

Australian Virtual Observatory

- overview
- publishing catalogues
- integration
- visualisation
- theory portals

Centre de Données astronomiques de Strasbourg
19th January 2004, Strasbourg

David Barnes
The University of Melbourne



Aus-VO Structure

- **Rachel Webster** (Melb) - **Lead Investigator**
- **David Barnes** (Melb) - **Project Scientist**
 - (sometimes Project Manager!)
- Funded **year-by-year** by the Australian Research Council [Linkage Infrastructure - Equipment and Facilities](#) grant program
- Institutes are broadly:
 - University **astronomy research groups**
 - National **telescope facilities** (AAO & ATNF)
 - University and partnership **computing groups**



Aus-VO Partner Institutes

2003 LIEF

AUD 260K

- The University of Melbourne
- The University of Sydney
- CSIRO Australia Telescope National Facility
- Anglo-Australian Observatory

- Swinburne University of Technology
- The University of Queensland
- Monash University
- The University of New South Wales
- Victorian Partnership for Advanced Computing
- ANU Mount Stromlo Observatory & Supercomputing Facility

2004 LIEF

AUD 306K

**unfunded
partners**

- CSIRO Mathematical and Information Sciences
- Australian Partnership for Advanced Computing



Our take on virtual observatories

- bring **legacy astronomy archives on-line** and ensure **future project compliance**
- provide access to **archived realisations of simulations** and to resources for **computing against new parameter sets**
- describe all data fully, and support a **small and well-chosen** set of interoperability protocols
- develop **tools** and **interfaces** to find, acquire, process and visualise data
- **build national and international grids to host the data, tools and interfaces**



Aus-VO projects 2003-04

- Common format on-line archive projects:
 - **HIPASS catalog**: HI Parkes All Sky Survey: neutral Hydrogen spectral line survey, 4,300 sources with ~30 parameters and 1024-channel radio spectra
 - **SUMSS catalog**: Sydney University Molonglo Sky Survey: radio continuum survey at 843 MHz, 107,000 sources with ~15 parameters
 - **2dFGRS QSO catalog**: 2-degree Field Galaxy Redshift Survey: optical spectra of >20,000 southern quasi-stellar objects
 - **ATCA archive**: Australia Telescope Compact Array archive: all observations since 1988, circa 1.5 TB of more than 1,000 separate observing projects! Substantial exercise in **describing data with metadata**.
 - **MACHO, RAVE, Pulsar timing archives, Gemini archive and more in 2004!**



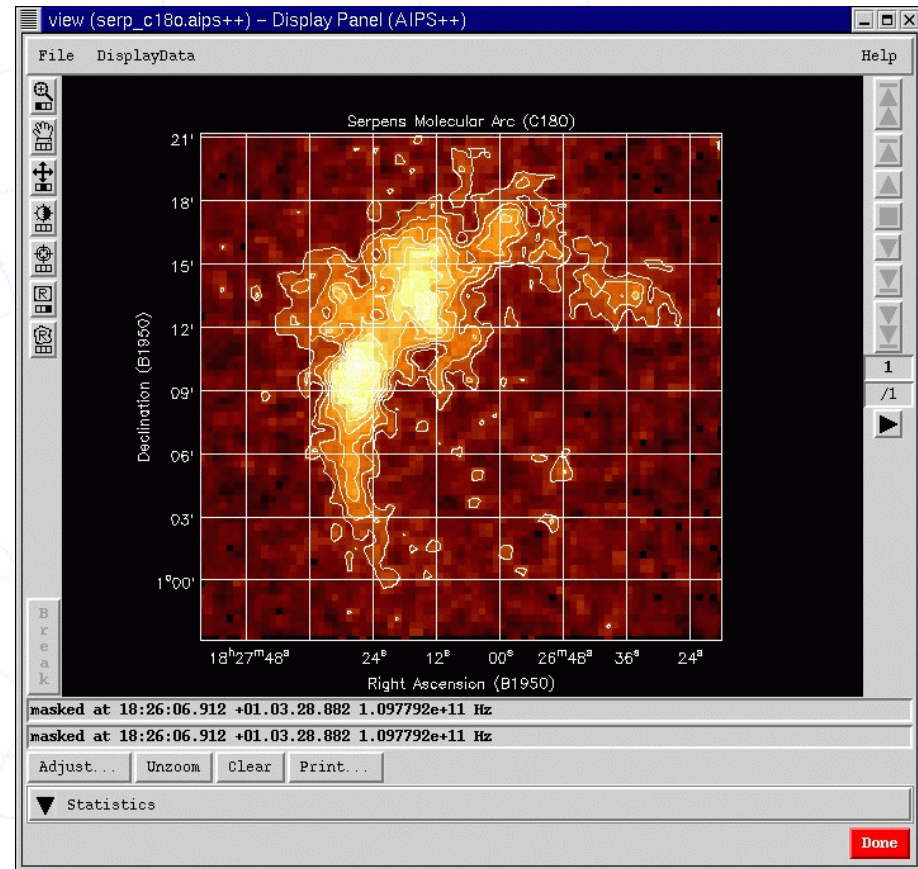
Aus-VO projects 2003-04

- **Server- and client-based visualisation tools:**
 - client canvas for **legacy software** package AIPS++ to draw upon from a remote server.
 - 3d visualisation of catalogues
- **Data reduction pipelines for:**
 - Molonglo Observatory Synthesis Telescope
 - AT Compact Array archive
 - Gemini, for Australian-used instruments
- **Portals for theoretical astrophysics jobs:**
 - configuration and execution
 - monitoring
 - result retrieval and initial analysis and display



