Implementing a VO archive for datacubes of galaxies

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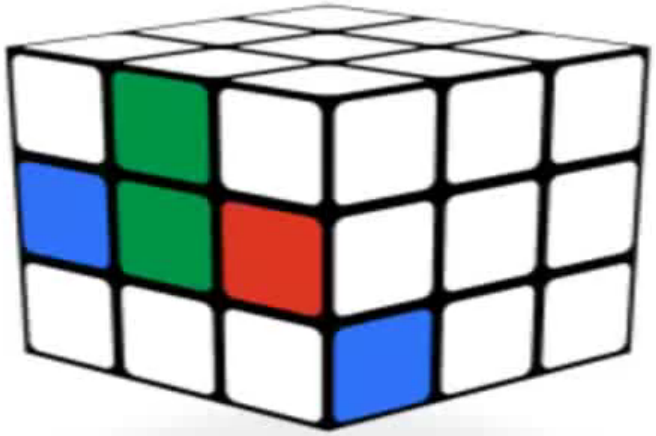
Discovering Cubes

Buscar con Google Voy a tener suerte

Google.es también en: català galego euskara

And doing something…



Buscar con Google Voy a tener suerte

Google.tk también en: English

Collections

SMA B0DEGA
Below 0 Degrees Galaxies

- 30 FITS Files
- Single Object / Single Line Emission
- 2D Spatial + 1D **Velocity** + 1D Polarization
- 12 CO 21 Molecular Transition

WSRT WHISP
Westerbork observations of neutral Hydrogen in Irregular and SPiral galaxies

- 33 FITS Files
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- 2D Spatial + 1D **Frequency** + 1D Polarization
- HI 21cm Transition

