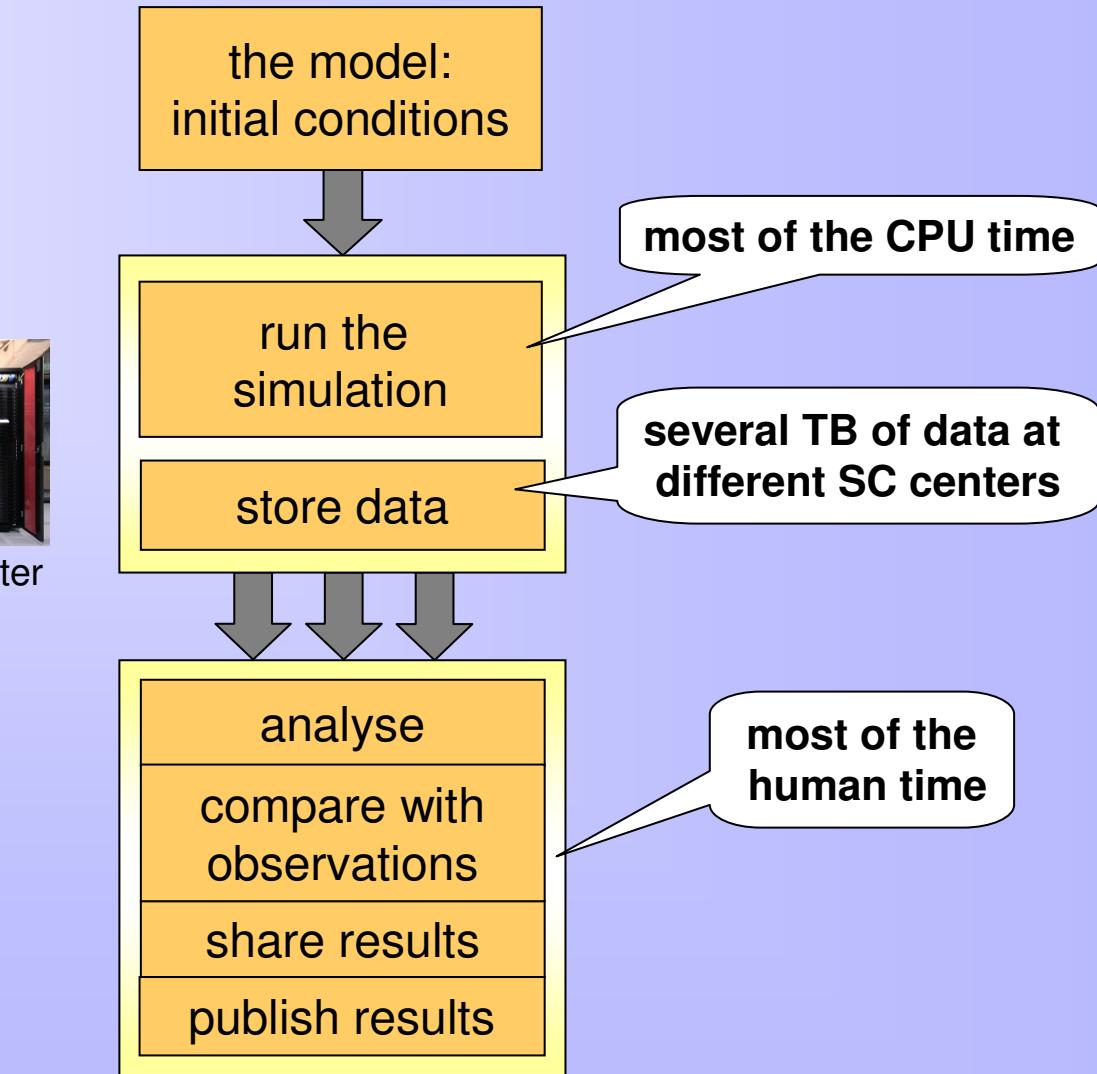
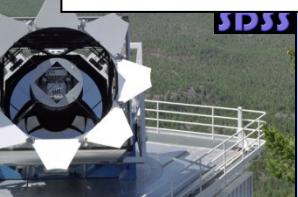
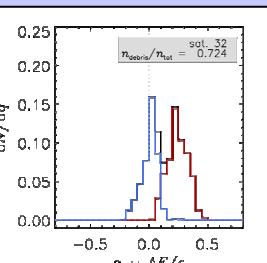
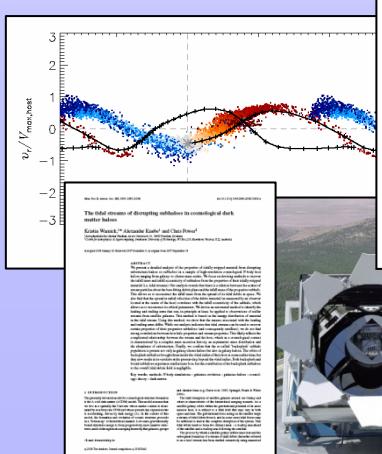
Cosmological Model  
+ constraints