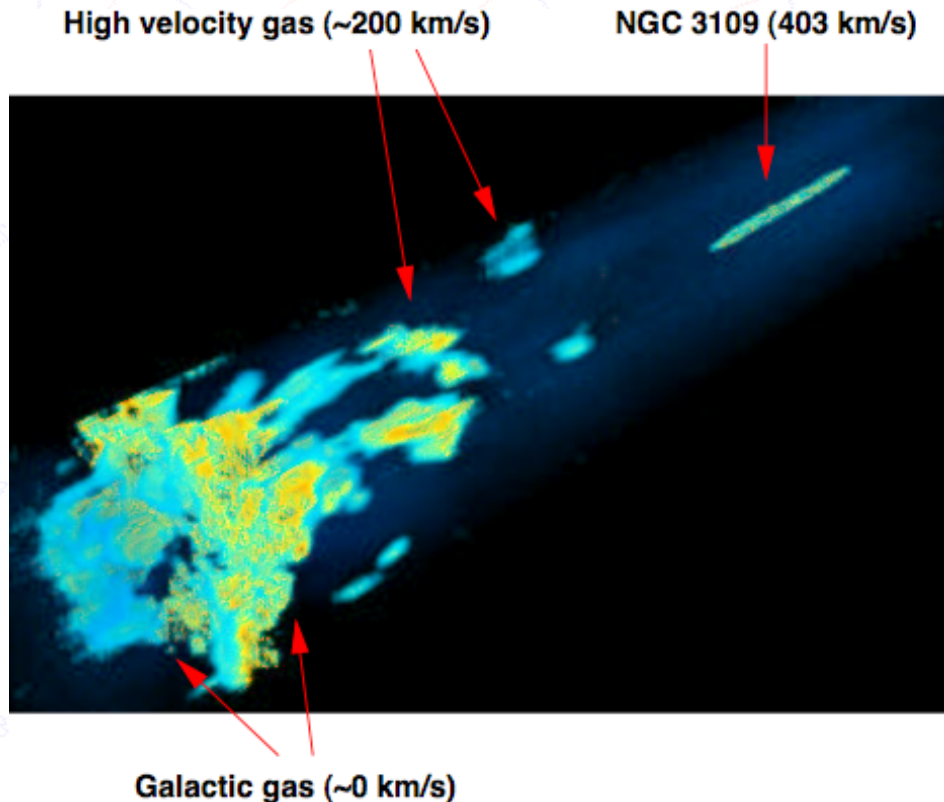
Niche role: visualisation

- A **web-based canvas** for AIPS++ display apps to be deployed as **Web-Service and Grid-Service Java Applets**. Using CORBA & JAVA.
- AIPS++ is modern, OpenSource software for reducing (radio) astronomy data, 1.6M lines of code.



Collaborative role: grid-based volume rendering

- With **AstroGrid** we developed our existing distributed-data volume rendering code into a fully-fledged **Grid-Service**, demonstrated at the IAU 2003 GA.



- render lines of sight through the entire volume - this is volume rendering and may offer new insights to complex data collections, images *and* catalogs.

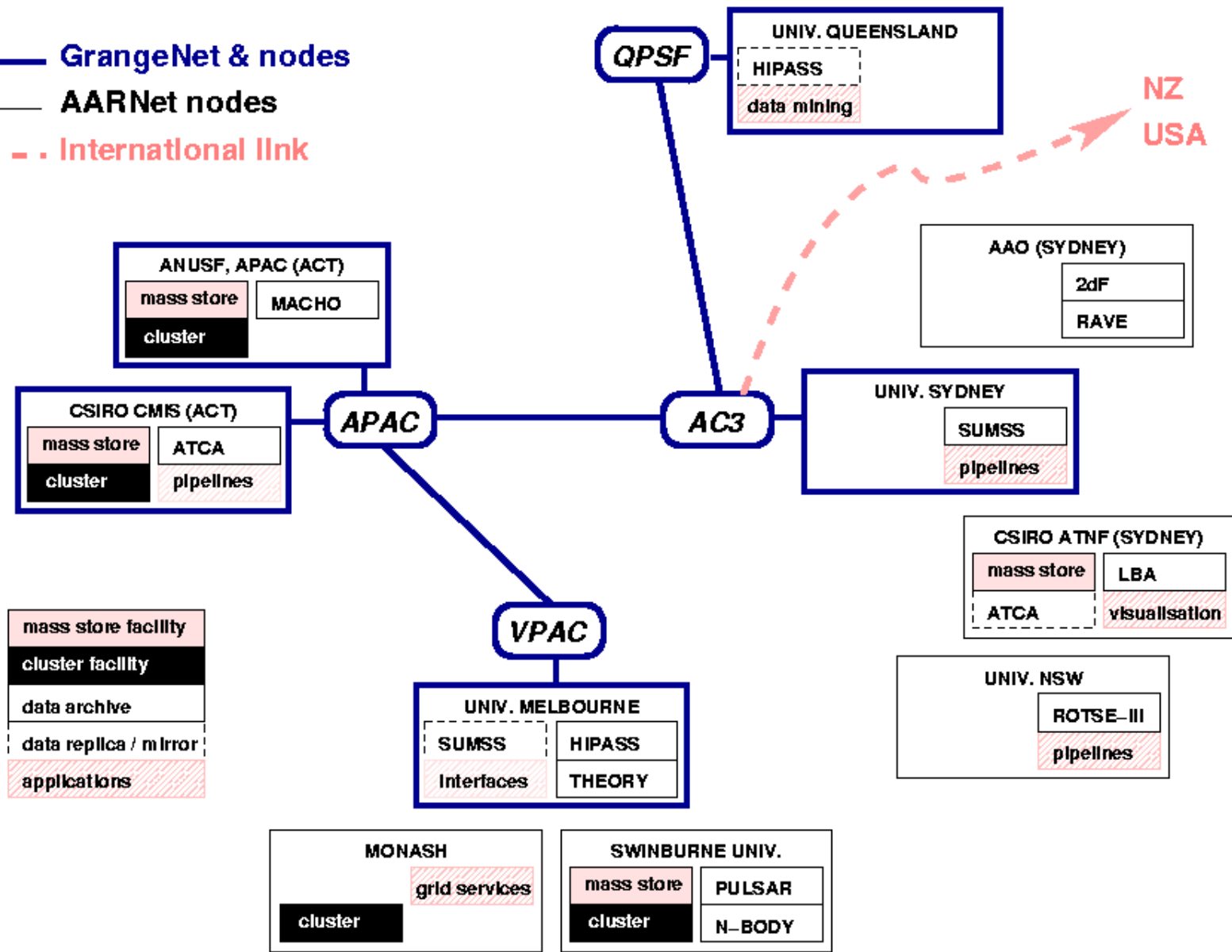


General future challenges & opportunities

- **Data grid**: replica catalogs done properly, **bandwidth** (esp. regional), **certificate authority**, virtual data grids?, ...
- Services for **uploading user codes**: is a sandbox needed?, compiler and library versions, is a cluster needed?
- Grid management - **synchronising** Globus, Tomcat, ... versions, **legacy software**, account names, geographical location, **firewalls**, ... - use MDS?



- GrangeNet & nodes
- AARNet nodes
- - - International link



Declination

185



The Australian Astronomy Grid 2004



Australian Virtual Observatory

Aus-VO home

The Australian Virtual Observatory

Aus-VO home

Motivation

Function

Reading

Partners

Projects

Personnel

Jobs

Meetings

Paper trail

Links

Aus-VO WIKI

The Australian Virtual Observatory (Aus-VO) will be a facility that provides a distributed, uniform interface to the data archives of Australia's major astronomical observatories.

Aus-VO will be a key component of the International Virtual Observatory, a worldwide facility which will link the archives of the world's major astronomical observatories into one distributed database.

