

# Japanese Virtual Observatory: Recent Progress and Collaboration with NaReGi

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大石雅寿 /

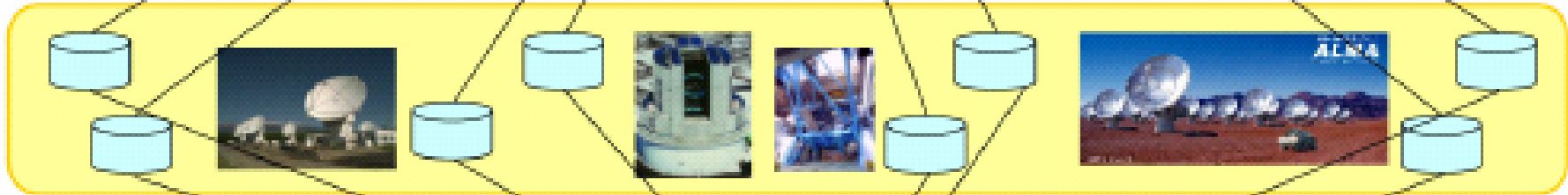
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**Too hard to collect and analyze whole data.  
Need Cat's help**

	Data Rate
Nobeyam Radio Obs.	~ 1 TB/yr
SUBARU telescope	~ 20 TB/yr
ALMA	~ 1 PB/yr



**Accelerate astronomical research, and sufficient time for research itself !!**

**Virtual Observatory**

**Even for educational use**



**Accessible from anywhere at any time**



# Virtual Observatory Architecture

Discover Compute Publish Collaborate

Portals, User Interfaces, Tools

VOPlot DIS SkyQuery Aladin Mirage Topcat conVOT OASIS

Interfaces to data

Registry Services Data Services Compute Services

HTTP Services stateless, registered SOAP Services & self-describing Grid Services & persistent, authenticated

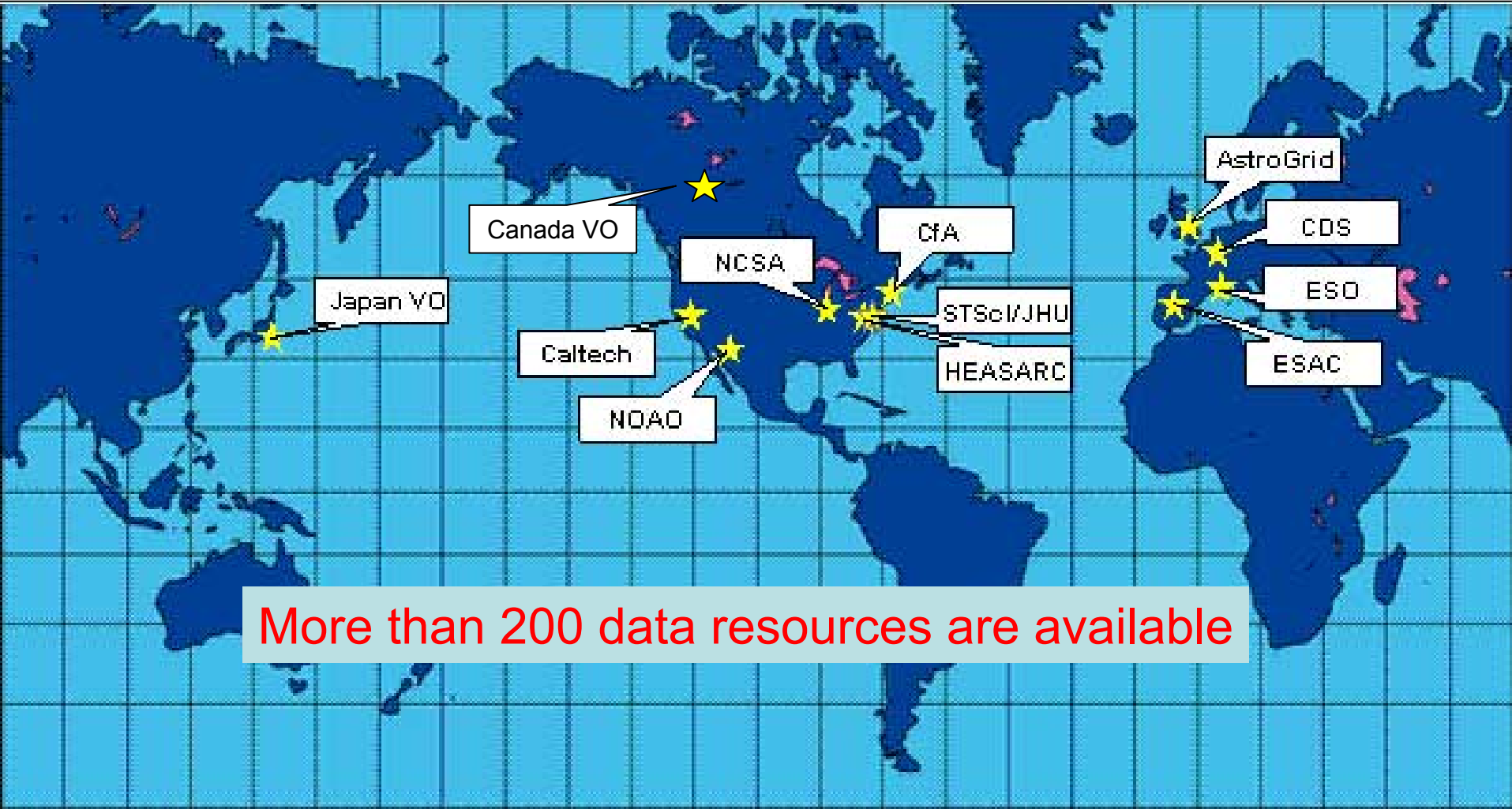
OAI ADS Semantics (UCD) Digital Library Other registries XML, DC, METS  
source detection visualization crossmatch image data mining  
Virtual Data Workflow (pipelines) Authentication & Authorization