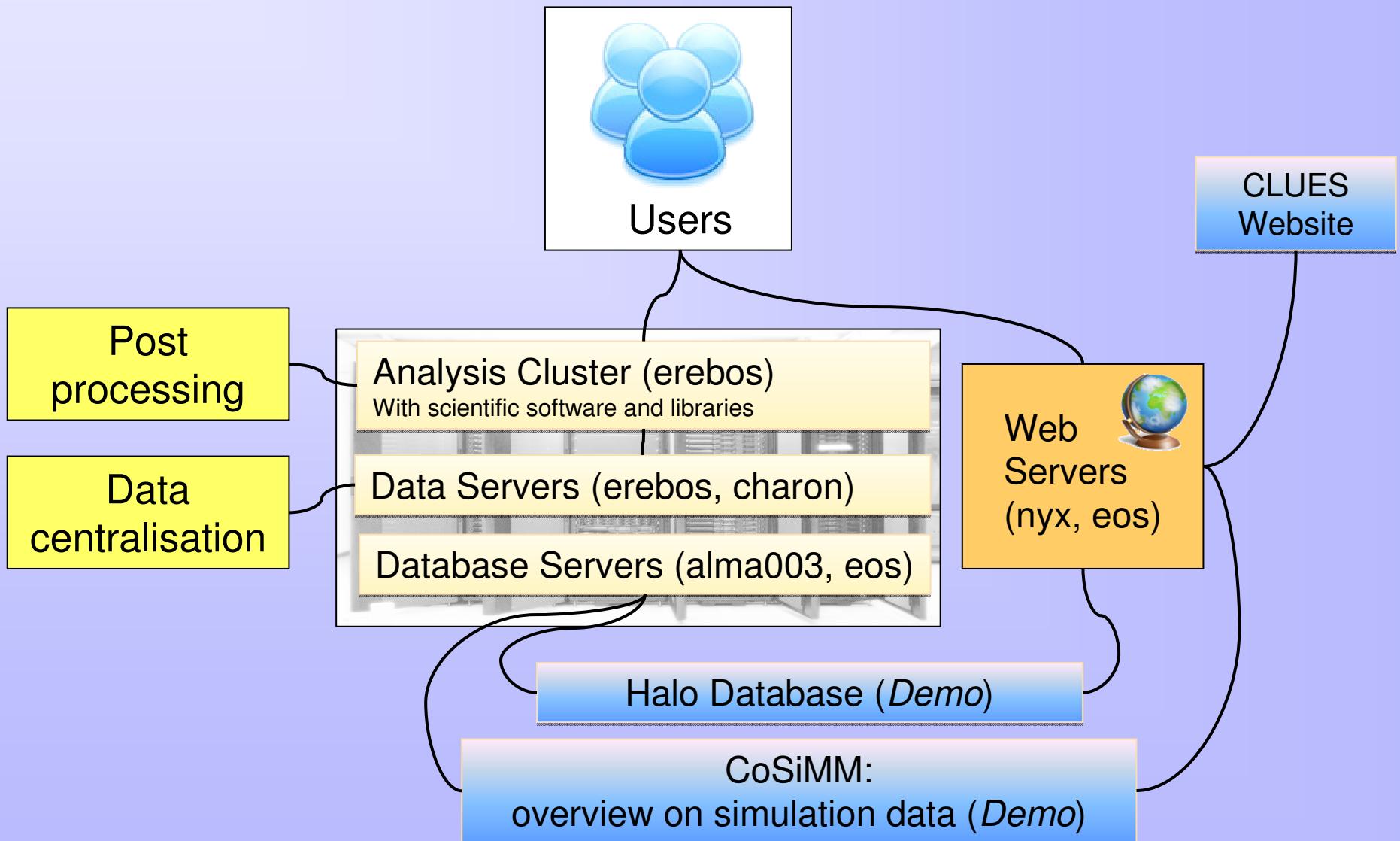
simulation snapshots



computer cluster

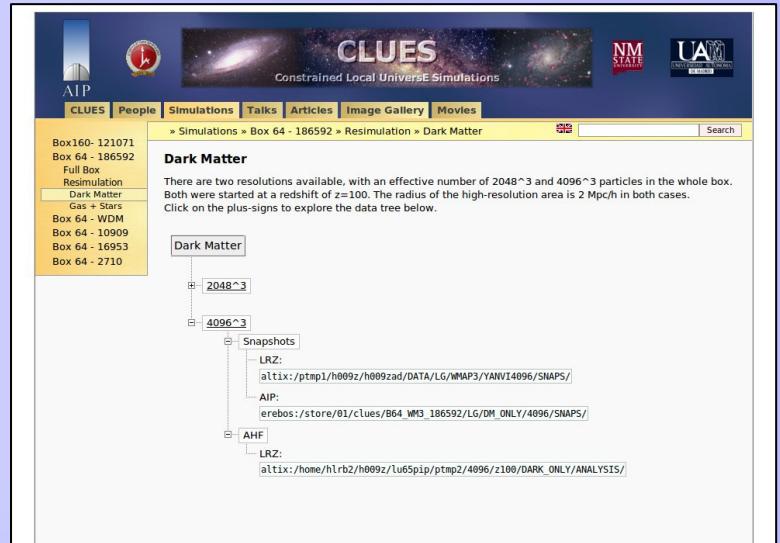


# Overcoming the problems



# CLUES Website and CMS

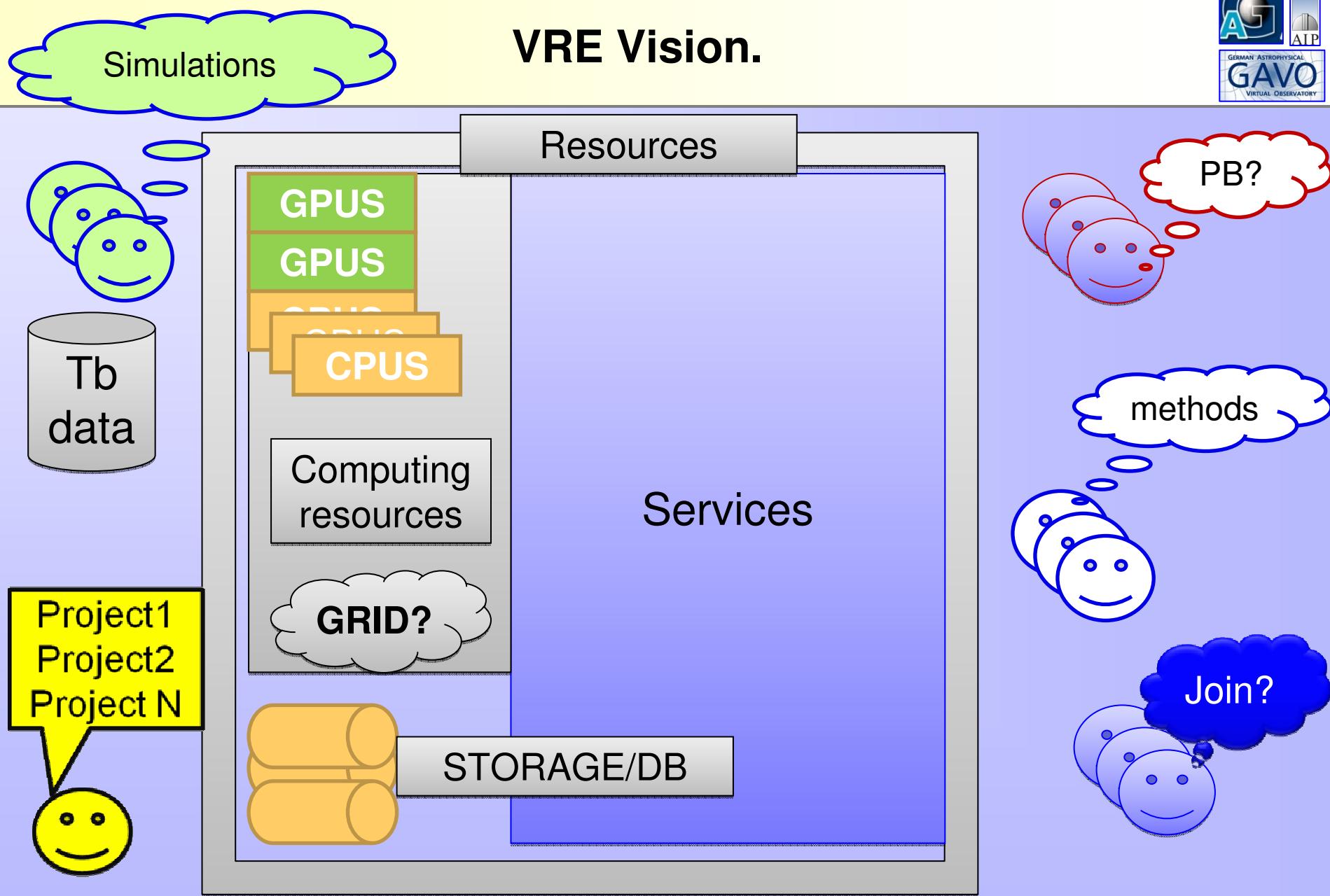
- <http://www.clues-project.org>
- exchange images, movies, talks, useful for public outreach
- overview on data locations
- simple content management system (CMS):
  - limited group of users can edit content directly



*“... very great job you are doing with the CLUES web page. The web page has changed the way we work within the collaboration.”*  
 (Y. Hoffman, CLUES member)