Astronomers will explore Aus-VO and the IVO using advanced data mining and visualisation tools. These tools will exploit a unified data interface to enable cross-correlation and combined processing of data from otherwise disparate sources.

Preliminary work on Aus-VO has been funded for the 2003 calendar year by an Australian Research Council Linkage Infrastructure (Equipment and Facilities) grant. The funded institutions are the Universities of Melbourne and Sydney, the CSIRO Australia Telescope National Facility and the Anglo-Australian Observatory.

This is the primary reference site for Aus-VO. The motivation and function of Aus-VO are described, and some detail is given on specific contributing projects to Aus-VO.

Subscribe now to the [Australian Virtual Observatory e-mail list](#). Leave the subject blank, and include the single word subscribe in the body of the e-mail. You can browse the archives of this list [here](#).

Subscribe now to the IVOA forums at www.ivoa.net.



<http://www.aus-vo.org>

Publishing catalogues: HIPASS and SUMSS



David Barnes, **Brett Beeson**,
Travis Stenborg and Michael Lancaster
The University of Melbourne



a learning experience

VOTable standard

+

ConeSearch standard

=

VO compliant catalogue service

- two catalogues: HIPASS and SUMSS
- two approaches: Commercial and in-house
- high-level integration with VOTable “consumers”



The HI Parkes All Sky Survey

- Parkes 64m radio telescope in NSW.
- Hyperfine transition of atomic Hydrogen, $\lambda_0=21\text{cm}$.
- 280 days over 4 years; 40 observers; 1000GB raw data.
- 400 image “cubes” searched by computer for significant signals.
- 30000+ potential detections examined by three HI observers





The Catalogue

Pre-computed MPEG movie

- **4,300 galaxies**
- Mostly spiral disk galaxies
- HI mass
- Redshift
- Kinematic data
- Large scale structure
- Galaxy HI mass function

QuickTime™ and a YUV420 codec decompressor are needed to see this picture.

“Interactive model”



[HIPASS VRML model](#)



Meyer et al., 2004
Zwaan et al., 2004

commercial: IBM Lotus (Domino) Notes

- Domino R6 backend database
 - database access
 - web server for remote browsing
- Lotus clients
 - Designer: client to create interface/s
 - Notes: client for local browsing
- HIPASS catalogue (HICAT)
 - 4300 sources, 172 parameters
 - 32 assigned UCDs and queryable



domino: applet view

HIPASS Catalogue

[HICAT view](#)

[UCD view](#)

[Generate VOTable](#)

[Search](#)

[Conesearch](#)

[Options](#)

ID	Detection number	HIPASS name	RA	Dec
1	11	HIPASSJ015613-891849_02426	01:56:13.1	-89:18:49.1
2	7	HIPASSJ230801-890638_02503	23:08:01.3	-89:06:38.3
3	2	HIPASSJ085425-880359_04900	08:54:24.7	-88:03:59.0
4	13	HIPASSJ143016-874845_02234	14:30:16.5	-87:48:45.0
5	12	HIPASSJ153308-872611_02269	15:33:07.6	-87:26:11.1
6	10	HIPASSJ171201-872335_02297	17:12:01.1	-87:23:35.1
7	5	HIPASSJ050248-870208_01750	05:02:47.8	-87:02:08.0
8	3	HIPASSJ060430-863550_01847	06:04:29.6	-86:35:50.0
10	14	HIPASSJ111435-862015_02169	11:14:35.2	-86:20:15.0
12	4	HIPASSJ051446-861529_01831	05:14:45.6	-86:15:29.0
13	272	HIPASSJ204103-860602_05028	20:41:03.1	-86:06:02.0
14	8	HIPASSJ192960-860052_02426	19:29:59.7	-86:00:52.0
15	1	HIPASSJ095840-854554_01954	09:58:39.7	-85:45:54.0
18	396	HIPASSJ010010-853215_04585	01:00:09.9	-85:32:15.0
20	296	HIPASSJ182114-852148_02535	18:21:13.6	-85:21:48.0
21	304	HIPASSJ173809-851808_02418	17:38:08.7	-85:18:08.0

Done Local intranet



domino: view settings

HIPASS Catalogue

[Submit](#)

Toggle the checkboxes to modify which HIPASS parameters are displayed.

<input checked="" type="checkbox"/>	ID	generic source identifier
<input checked="" type="checkbox"/>	Detection number	alternate source identifier
<input type="checkbox"/>	HIPASS name	HIPASS catalogue source name
<input checked="" type="checkbox"/>	RA	right ascension
<input checked="" type="checkbox"/>	Dec	declination
<input type="checkbox"/>	RA box	right ascension of initial fitted gaussian
<input type="checkbox"/>	Dec box	declination of initial fitted gaussian
<input checked="" type="checkbox"/>	RA ell	right ascension of final fitted gaussian
<input checked="" type="checkbox"/>	Dec ell	declination of final fitted gaussian
<input checked="" type="checkbox"/>	X pix orig	finder script based detection position (image x-axis)
<input checked="" type="checkbox"/>	Y pix orig	finder script based detection position (image y-axis)
<input checked="" type="checkbox"/>	X pix final	final best detection position (image x-axis)