Collections

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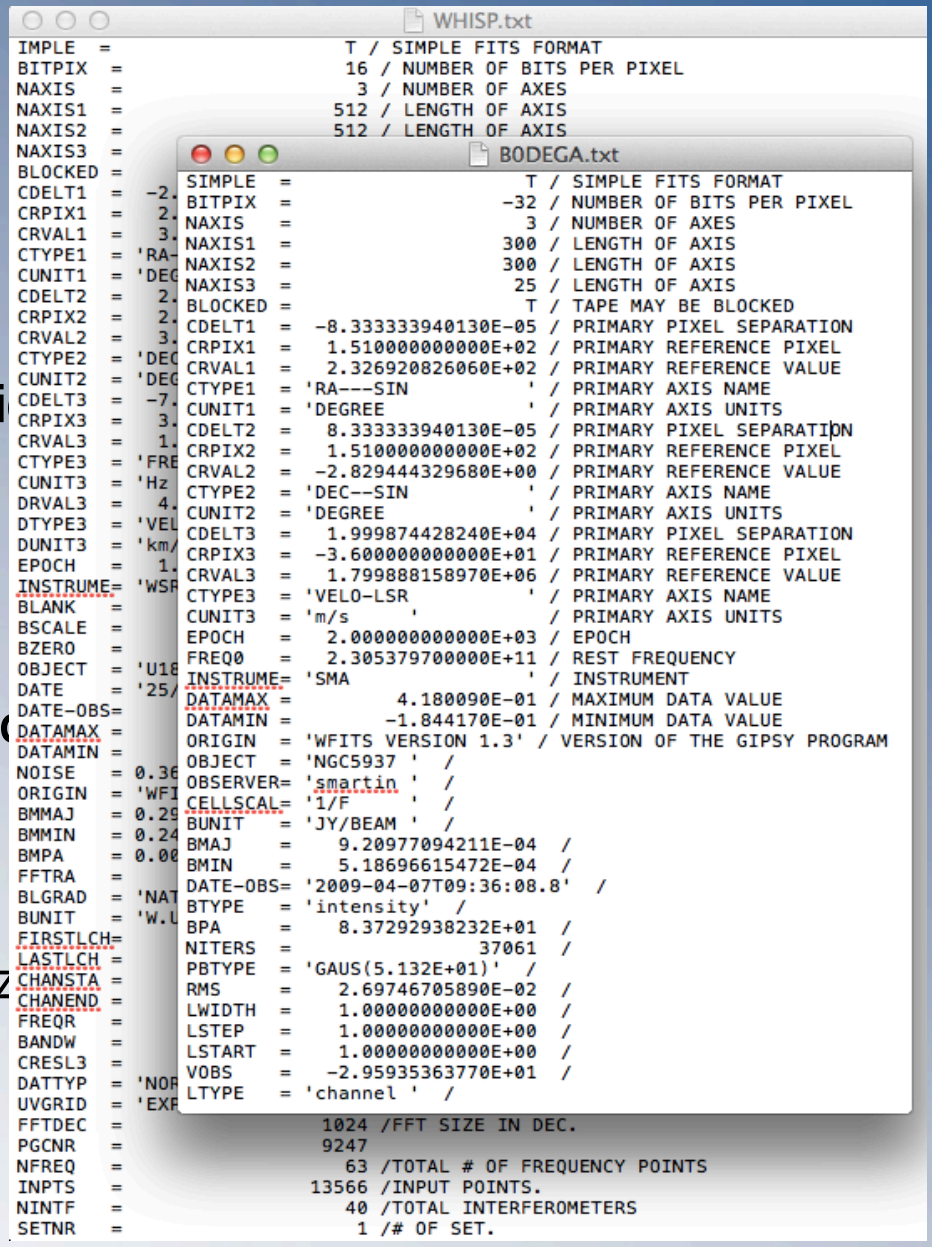
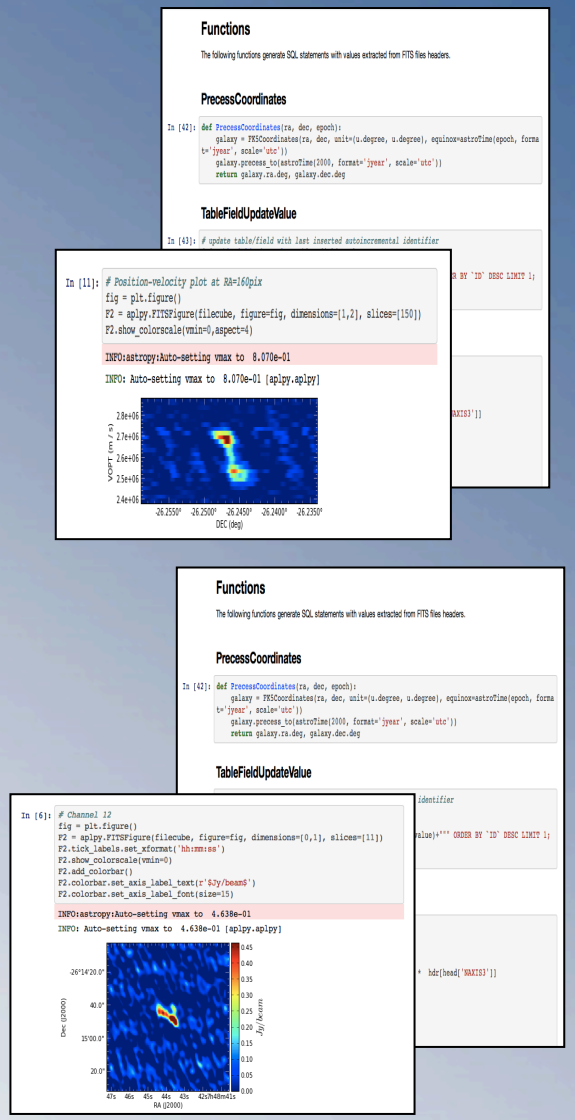


Technologies

- Linux Ubuntu 12.04 LTS Server
- MySQL Community Server
- Apache HTTP Server
- Django Web Framework 1.6