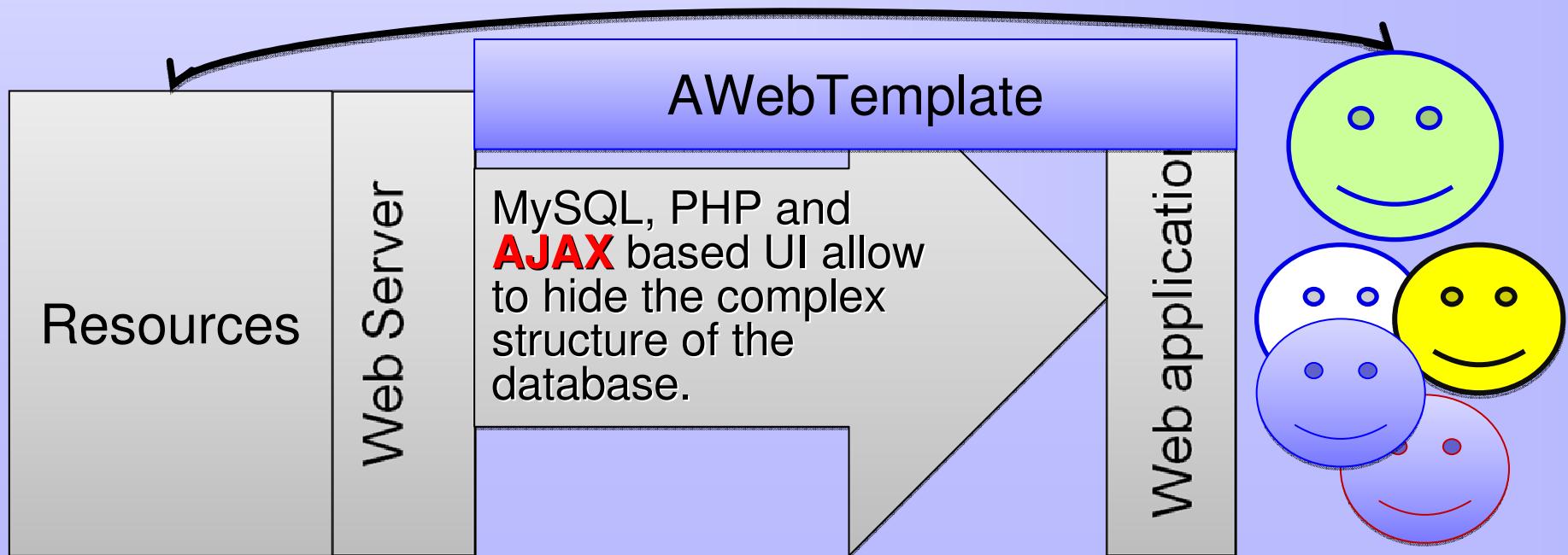
# Arman's turn.