Done Local intranet



domino: VOTable output

```
(Untitled) - Page - Lotus Domino Designer
File Edit View Create Tools Design Text Help
Default Sans Serif 10 B I
< !DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN" >
<html>
<head>
</head>
<body text="#000000">
<?xml version="1.0" encoding="UTF-8"?>
< !DOCTYPE VOTABLE SYSTEM "http://usvo.org/xml/VOTable.dtd" >
  <VOTABLE version="1.0">
    <RESOURCE>
      <TABLE name="HIPASS entries">
        <DESCRIPTION>HIPASS entries</DESCRIPTION>
        <FIELD name="ID" ucd="ID_NUMBER" datatype="int" width="6"/>
        <FIELD name="Detection number" ucd="ID_ALTERNATIVE" datatype="int" width="6"/>
        <FIELD name="HIPASS name" ucd="ID_CATALOG" datatype="char" arraysize="26"/>
        <FIELD name="RA" ucd="POS_EQ_RA_MAIN" unit="deg" datatype="char" arraysize="10"/>
        <FIELD name="Dec" ucd="POS_EQ_DEC_MAIN" unit="deg" datatype="char" arraysize="10"/>
        <FIELD name="RA box" ucd="POS_EQ_RA_BOX" unit="deg" datatype="char" arraysize="12"/>
        <FIELD name="Dec box" ucd="POS_EQ_DEC_BOX" unit="deg" datatype="char" arraysize="12"/>
        <FIELD name="RA ell" ucd="POS_EQ_RA_ELL" unit="deg" datatype="char" arraysize="12"/>
        <FIELD name="Dec ell" ucd="POS_EQ_DEC_ELL" unit="deg" datatype="char" arraysize="13"/>
        <FIELD name="X pix orig" ucd="DATA_XPIX_ORIG" datatype="int" arraysize="3"/>
        <FIELD name="Y pix orig" ucd="DATA_YPIX_ORIG" datatype="int" arraysize="3"/>
        <FIELD name="X pix final" ucd="DATA_XPIX_FINAL" datatype="float" precision="F2"/>
        <FIELD name="Y pix final" ucd="DATA_YPIX_FINAL" datatype="float" precision="F2"/>
        <FIELD name="Vel" ucd="VELOC" datatype="float" precision="F3"/>
        <FIELD name="Vel lo" ucd="VELOC_MIN" datatype="float" precision="F3"/>
        <FIELD name="Vel hi" ucd="VELOC_MAX" datatype="float" precision="F3"/>
        <FIELD name="Vel mask" ucd="VELOC_MINMAX" datatype="char" arraysize="78"/>
        <FIELD name="Vel 50 max" ucd="VELOC_MEAN_FLUX_50MAX" datatype="int" arraysize="10"/>
        <FIELD name="Vel 20 max" ucd="VELOC_MEAN_FLUX_20MAX" datatype="int" arraysize="10"/>
        <FIELD name="Vel 50 min" ucd="VELOC_MEAN_FLUX_50MIN" datatype="int" arraysize="10"/>
        <FIELD name="Vel 20 min" ucd="VELOC_MEAN_FLUX_20MIN" datatype="int" arraysize="10"/>
        <FIELD name="Vel mom" ucd="VELOC_MOMENT" datatype="int" arraysize="10"/>
        <FIELD name="Vel sp" ucd="VELOC_PROFILE_PEAK" datatype="int" arraysize="10"/>
        <FIELD name="Vel pk1" ucd="VELOC_PEAK_LOW_MAX" datatype="int" arraysize="10"/>
        <FIELD name="Vel pk2" ucd="VELOC_PEAK_HIGH_MAX" datatype="int" arraysize="10"/>
        <FIELD name="Width 20 min" ucd="VELOC_DIFF_FLUX_20MIN" datatype="int" arraysize="9"/>
        <FIELD name="Width 50 min" ucd="VELOC_DIFF_FLUX_50MIN" datatype="int" arraysize="9"/>
      </TABLE>
    </RESOURCE>
  </VOTABLE>
</body>
</html>
```



Declination

-89°59'59".45 59".50 59".55 59".55 59".60 59".60 59".65 59".65

in-house:

MySQL + Java + Tomcat

- database stored in MySQL, an open source DB
 - Java API used to access DB
 - Java code to format HTML, VOTable, CSV, ...
 - conforms to ConeSearch protocol
 - Tomcat server to deploy the service
 - HICAT (~4300 sources, 33 columns)
 - SUMSS (~100K sources, 18 columns)
- Declination
- 89°59'59".65



skycat: query form

Australian Virtual Observatory - Astronomical Catalogue Viewer

Submit

Current database: Format of results:

See the 'Help' section for more information about Java Web Start

Help

Results

Displaying 100 of a total of 121 records

POS_EQ_DEC_MAIN	POS_EQ_RA_MAIN	HIPASS_NAME	POS_EQ_RA_MAIN_STR	POS_EQ_DEC_MAIN_ST
-32.920	39.413	HIPASSJ0237-32	02:37:39.0	-32:55:12
-27.403	39.747	HIPASSJ0238-27	02:38:59.2	-27:24:12
-29.686	40.868	HIPASSJ0243-29	02:43:28.3	-29:41:08
-29.009	40.934	HIPASSJ0243-29	02:43:44.1	-29:00:31
-30.273	41.574	HIPASSJ0246-30	02:46:17.7	-30:16:22
-23.338	41.944	HIPASSJ0247-23	02:47:46.5	-23:20:17
-36.592	42.209	HIPASSJ0248-36	02:48:50.2	-36:35:30
-31.556	42.209	HIPASSJ0248-31	02:48:50.2	-31:33:23
-30.983	42.430	HIPASSJ0249-30	02:49:43.2	-30:58:58
-33.349	42.974	HIPASSJ0251-33	02:51:53.7	-33:20:58
-32.894	43.193	HIPASSJ0252-32	02:52:46.4	-32:53:38
-26.517	43.389	HIPASSJ0253-26	02:53:33.4	-26:31:00

Define Cone

RA:
Dec:
Radius:

Aus-VO

skcat: votable output

This XML file does not appear to have any style information associated with it. The document tree is shown below.

```
-<VOTABLE>
-<DESCRIPTION>
  Created by SkyCat, Australian Virtual Observatory (http://www.aus-vo.org)
</DESCRIPTION>
-<RESOURCE>
  -<TABLE name="Skycat Data">
    <FIELDID="POS_EQ_DEC_MAIN" unit="degrees" datatype="double" name="POS_EQ_DEC_MAIN"
    ucd="POS_EQ_DEC_MAIN"/>
    <FIELDID="POS_EQ_RA_MAIN" unit="degrees" datatype="double" name="POS_EQ_RA_MAIN"
    ucd="POS_EQ_RA_MAIN"/>
    <FIELDID="HIPASS_NAME" datatype="char" name="HIPASS_NAME" ucd="MOSAIC_NAME"/>
    <FIELDID="POS_EQ_RA_MAIN_STR" unit="hrs" datatype="char" name="POS_EQ_RA_MAIN_STR"
    ucd="NOTE"/>
    <FIELDID="POS_EQ_DEC_MAIN_STR" unit="deg" datatype="char"
    name="POS_EQ_DEC_MAIN_STR" ucd="NOTE"/>
    <FIELDID="VEL_50_MAX" unit="kms-1" datatype="double" name="VEL_50_MAX"
    ucd="VELOC_MEAN"/>
    <FIELDID="VEL_50_MIN" unit="kms-1" datatype="double" name="VEL_50_MIN"
    ucd="VELOC_MEAN"/>
    <FIELDID="VEL_20_MAX" unit="kms-1" datatype="double" name="VEL_20_MAX"
    ucd="VELOC_MEAN"/>
    <FIELDID="VEL_20_MIN" unit="kms-1" datatype="double" name="VEL_20_MIN"
    ucd="VELOC_MEAN"/>
    <FIELDID="VEL_MON" unit="kms-1" datatype="double" name="VEL_MON" ucd="VELOC_MEAN"/>
    <FIELDID="VEL_SP" unit="kms-1" datatype="double" name="VEL_SP" ucd="VELOC_MEAN"/>
    <FIELDID="VEL_GSR" unit="kms-1" datatype="double" name="VEL_GSR" ucd="VELOC_MEAN"/>
    <FIELDID="VEL_LG" unit="kms-1" datatype="double" name="VEL_LG" ucd="VELOC_MEAN"/>
    <FIELDID="VEL_CMR" unit="kms-1" datatype="double" name="VEL_CMR" ucd="VELOC_MEAN"/>
```



Declination

58°55

59°55

59°60

59°65

59°70

59°75

59°80

-89°59'59".85

tying things together

- VOTable good, but who has an application which uses it?
- TOPCAT is a Java application from Starlink for viewing and plotting tabular data, including VOTables.
- We have hooked TOPCAT into the output of skycat using Java Web Start technology...
- User can configure their search then drop the result directly into TOPCAT!
- High-level integration of VO services.