Existing Data Centers My Space storage services Grid Middleware SRB, Globus, OGSA SOAP, GridFTP  
Databases, Persistency, Replication

Disks, Tapes, CPUs, Fiber

Bulk Access

# Interconnected VO Data services in the World



More than 200 data resources are available



Mercury  
Venus

Earth

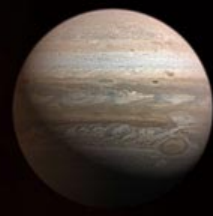
Mars

Jupiter

Saturn

Uranus

Neptune



— “Planets”

Ceres

Pluto

2003 UB<sub>313</sub>

— “Dwarf Planets”



M 100 (NGC 4321)

Ultra-high-sensitivity HDTV I.I. color camera (NHK)  
Exp. 24 sec. (12 frames coadded)

NGC 6543

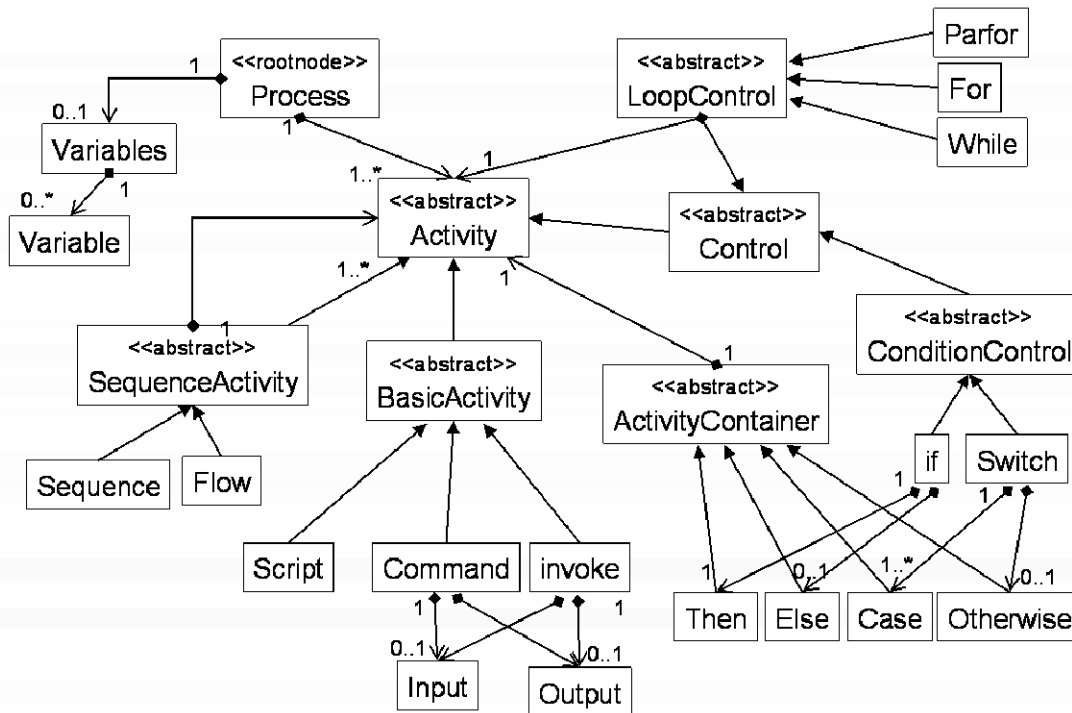
Ultra-high-sensitivity HDTV I.I. color camera (NHK)  
Exp. 1.5 sec. (12 frames coadded) January 17, 1999