# VRE Vision.

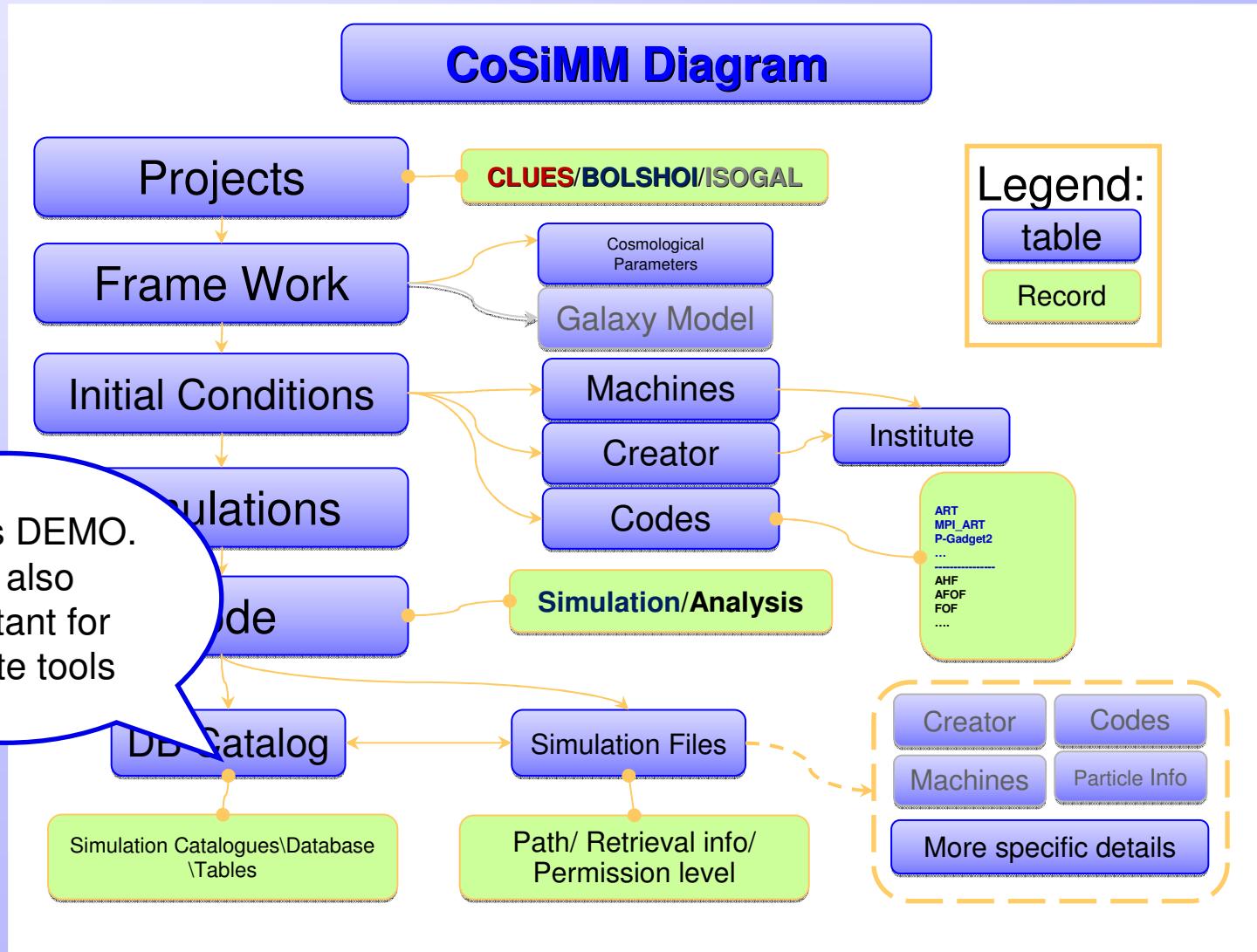


# The Collaborative Simulation MetaData Management: CoSiMM

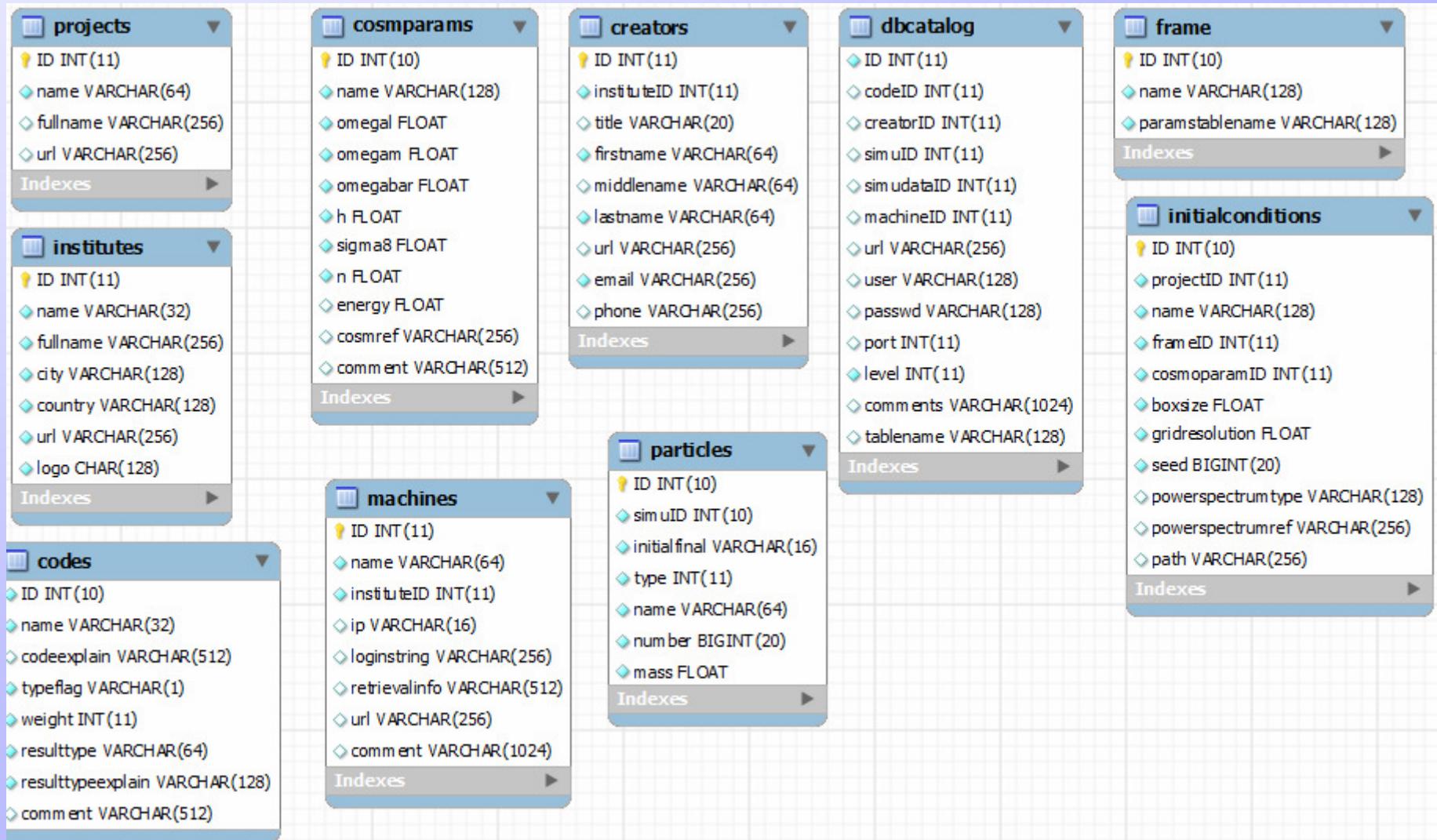
- CoSiMM is a pilot project for:
  - Standardizing data bookkeeping
  - makes data exchange easy
  - simplifies collaboration between group members and groups
  - Should be extendable and simple to manage



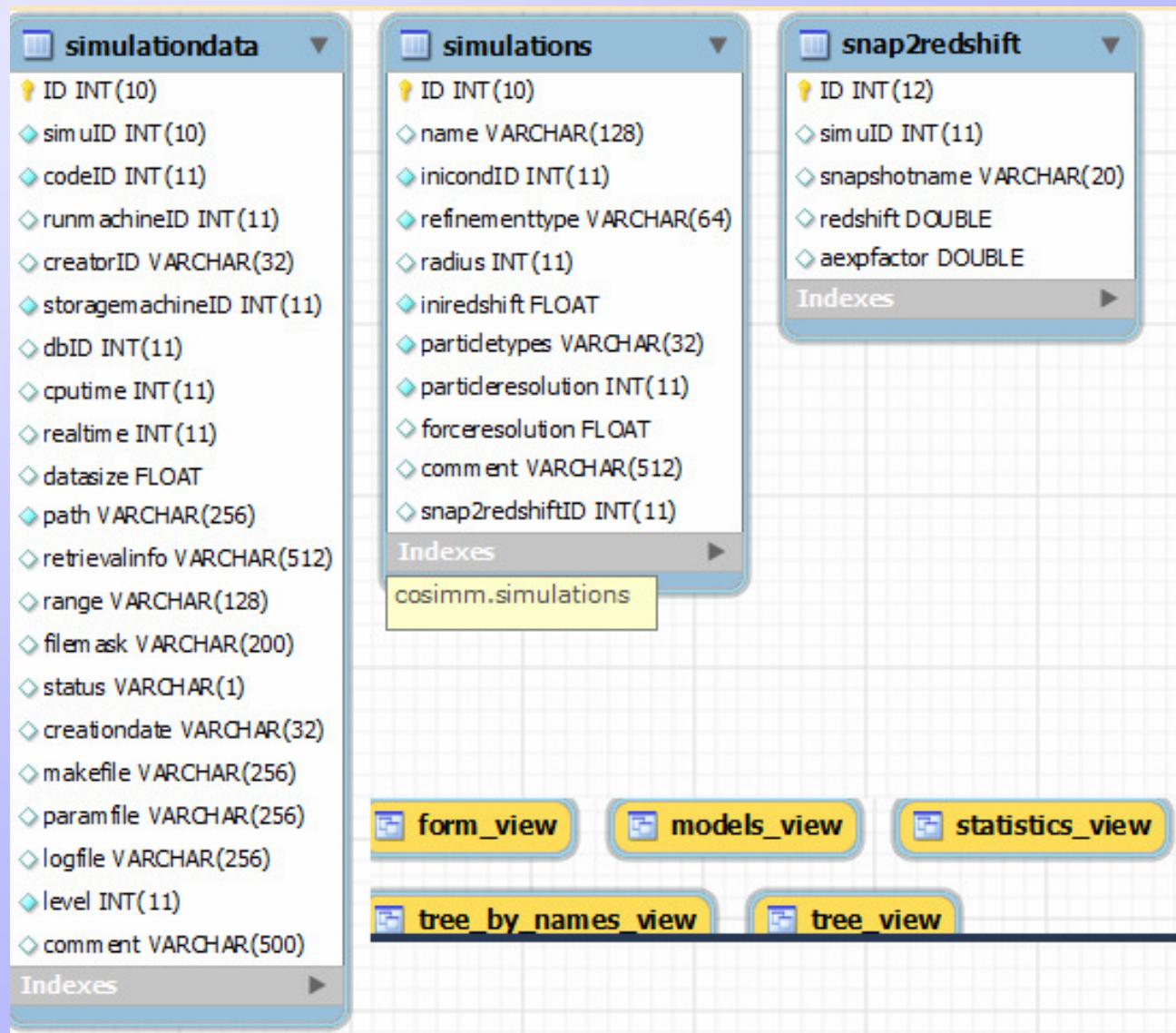
# CoSiMM: Diagram



# Diagram-1



# Diagram-2



# AWebTemplate

- Libraries: JQuery-1.4.2 and JQuery-UI 1.8(included in package)
- Many useful plug-ins: Tables, Trees, Menu, Forms

```

<?php
require('include/templatevars.php');//require to initialize the template variables:
see details in variables section
$hitfile="index.php.txt";// this is require to track page access, this file will be
generated by apache, we are going to move it in a future to database table.
$site_title = "CLUES: Analysis Server";//the site title
$page_title = " Analysis Server";//the page title
$header = $page_title;//the header
$main='';//the main content for the page
//require('templates/header.php');//show the text and/or image in the Top part
of the page
//require('templates/news.php');//show some information in the Right frame

$main .= implode("", file('templates/Tmain.html'));// this is appends the existing
html page.
//TMain.html should contains only part between <body></body> tags of the
existing page.

require('templates/main_menu.php');//enable left navigation menu
require('templates/footer.php');//enable footer for all pages
require('templates/template_1.php');//render final page
?>

```

# DEMOS(Arman)

- CLUES
  - TreeView
  - Direct query interface
  - Remote rendering prospects.