TOPCAT: Skycat Data

File Windows Subsets Help

Table Plotter

Data for all rows (121 rows x 22 columns)

	POS_EQ_RA_MAIN	POS_EQ_DEC_MAIN	VEL_50_MAX	VEL_50_MIN	VEL_20_MAX
25					
110					
92					
86					
39					
119					
103					
91					
121					
23					
67					
97					
40					
61					
107					
83					
95					
27					
99					
120					
66					
80					
5					
26					
58					
64					
42					
118					
56					
106					
68					
81					
15					
?					

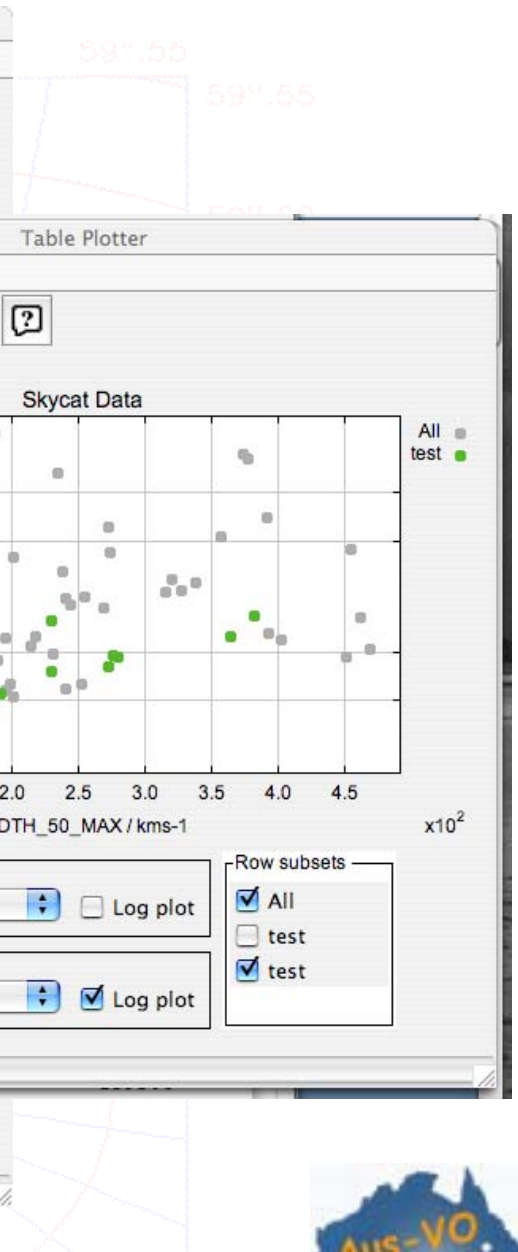
Table Plotter

Skycat Data

Table Plotter

Skycat Data

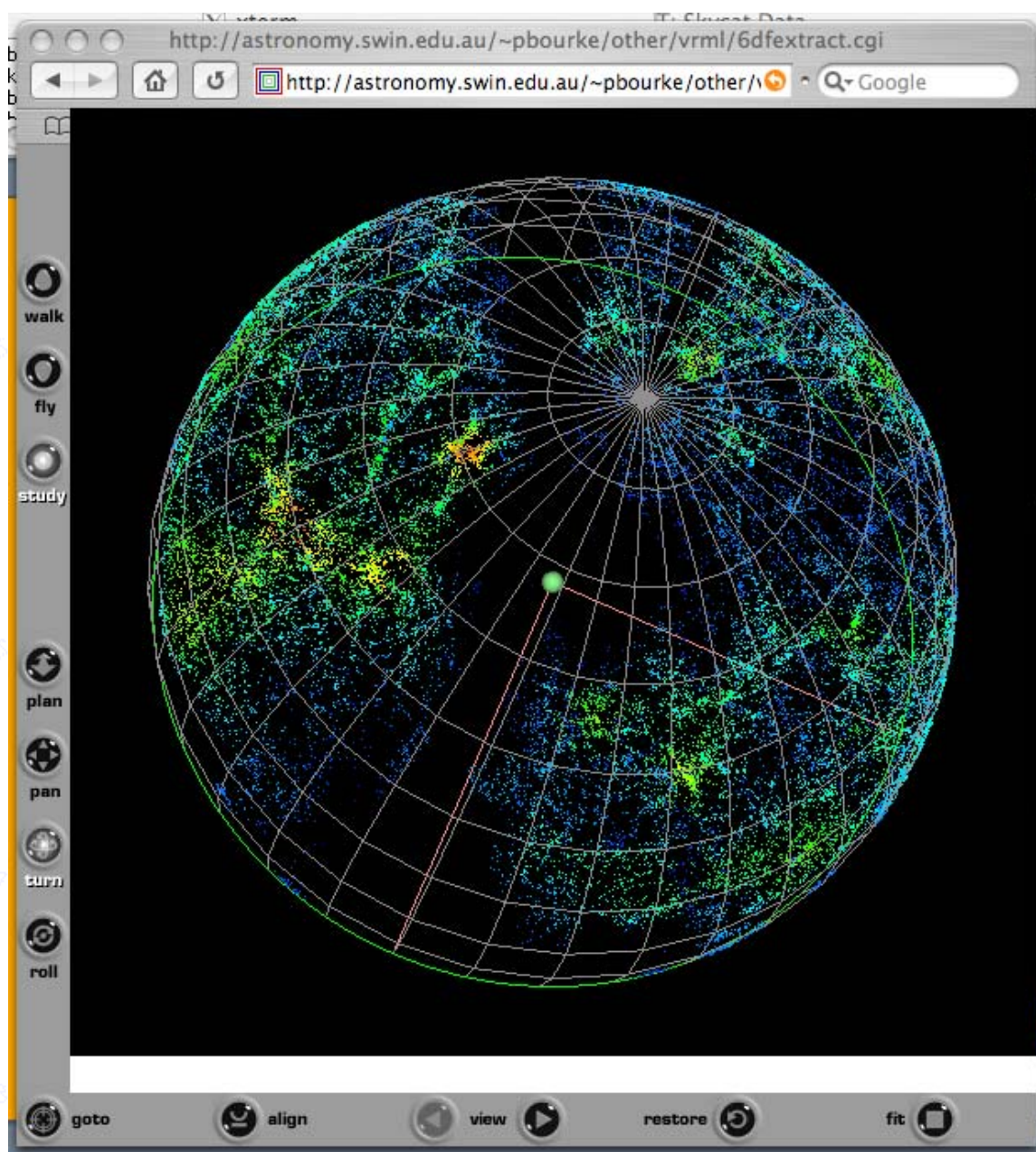
Row Subset: All Sort Column: VEL_MON



visualising VOTables

- VOTable is XML - easily transformed
- VRML is markup language for 3d graphical content
- Components for VOTable to VRML:
 - upload or provide URL to VOTable
 - select columns to map to geometry
 - VRML viewer eg. Cortona, VRMLview, ...
- Paul Bourke's 6dF explorer
- VOTable to VRML web servlet & service

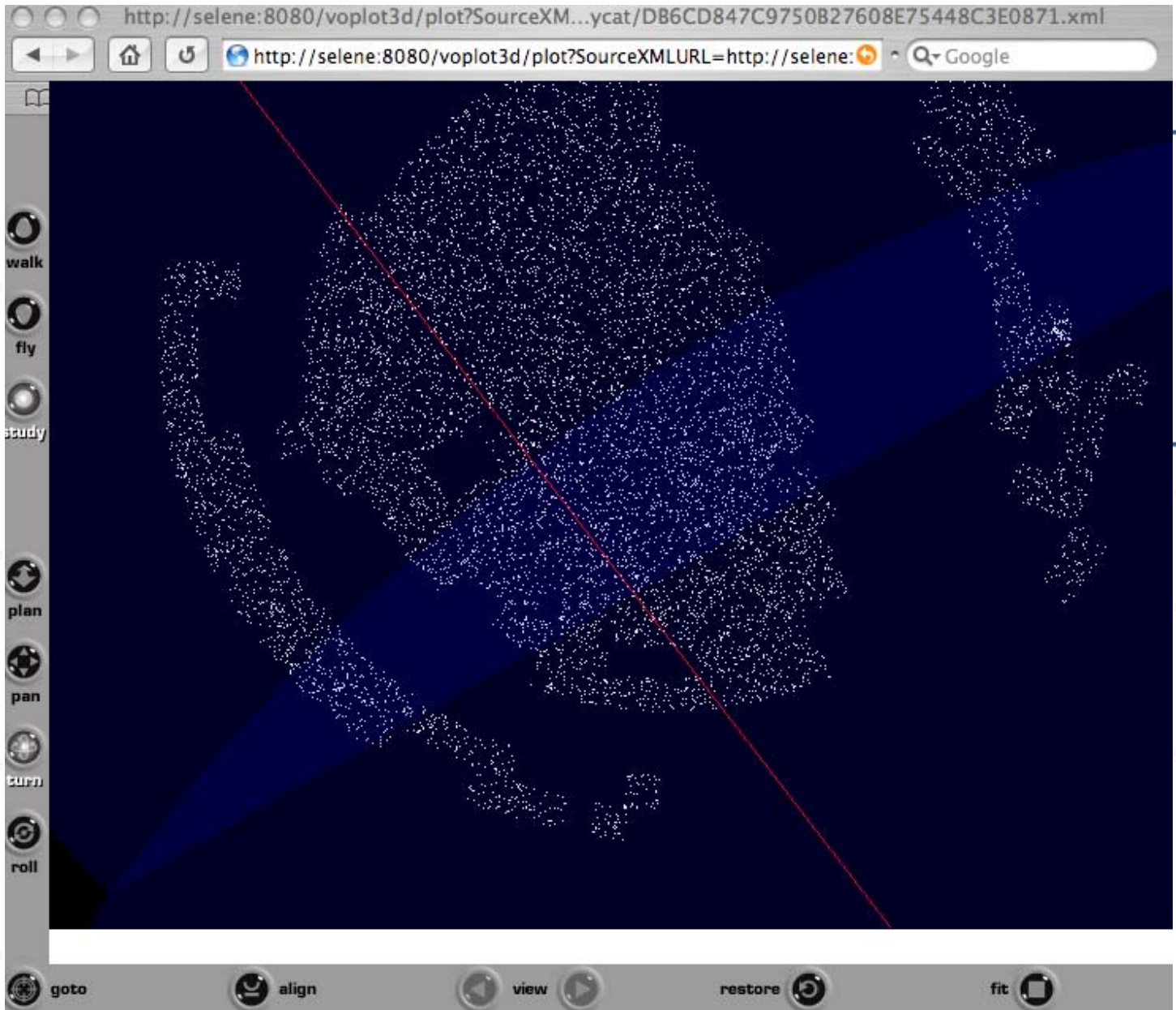




VRML viewer
exploring 6dF
data

Paul Bourke
(Swinburne)