IC 434 (Horse-head Nebula)

Ultra-high-sensitivity HDTV I.I. color camera (NHK)  
Exp. 22 sec. (11 frames coadded) January 16, 1999

# Workflow Description Language

## Schema Diagram of Workflow Description Language



## Based on BPEL4WS

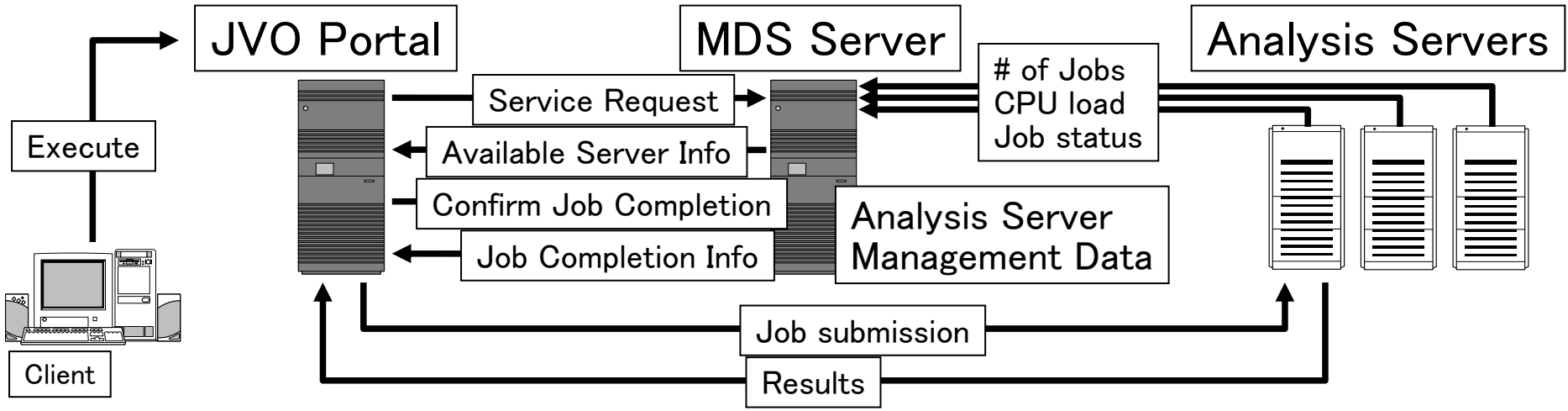
- Variable definition
- Controls (Loop, Condition)
- Parallel execution
- Invoke external services
- Invoke built-in Java Classes



# Management of Multiple Servers

- Data Analysis services under JVO
  - SExtractor (Image → Catalog)
  - HyperZ (Catalog → photometric redshift)
    - In operation on multiple servers

→ Monitor and Discovery Service (MDS) server



Parallel Executions on Multiple Servers are available

# Workflow

[Status](#) | [Registry](#) | [Search](#) | [Workflow](#) | [Result](#) | [Database](#) | [QSO](#) | [DataViewer](#) | [Link](#) | [MemoryMonitor](#) | [Logout](#)