# Kristin's turn

# CLUES Simulation Databases

- databases for halo catalogues of simulations
- database design similar to Millennium Simulation DB
- VO compliant
- direct SQL queries

**CLUES Database**

**Query Form**

**Credits**

**Documentation**

**Databases**

- CLUES

**Private (MyDB) Databases**

- clues\_guest\_db (rw) (conten







**Query the CLUES database**

Place your SQL statement directly in the text area below and submit your request by pressing one of the 'Submit' buttons.  
 Please note, that there is a timeout and row limit for each query:  
 Streaming queries: return unlimited number of rows in CSV format and are cancelled after 420 seconds.  
 Browser queries: return a maximum of 1000 rows in HTML format and are cancelled after 30 seconds.

```
SELECT child.* FROM CLUES..FOFtree parent, CLUES..FOFtree child
WHERE
    parent.fofTreeId = 100000000
AND
    child.mass > 1.5
AND
    child.fofTreeID BETWEEN parent.fofTreeId AND parent.lastProgID
ORDER BY
    child.fofTreeID asc
```

**Query (stream)**   **Query (browser)**   Maximum number of rows to return: 1000

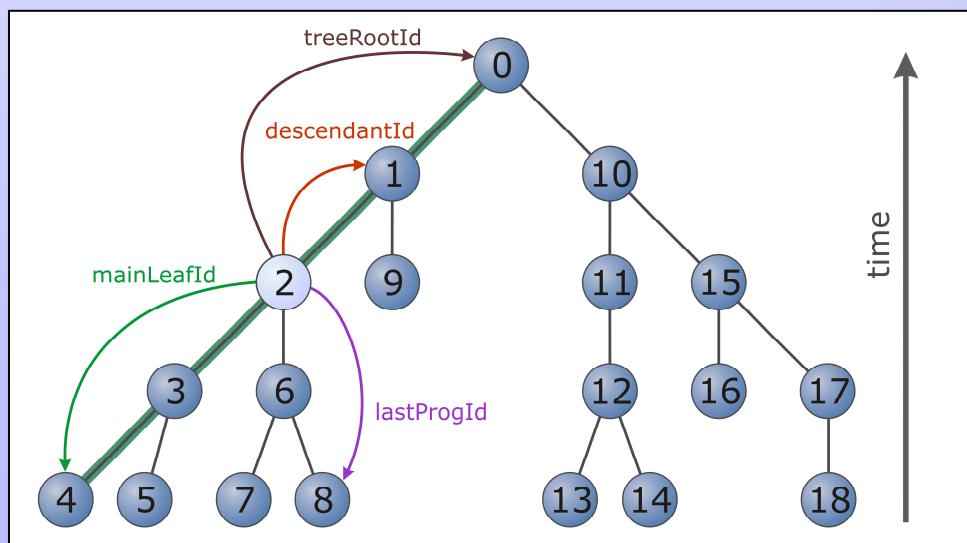
**Help**

**Previous queries**

List of all queries executed so far in this session.  
 Selecting a query will make it appear in the query window; the link will show all of them in a separate window.

# Database design: Merger Trees

- Halos grow via merging and accretion
- Merger trees represent the merging history of halos
- Proper indexing ensures quick access
- WEB: <http://charon.aip.de:8080/CLUES>



# Summary and Outlook

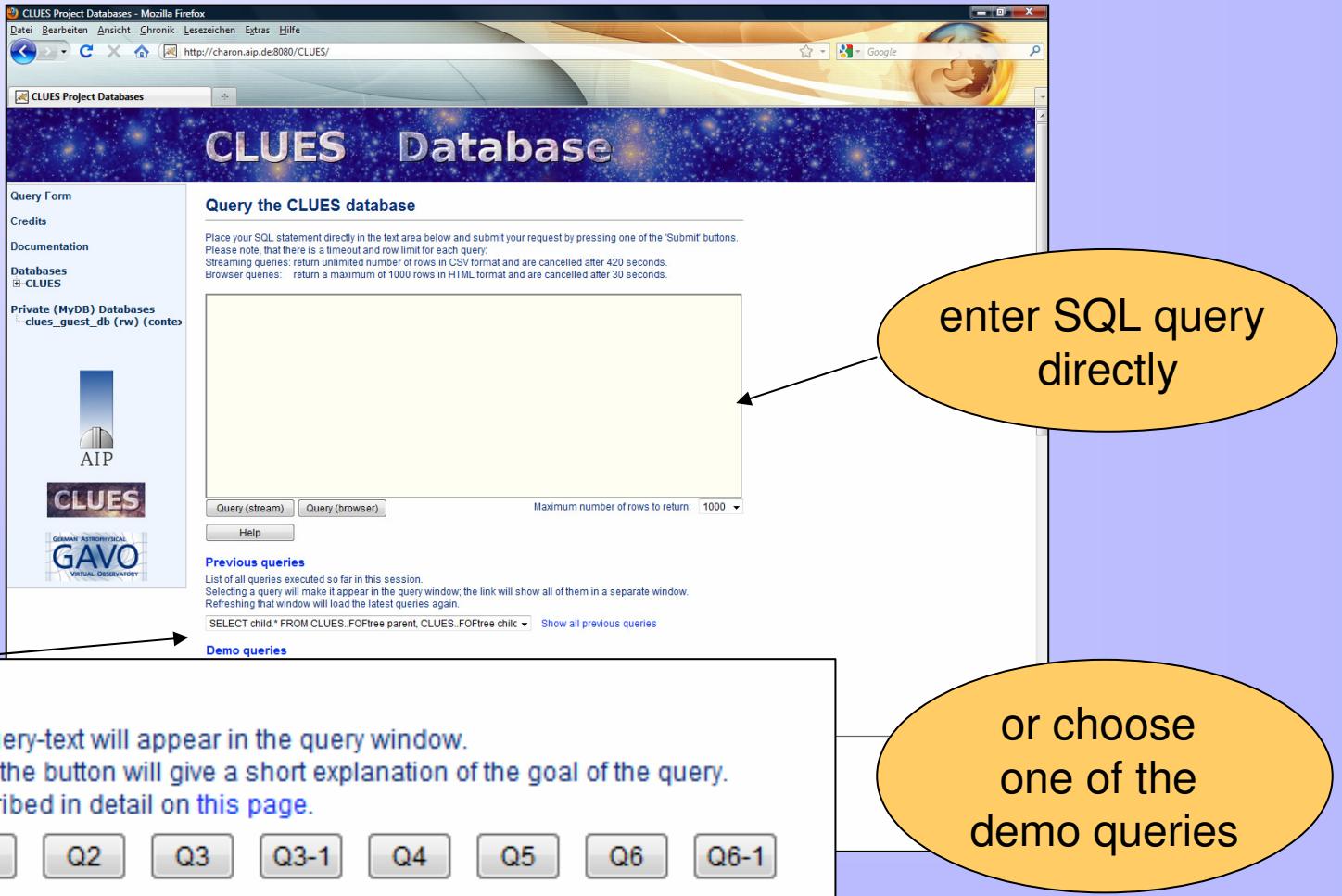
- Current state:
  - Clues website
  - Direct data access
  - Analysis server with scientific software and libraries
  - Databases with post processed data and simulations metadata
- Work in progress:
  - Queuing system for job submission
  - Automated analysis pipeline for common algorithms:
    - Halos, Tracking, Profiles, Structure finders
  - Remote rendering servers
    - Snapshots or time evolution for different components
    - Mock observational images

# Additional Demo Slides

- ... in case the live demo is not working ...