55
 75
 80
 Declination
 $^{\circ}59'59''{.}85$



legacy software: aips++ quantities

iQuant

iQuant quantity conversion utility

units conform

quantity in base units

convert to unit in target units

prefix base SI extended

unit	description	definition
na	nectare	10000 m ²
hp	horsepower	745.7 m ² .kg.s ⁻³
in	inch	0.0254 m
kn	knot (Imp)	0.514773333333 m.s ⁻¹
lambda	lambda	1 _
lb	pound (avoirdupois)	0.45359237 kg
ly	light year	9.46073047e+15 m



Astrophysics on the Grid

- MHD portal with Zeus3D
- Brett Beeson
- Collaborators
 - David Barnes (VO)
 - Andrew Melatos (MHD)
 - Slavisa Garic (NimrodG)
 - Astrogrid (MySpace)



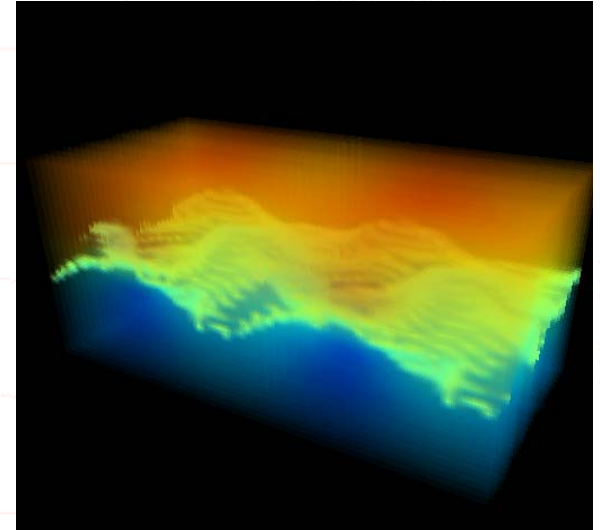
Astrophysics and the VO

- Synthetic telescopes.
 - “convolve” simulations to compare statistically with observations.
- Access to pre-computed, high-demand simulation realisations, eg. Virgo data.
- Access to well-described codes for download.
- **Access to well-described codes and HPC resources to run them, storage services to archive results, retrieval, display, analysis, ...**