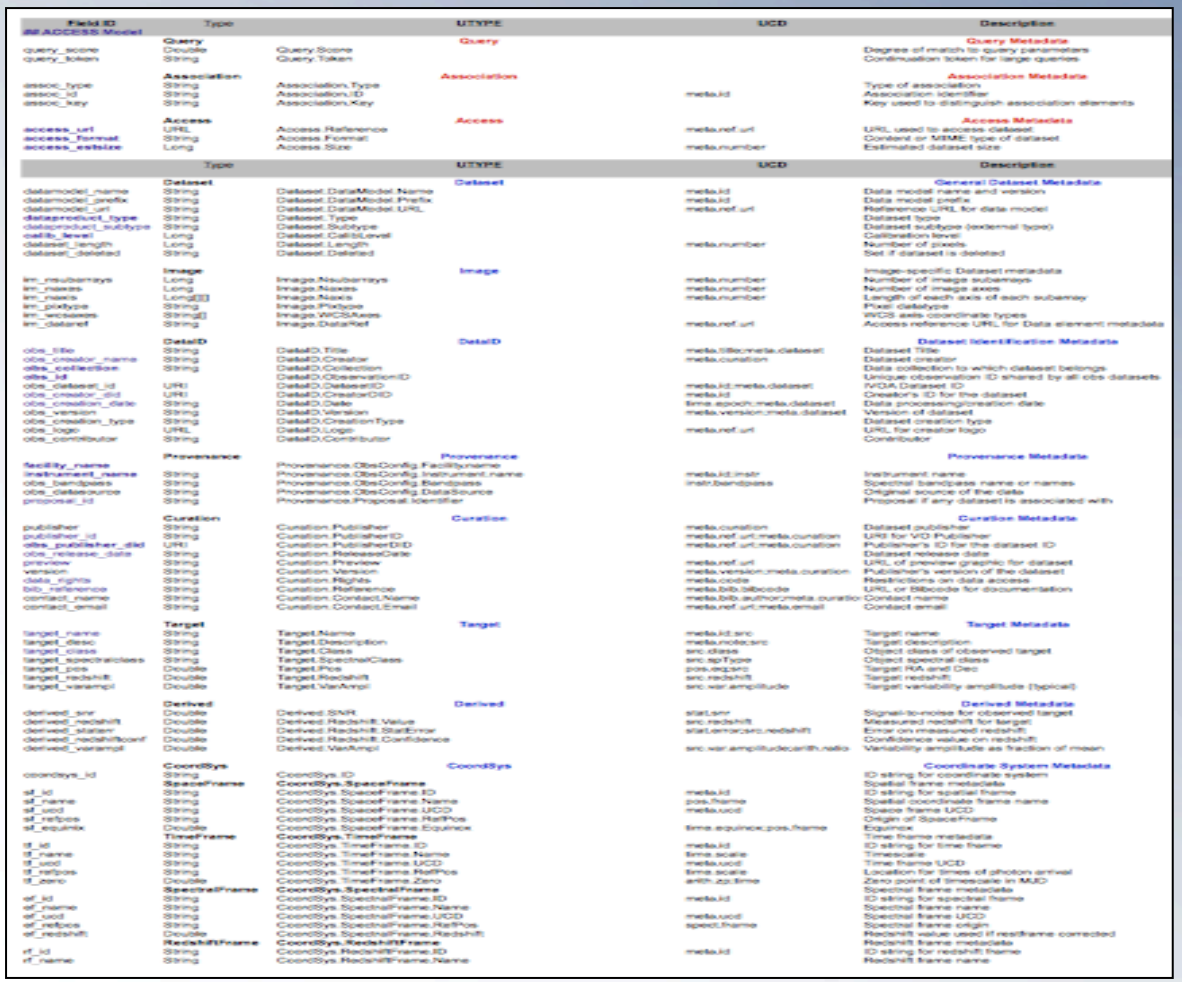
- MySQL Workbench
- **IPython Notebooks Framework**
- Python Libraries and Software
  - Kapteyn Package
  - AstroPy
  - APLPy
  - PVExtractor
  - PySpeckit
  - yt project
- GIPSY