# Demo: Halo database

- <http://charon.aip.de:8080/CLUES>



enter SQL query directly

or choose one of the demo queries

**Demo queries**

Click a button and the query-text will appear in the query window.  
 Holding the mouse over the button will give a short explanation of the goal of the query.  
 These queries are described in detail on this page.

CLUES Demos: [Q1](#) [Q2](#) [Q3](#) [Q3-1](#) [Q4](#) [Q5](#) [Q6](#) [Q6-1](#)

# Demo: Halo database

CLUES Project Databases - Mozilla Firefox

Datei Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe

http://charon.aip.de:8080/CLUES/MyDB

CLUES Project Databases

# CLUES Database

Query Form

Credits

Documentation

Databases

- CLUES

Private (MyDB) Databases

- clues\_guest\_db (rw) (conte

AIP

CLUES

GERMAN ASTROPHYSICAL  
GAVO  
VIRTUAL OBSERVATORY

Fertig

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WHERE
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AND
    child.mass > 1.5
AND
    child.fofTreeId BETWEEN parent.fofTreeId AND parent.mainLeafId
ORDER BY
    child.fofTreeId asc
```

Query (stream)    Query (browser)

Help

Maximum number of rows to return: 100

Previous queries

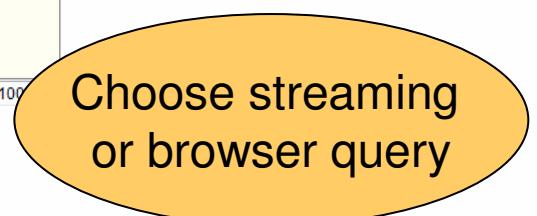
List of all queries executed so far in this session.

Selecting a query will make it appear in the query window; the link will point to the corresponding page.

Query (stream)    Query (browser)

Help

**Choose streaming or browser query**



# Demo: Halo database

- Browser queries return results at the bottom of the page

Query time (in millisec) = 6568  
 Number of rows retrieved from database = 61

Select an output format and press the "Get table" button to open a new window with your data in the chosen table format.  
 Click "Plot" to start the VOPlot Java applet.

fofTreelid	fofid	treeSnapshot	descendantid	lastProgId	mainLeafId	treeRootId	ix	iy	iz	phkey	x	y	z
100000000	80000000000000000000	80	100000000	101381307	100000079	100000000	7	22	7	2268612	14.8114	44.3871	15.5888
100000001	79000000000000000000	79	100000000	101325696	100000079	100000000	7	22	7	2268481	15.1894	45.6027	15.9192
100000002	78000000010000000000	78	100000001	101210156	100000079	100000000	7	22	7	2268541	15.1739	45.3779	15.6978
100000003	77000000010000000000	77	100000002	101180115	100000079	100000000	7	22	7	2268541	15.1581	45.4253	15.6213
100000004	76000000010000000000	76	100000003	101159035	100000079	100000000	7	22	7	2268517	15.0221	45.0658	15.439
100000005	75000000010000000000	75	100000004	101125221	100000079	100000000	7	22	7	2268446	14.9952	45.1502	15.3954
100000006	74000000010000000000	74	100000005	101104133	100000079	100000000	7	22	7	2268446	14.9748	45.1817	15.3394