Upload your workflow

Edit workflow

```
<?xml version="1.0" encoding="UTF-8"?>
<Workflow xmlns="http://jvo.nao.ac.jp/workflow/v0.4" xmlns:xsi="http://www.w3.org/2001/XMLSchema-ins
  <!-- ***** -->
  <!-- Search for Brown Dwarf candidates -->
  <!-- 01. Simplest Case -->
  <!-- ***** -->
  <name>SequentialQuery</name>
  <author>M.Tanaka</author>
  <identifier>ivo://jvo.nao.ac.jp/workflow/Y.Shirasaki/SequentialQuery</identifier>
  <create_date>2006/01/22 00:20:00</create_date>
  <update_date>2006/01/22 00:20:00</update_date>
  <description>Query to Mutple Data Services</description>
  <status>wating</status>

  <variables>

    <variable name="query1" type="String">
      <value>SELECT * FROM ivo://cxc.harvard.edu:cda WHERE region = BOX( (83.633212,22.014460), 0.2
    </variable>

    <variable name="query2" type="String">
      <value>SELECT ra, dec, dered_z FROM ivo://jvo/sdss:photoobjall WHERE Region('Circle 20.0
    </variable>
```

```
<command xsi:type="builtin" proc_name="noname" name="executeQuery">
  <activity_status>
    <status>wating</status>
    <elapsed_time>0.0</elapsed_time>
    <log>none</log>
    <error_info>none</error_info>
  </activity_status>
  <input>
    <varRef>query1</varRef>
  </input>
  <output>
    <varRef>result1</varRef>
  </output>
</command>
```

```
<command xsi:type="builtin" proc_name="noname" name="executeQuery">
  <activity_status>
    <status>wating</status>
    <elapsed_time>0.0</elapsed_time>
    <log>none</log>
    <error_info>none</error_info>
  </activity_status>
  <input>
    <varRef>query2</varRef>
  </input>
  <output>
    <varRef>result2</varRef>
  </output>
</command>
```

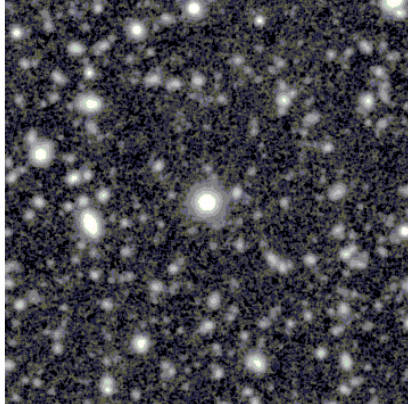
# demonstration

## JVO Workflow system

### Data Viewer

Status | Registry | Search | Workflow | Result | QSO | DataViewer | Usage | Logout

Name	Origin	Scale	Contrast
tmp0	http://jvo.nao.ac.jp/	hist	min = 0.0 max = 0.0 auto = true

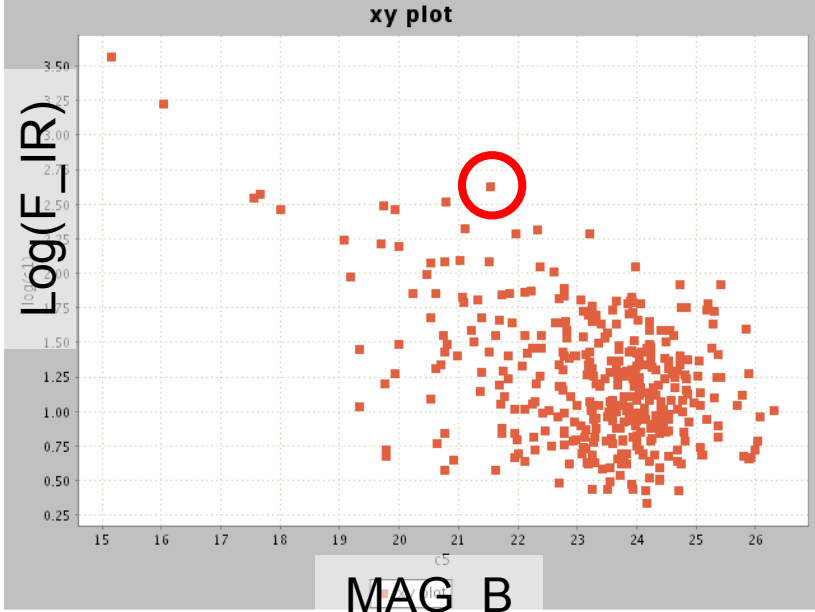


Scale : hist eq  
 Contrast : min = 0.0 max = 0.0  
 VOTable :  
 Overplot

http://jvo.nao.ac.jp - votable-viewer - Mozilla Firefox

X expression: c5  
 Y expression: log(c1)  
 bin number: 20  
 Invert X:   
 Invert Y:

### xy plot



Log(F\_IR)  
 MAG\_B

### VOTable View

Status | Registry | Search | Workflow

Metadata: Display

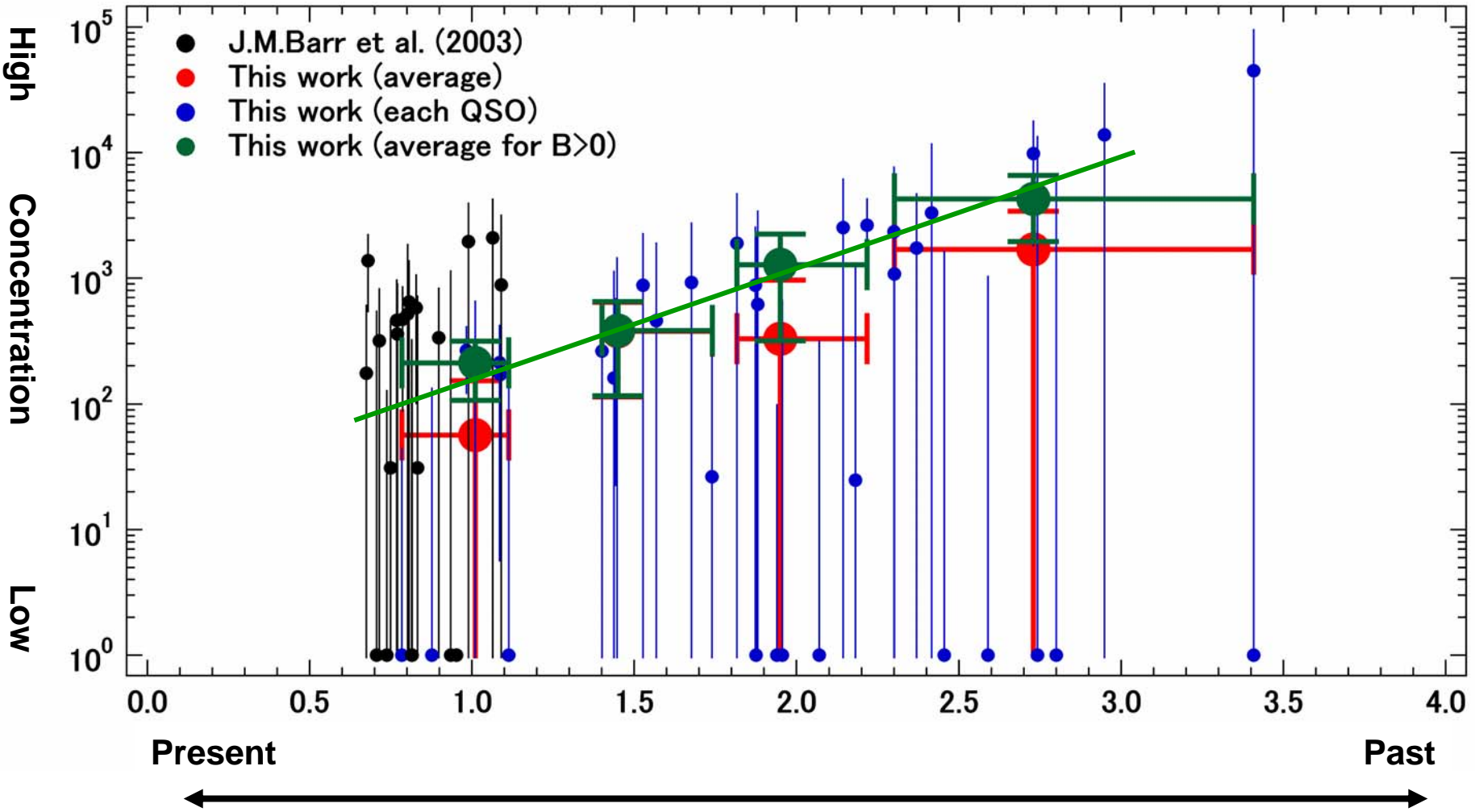
MESSAGE:  
 FROM: 0 MAX: 20 SCROLL: 1  
 SELECT: c0,c1,c2,c3,c4,c5,c6,c7,c8,c9,c10,c11,c12,c13  
 FILTER:  
 ORDER:

data viewer VOPlot Aladin VOPlot VOTable download

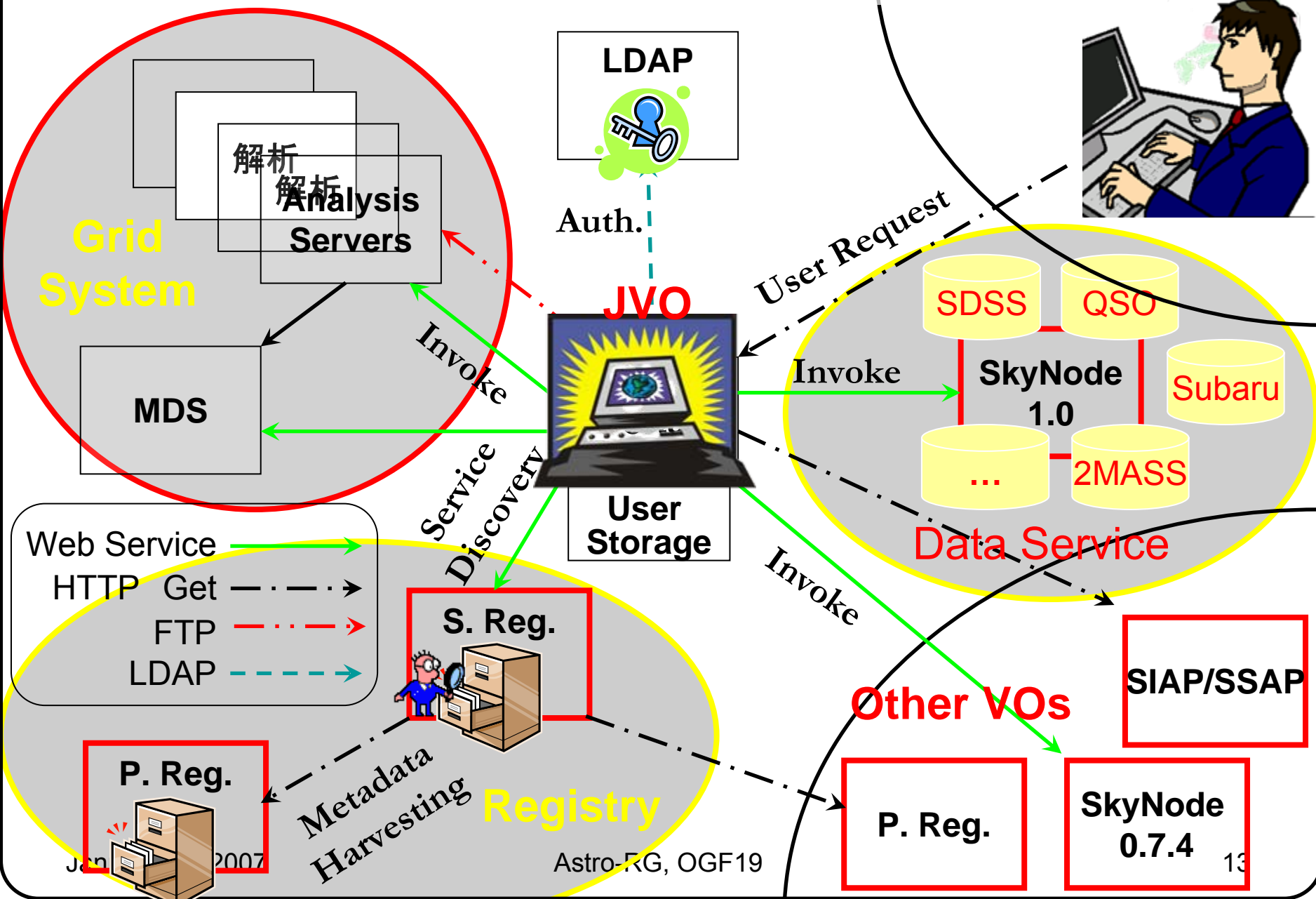
800 records,  
 1 2 3 4 5 6 7 8 9 10

#	Alias Name	C0	C1	C2	C3	C4	C5	C6
	check download	IR.OBJECT	IR.FLUX_ISO_45	IR.RA	IR.DEC	OPT.NUMBER	OPT.MAG_AUTO_B	OPT.MAG_AUTO_C
0	<input type="checkbox"/> Download	SWIRE2_J021648.87-045812.0	3663.32006835938	34.2036514282227	-4.97001981735229	SXDS-RC-088303	15.1500997543335	14.792591
1	<input type="checkbox"/> Download	SWIRE2_J021700.24-050112.7	1676.02001953125	34.2510414123535	-5.02021980285645	SXDS-RC-067315	16.025899887085	15.651801
2	<input checked="" type="checkbox"/> Download	SWIRE2_J021705.98-045953.3	422.559997558594	34.2749404907227	-4.99815988540649	SXDS-RC-092411	21.533899307251	20.075701
3	<input type="checkbox"/> Download	SWIRE2_J021704.82-045409.2	370.059997558594	34.2701187133789	-4.90256977081299	SXDS-RC-125356	17.6541996002197	17.301091