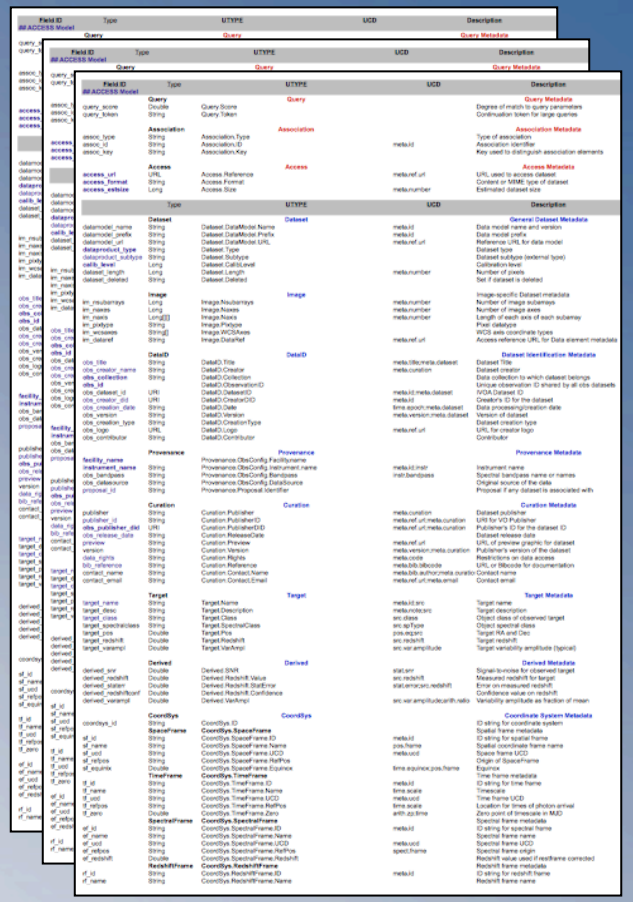


Data Model

Image DM, ObsCore, Spectral DM

FieldID – Type – UType – UCD – Description – FITS Group Name





Data Model

Single-line / Single-object velocity data cubes
Velocity associated to emission line

VelocityAxisName	Name for velocity axis
VelocityAxisUCD	UCD for velocity
VelocityAxisUnit	Unit for velocity
LineName	Name of spectral line
LineRestFrequency	Line rest frequency
VelocityAxisLocation	Central velocity in datacube
VelocityAxisExtent	Velocity axis length
VelocityAxisSupportExtent	Velocity line length
VelocityStart	Start value for measured velocity in line
VelocityStop	Last value for measured velocity in line
VelocityBinSize	Velocity bin size

Better Flux Characterization

FluxAxisName			char	*
FluxAxisUCD			char	*
FluxAxisUnit			char	*
FluxMin	FluxMin	Flux min value	double	
FluxMax	FluxMax	Flux max value	double	
FluxSupportExtent	FluxSupportExtent	Flux dynamic range	double	
FluxLineAxisMax	FluxLineAxisMax	Max value for flux measured for the line	double	
FluxStatError			double	
FluxSysError			double	
FluxCalibration			char	*