100000007	73000000010000000000	73	100000006	101081113	100000079	100000000	7	22	7	2268446	14.9474	45.1514	15.2582
100000008	72000000010000000000	72	100000007	101067172	100000079	100000000	7	22	7	2268441	14.951	45.2309	15.2142
100000009	71000000010000000000	71	100000008	100917410	100000079	100000000	7	22	7	2268443	14.7183	45.3315	15.1695
100000010	70000000010000000000	70	100000009	100900720	100000079	100000000	7	22	7	2268443	14.7004	45.3699	15.1163
100000011	69000000010000000000	69	100000010	100883229	100000079	100000000	7	22	7	2268443	14.6953	45.4074	15.0626
100000012	68000000010000000000	68	100000011	100867125	100000079	100000000	7	22	7	2268443	14.7	45.4543	15.0061
100000013	67000000010000000000	67	100000012	100849045	100000079	100000000	7	22	7	2268411	14.675	45.506	14.9527
100000014	66000000010000000000	66	100000013	100810611	100000079	100000000	7	22	7	2268411	14.6815	45.5568	14.8738

III

**Click on „Plot“ button**

# Demo: Halo database

CLUES Project Databases - Mozilla Firefox

Datei Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe

http://charon.aip.de:8080/CLUES/MyDB

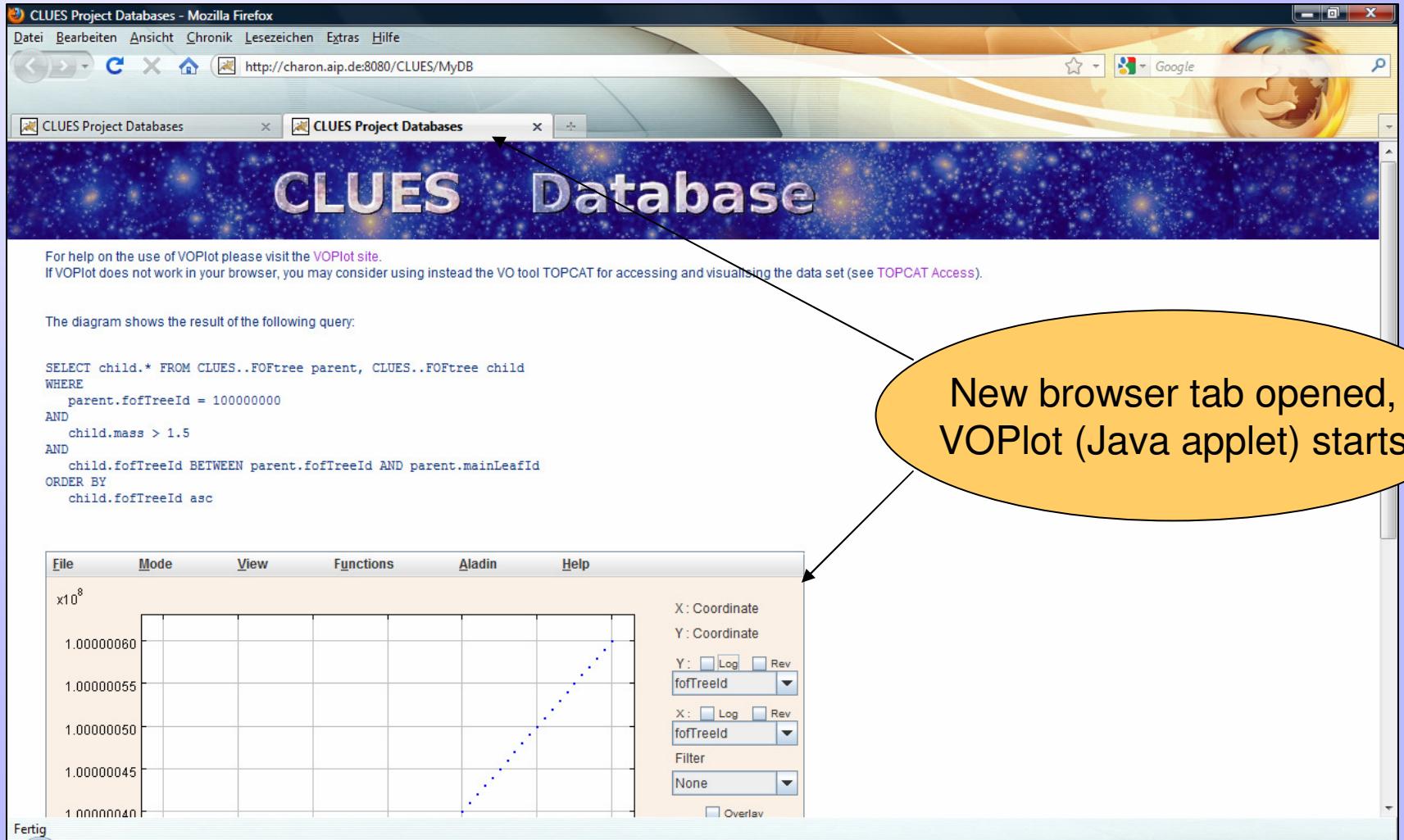
CLUES Project Databases CLUES Project Databases

For help on the use of VOPlot please visit the [VOPlot site](#).  
 If VOPlot does not work in your browser, you may consider using instead the VO tool TOPCAT for accessing and visualising the data set (see [TOPCAT Access](#)).

The diagram shows the result of the following query:

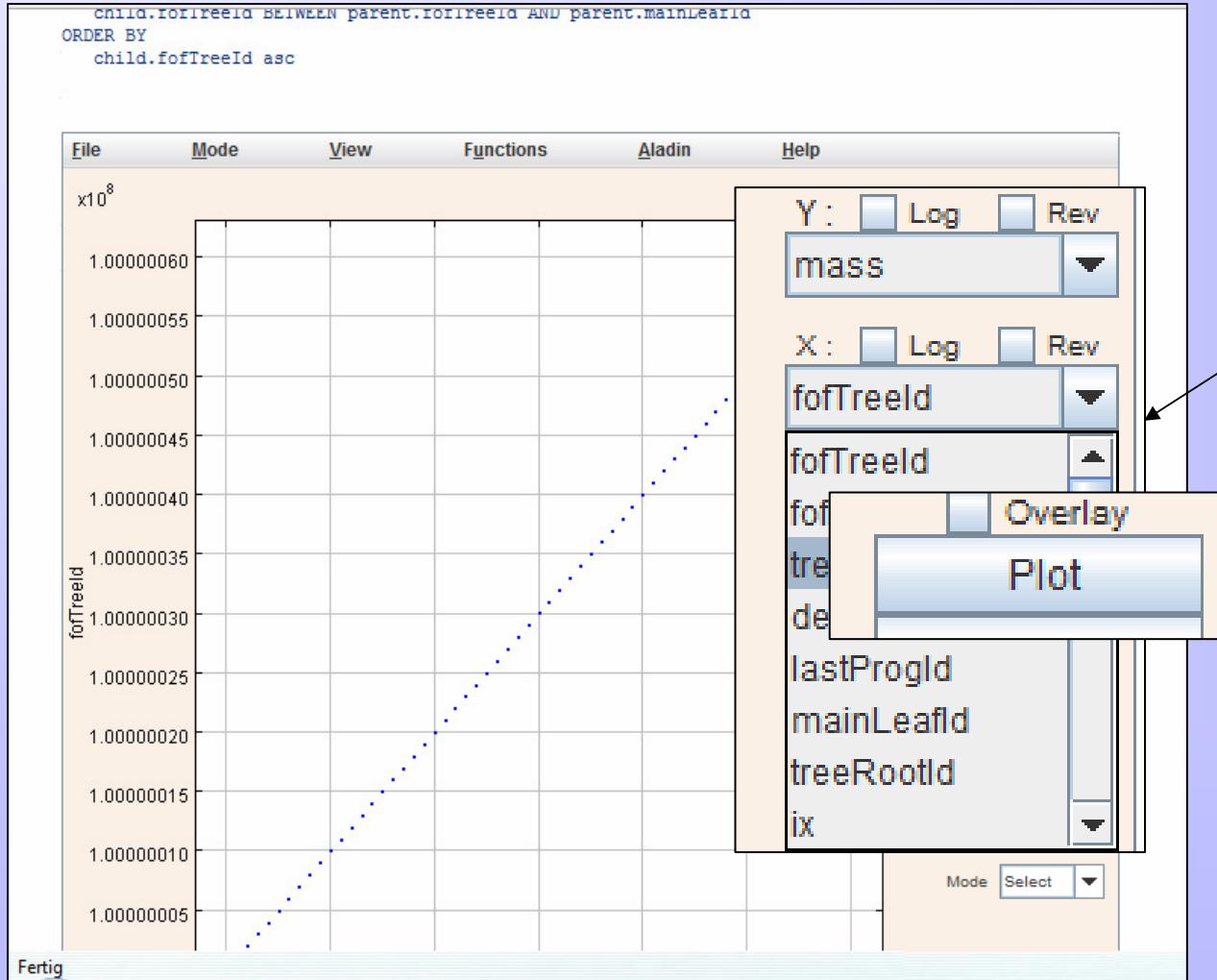
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ORDER BY
  child.fofTreeId asc
```

New browser tab opened,  
VOPlot (Java applet) starts



The screenshot shows a Mozilla Firefox browser window with two tabs. The active tab displays the 'CLUES Project Databases' interface, featuring a large 'CLUES Database' logo against a starry background. Below the logo, there's a note about VOPlot and TOPCAT access, followed by a query text area containing the SQL-like code provided above. A yellow callout bubble points from the text 'New browser tab opened, VOPlot (Java applet) starts' to the VOPlot Java applet window. This window has a menu bar with 'File', 'Mode', 'View', 'Functions', 'Aladin', and 'Help'. It features a logarithmic plot of mass (Y-axis, labeled  $\times 10^8$ ) versus halo ID (X-axis). The plot shows a series of blue dots forming a diagonal trend. To the right of the plot is a control panel with dropdown menus for X and Y coordinates, both set to 'fofTreeId' with 'Log' selected. Other options include 'Rev' (reverse), 'Filter' (set to 'None'), and 'Overlay'.