# Study on Environment around QSOs



# Overview of the JVO Portal Service



# Grid Computing



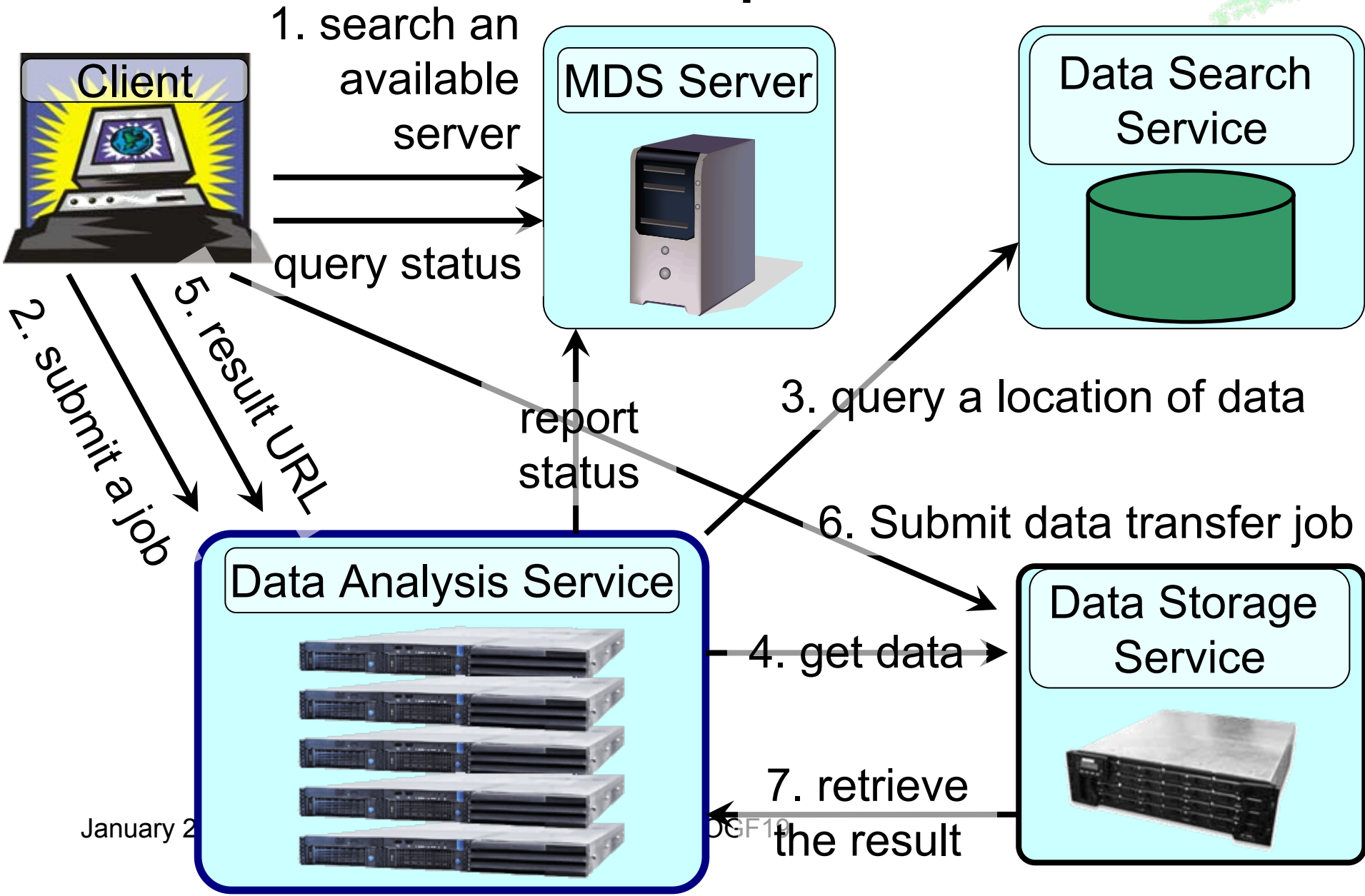
- **Subaru data reduction pipeline system**
  - Web service based GRID
  - Generates calibration data (Super-Flat) for all the SuprimeCam data in a week
  - On-the-fly data reduction with the pre-prepared Super-Flat
  - Users can access to the data reduced with the most recent algorithm
  - Also support the older version of pipeline
- **Backend computing system of the JVO**
  - catalog generation
  - photo-z calculation
  - Image arithmetic
  - ...