Zeus Overview

- The Good
 - F77 (language of the Gods)
 - Free for academic use
 - Widely used, flexible
- The Bad
 - F77 (language of the Gods)
 - Complex to build (CPP, G77, libraries)
 - Difficult to use, easy to break

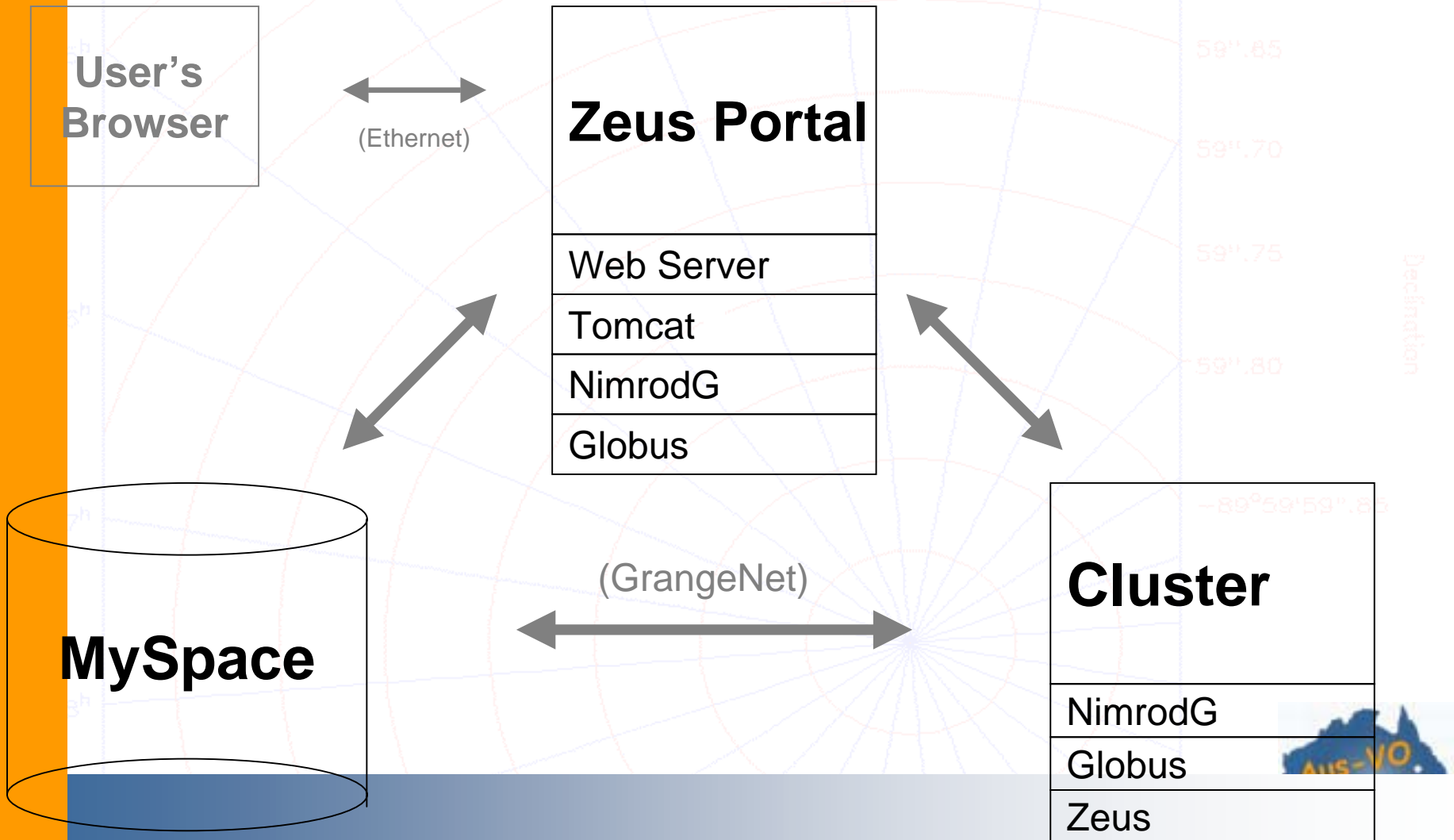


Portal Overview

- Make Zeus3D available to researchers
 - Use **Grid** to distribute computation
 - **Visualise** results quickly
- Explore **integration** of existing components.
 - Globus, MySpace, Tomcat, NimRod
- Demonstrator of theory on the VO, it is a **prototype!**
- Have decide to adopt **GridSphere** and work with Experimental Particle Physics group
- In future expand to include multiple codes, output formats, ...



System Overview



MHD Setup

Zeus Portal
Welcome, Demo User

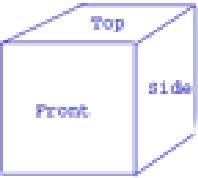
Simulation Type

Jet Self gravity

Simulation Parameters

Viscosity	from	<input type="text"/>	step <input type="text"/>
Gravity	from	<input type="text"/>	step <input type="text"/>
Mag Field	from	<input type="text"/>	step <input type="text"/>

Initial Conditions



Scheduling

[Experiments](#)

- [GoodPlan](#)
- [nimrode](#)
- [bead](#)

[New experiment](#)

[Resource management](#)

[Logout](#)

- Physical parameters
- Initial conditions
- Java for processing
- Interactivity possible

Job Submission

Zeus Portal

Web Server

Tomcat

NimrodG

Globus



Cluster

NimrodG

Globus

Zeus

- NimrodG and Globus
- Dynamic loading
- Robust
- Secure



Job Monitoring

Zeus Portal

Welcome, Demo User

Results

1	2	3	4	Title	Status
■	■	■	■	Zeus Test 1	OK
■	■	■	■	Zeus	Fail
■	■	■	■	Zeus MHD Jet	OK
■	■	■	■	Zeus MHD Shock	OK
■	■	■	■	Zeus MHD Collap	OK
■	■	■	■	Zeus MHD Test 2	Running
■	■	■	■	Zeus MHD	Running
■	■	■	■	Zeus MHD	Running
■	■	■	■	Zeus MHD	Running