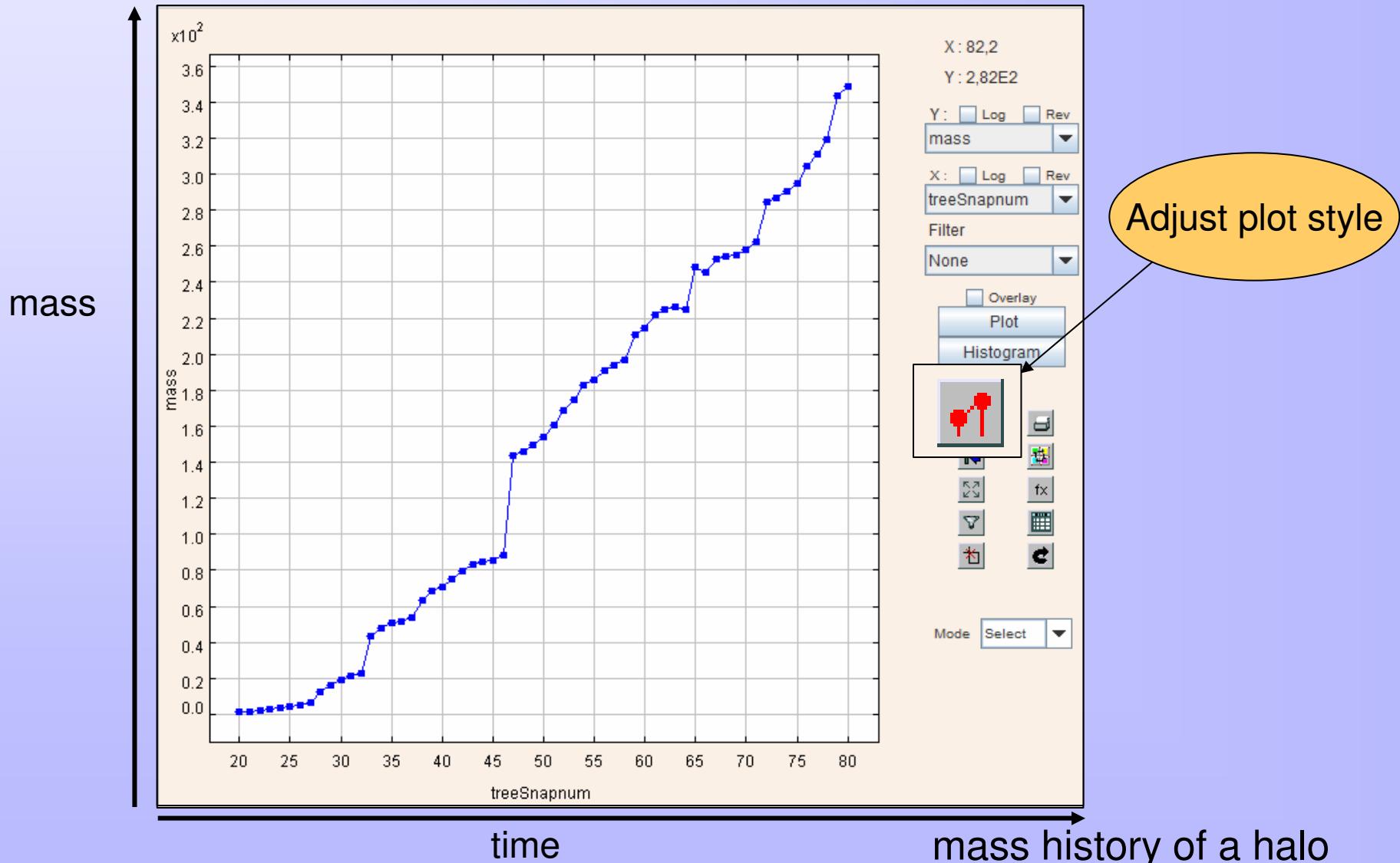
# Demo: Halo database



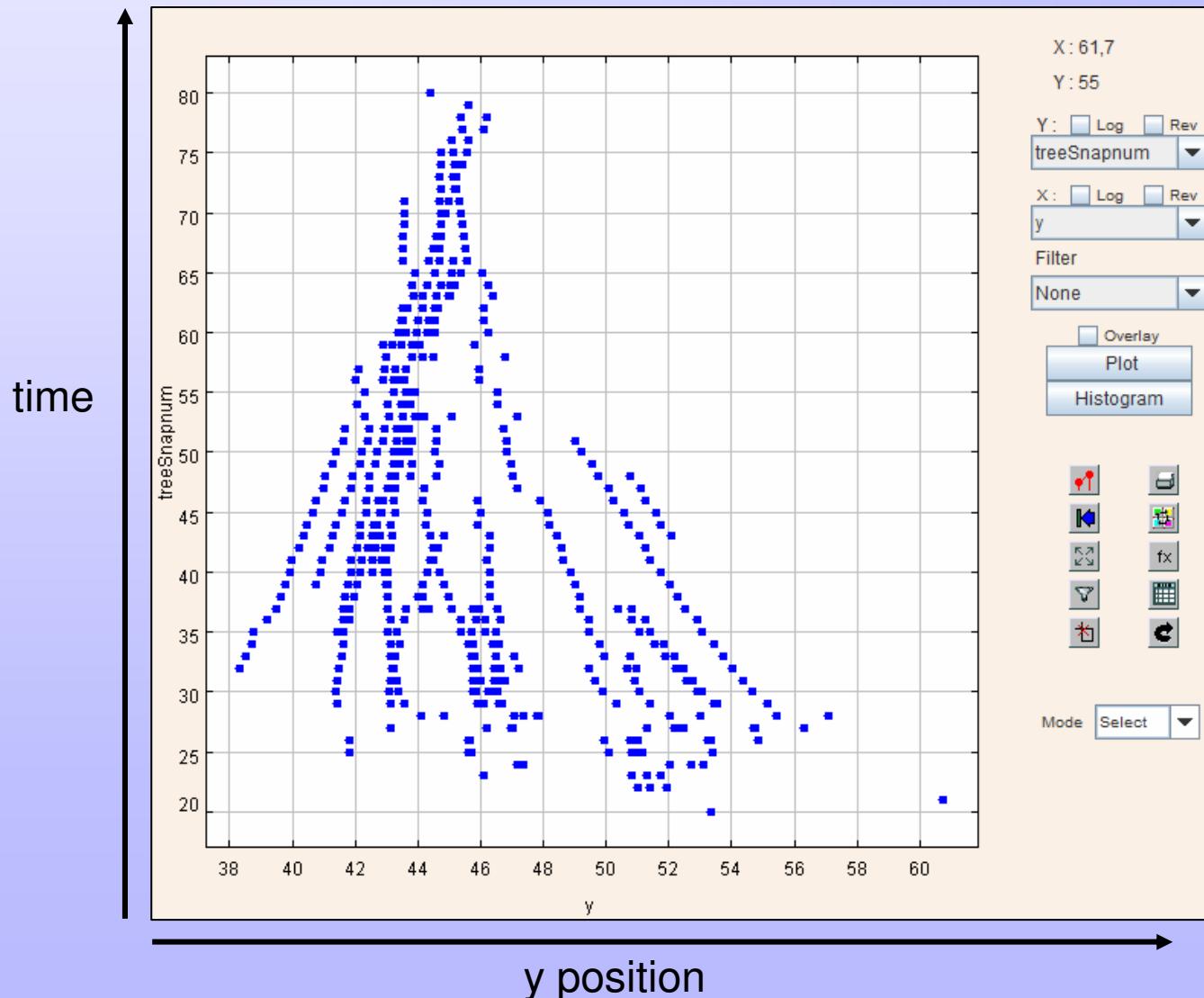
Choose x and y axis

Click „Plot“

# Example: Mass history



# Example: Merger Tree



# Example: Distribution of substructure