# Components of the Grid system



- **Computing resource management**
  - Monitoring and Discovery Service (MDS)
- **Data transfer**
  - FTP or HTTP get
- **Remote Job execution**
  - Web service (Tomcat + AXIS)
- **Authentication**
  - No authentication at resource by resource
- **All the components were developed by ourselves**

# Subaru Grid Pipeline Arch.



– Reduction **10s**  
 (Bias+Flat+Distortion+  
 Astrometry)

– Transfer **30s**

votable-viewer - Mozilla Firefox

ファイル(F) 編集(E) 表示(V) 移動(O) ブックマーク(B) ツール(T) ヘルプ(H)

## VOTable Viewer

Status Registry Search Workflow Result QSO DataViewer Usage Logout

Metadata:

MESSAGE: OK

FROM: 0 MAX: 20 SCROLL: 1

SELECT: c31,c32,c1,c2,c3,c4,c5,c6,c7,c8,c9,c10,c11,c1

FILTER:

ORDER:

<< < << >> > >>

1000records,  
 1 2 3 4 5 6 7 8 9 10

Alias Name	C31	C32	C1	C2	C3	C4	C5		
#	check	download	<input type="button" value="TO.ACCESS_REF_REF"/>	<input type="button" value="TO.ACCESS_REF_REF"/>	<input type="button" value="TO.PAW_ID"/>	<input type="button" value="TO.START"/>	<input type="button" value="TO.XF.TIME"/>	<input type="button" value="TO.FILTER.ID"/>	<input type="button" value="TO.DETECTOR.ID"/>
0	<input type="checkbox"/>	<a href="#">Download</a>	<a href="#">Link</a>	SUPA00134470	2002-09-30 11:11:47.326	900.0	W-J-B	w67c1	
1	<input type="checkbox"/>	<a href="#">Download</a>	<a href="#">Link</a>	SUPA00134480	2002-09-30 11:27:47.082	900.0	W-J-B	w67c1	
2	<input type="checkbox"/>	<a href="#">Download</a>	<a href="#">Link</a>	SUPA00134490	2002-09-30 11:42:44.419	900.0	W-J-B	w67c1	

Aladin v3.7 multiview

Load... Save... Tools... Print... Help... Quit

Position J2000 02:19:05.43 -04:55:01.9 Pixel 8 bits 027 / 255

SUPA00130730.fits SUPA00130730+SUPR0607291038430727.fits

select  
 dist  
 draw  
 tag  
 text  
 filter  
 rgb  
 assoc  
 isamp  
 cont  
 Z  
 zoom  
 mglss  
 pixel  
 prop  
 del

SUPA00130730  
 SUPA00130730

6.85' x 13.47' 6.84' x 13.66'

multiview Dview B1] - SUPA00130730+SUPR0607291038430727.fits - Local file [C:\DOCUME~1\ysh Zoom 1/8x

(c)1999-2006 ULP/CNRS - Centre de Données astronomiques de Strasbourg 2 planes, 2 views, 28Mb

**Data Reduction:**  
 ~24 hours → ~1 hour

# demonstration

## Subaru Grid Pipeline system

# Introduction of the NaReGi middleware into JVO



- NaReGi middleware version  $\beta 1$
- Trial introduction into the Subaru Grid pipeline
  - A part of middleware deployment program by the NII
- Plan to evaluate which components may be used for Virtual Observatories
  - SSO, Apps interface, and so on
- **Interoperability among the Grid middlewares is crucial**



Virtual Observatory Portals, Tools, etc.



IVOA Single-Sign-On, (Data Services,) Application interfaces, Storage service, etc.



Data Servers, Computing Resources, Disks, etc.