Load



[View Results](#)

[Experiments](#)

[GoodPlan](#)

[nimrodo](#)

[bead](#)

[New experiment](#)

[Resource manag](#)

[Logout](#)

- Mid-process monitoring
- Dead jobs restarted
- Monitor across clusters
- **NimrodG provides for parameter sweep**



Results

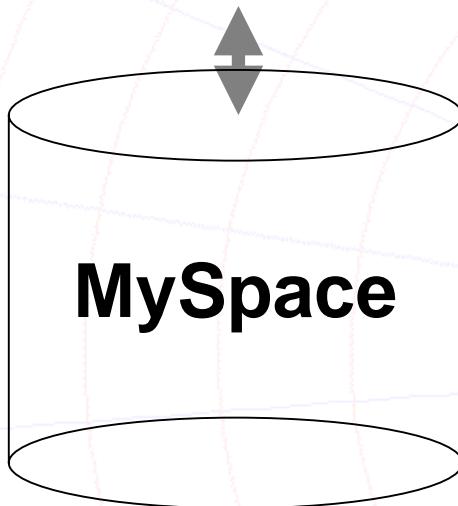
Zeus Portal

Web Server

Tomcat

NimrodG

Globus



- Post Processing
 - Transparent
- Storage
 - MySpace – portal or Astrogrid tools
- Data
 - Statistics, HDF, VOTable
- Visualise
 - Slices
 - Volume render

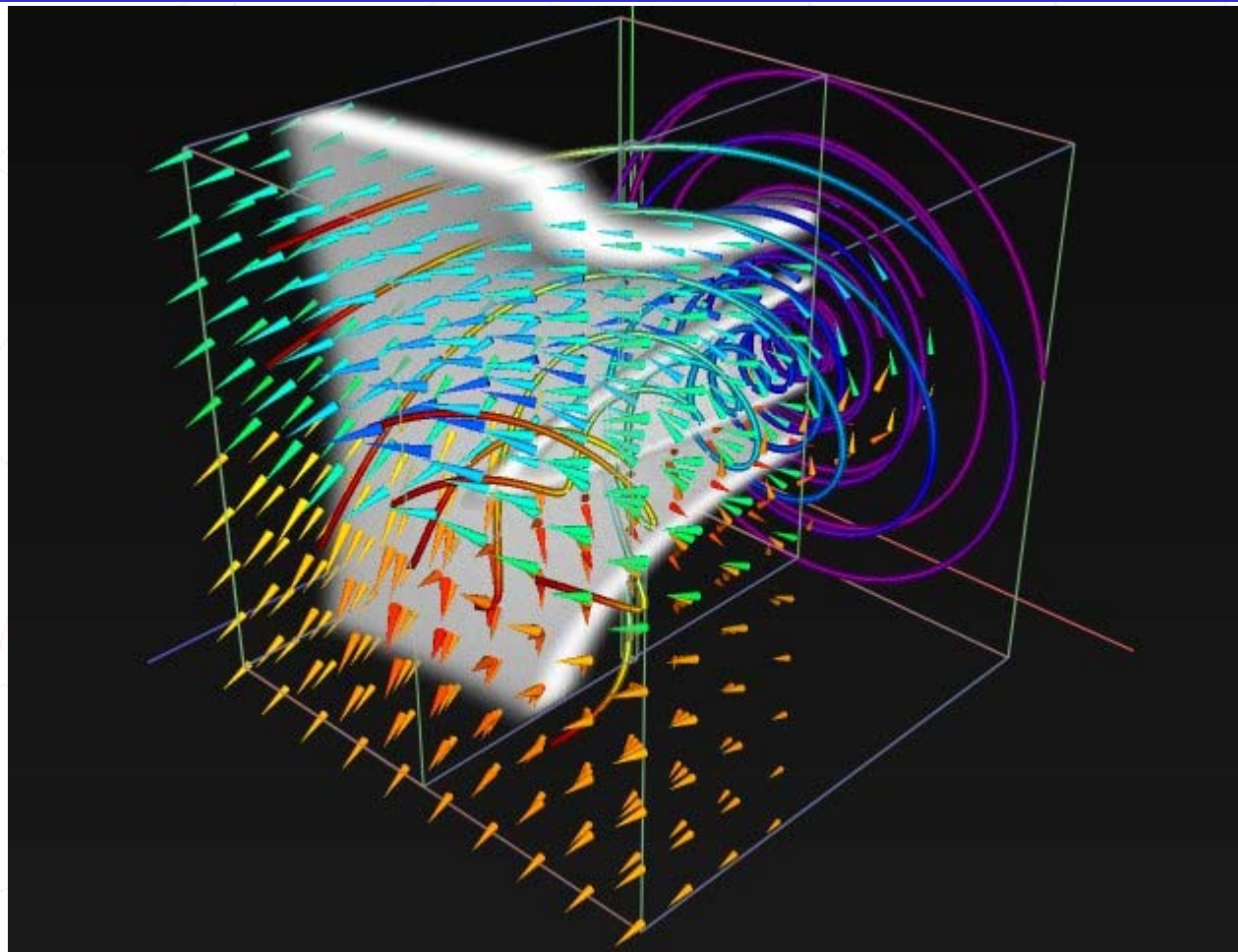


Embedded Visualisation



DVR Rendering

Embedded Visualisation



Declination
9° 65
9° 70
9° 75
9° 80
-89° 59' 59".85

Declination



OGLE Rendering

VO Theory future...

- **Proposal to VPAC** (Victorian Partnership for Advanced Computing) to develop our prototype into a more general service, requesting **AUD80K** in 2004:
 - include many astrophysics codes used in Australia
 - include Experimental Particle Physics analysis
 - describe theory codes with **data models, UCDs, ...**,
 - **boundary and initial conditions**
 - **equations solved or evolved**
 - **input parameters and output data**
 - add further analysis and display tools, eg. VOPlot, VoLume, VOstats service, ...
- **Theory WG in IVOA?**



What I want to do @ CDS...

- import **HICAT** and related catalogues into **CDS/Vizier**
- learn about **UCDs**: past, present and future!
- include **HIPASS spectra** or links in **CDS/Vizier**
- incorporate **HICAT & HIPASS images** in **CDS/Vizier** and/or work on **SIA** for HIPASS images
- review and demo our **Aus-VO skycat** service
- learn how to include **VOPlot** in our Aus-VO skycat service
- review and demo our progress with VOTable to VRML transformations - **VoLume** - and discuss inclusion in **CDS/Vizier**
- discuss potential and requirements for a **CDS mirror** in Australia
- learn about the **Aladin and ACE services** and how we can build them into Aus-VO sites / demos



Find me in room E6 until 11 February 2004...