Data Model

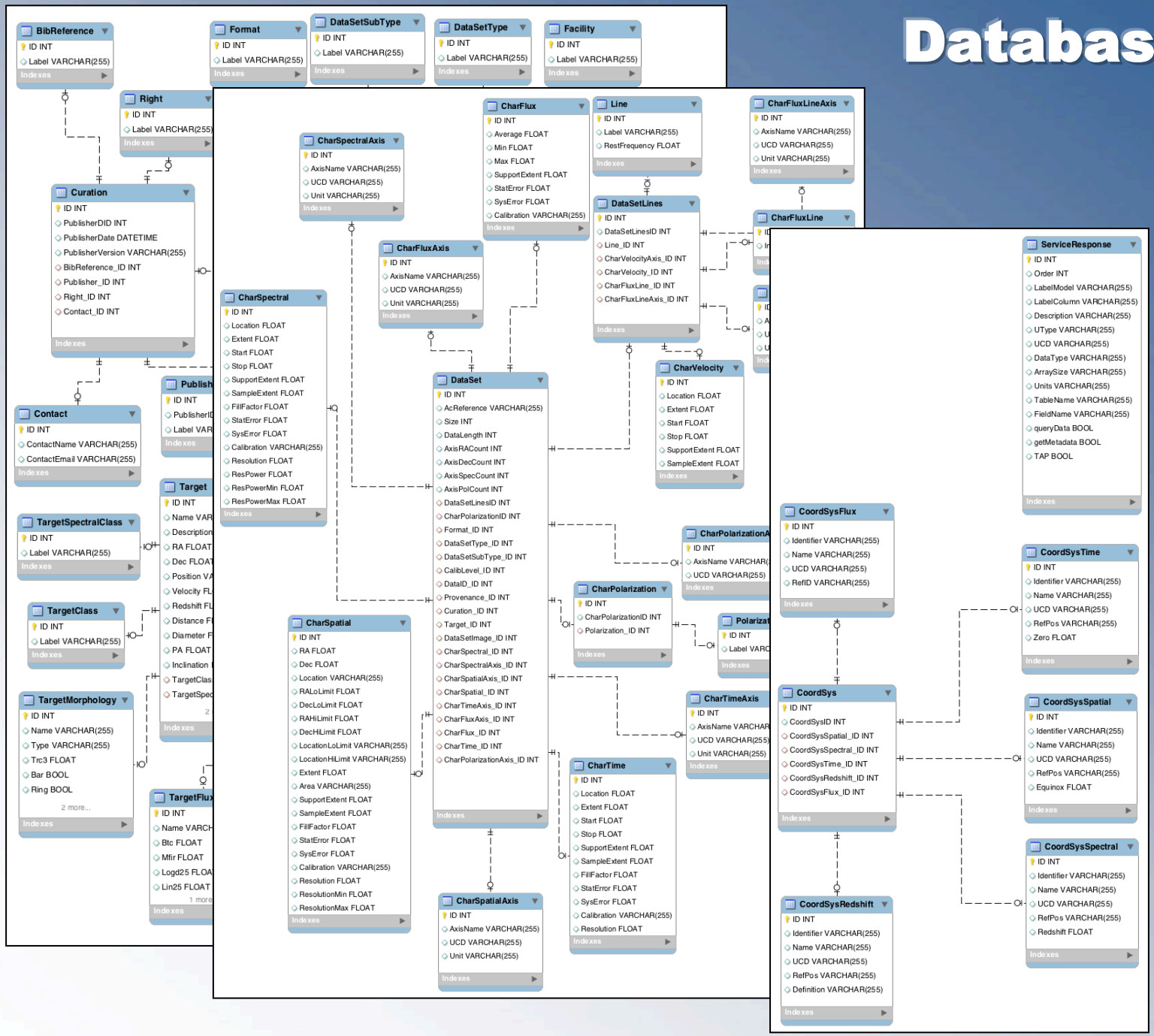
Instrumental and Post processing Provenance

BeamMajorAxis	Major axis (FWHM) of beam (arcsec)
BeamMinorAxis	Minor axis (FWHM) of beam (arcsec)
BeamPositionAngle	Position angle of major axis of beam (N->E)
Tapering	Taper type in cleaning process
OverSampling	Number of pixels considered as spatial resolution for CLEAN
MaximumAngularScale	Maximum angular scale for radiointerferometric observations

Derived properties associated to the Target

DerivedVelocity	Measured velocity for target
DerivedDistance	Derived distance for target
DerivedInclination	Derived inclination for target
TargetPositionAngle	Measured position angle for target
DerivedMorphologyType	Morphology Hubble classification code
DerivedBar	Presence of ring
DerivedRing	Presence of bar
DerivedBTc	Derived corrected bolometric absolute magnitude in B band
DerivedMFIR	Derived absolute magnitude in far infrared
DerivedLogLB	Log of derived total luminosity in solar units for B band

Database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DataSetType
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Facility
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Right
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Curation
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PublisherDate DATETIME
PublisherVersion VARCHAR(255)
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Right_ID INT
Contact_ID INT
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ContactName VARCHAR(255)
ContactEmail VARCHAR(255)
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Label VARCHAR(255)
Indexes
TargetClass
ID INT
Label VARCHAR(255)
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TargetMorphology
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Type VARCHAR(255)
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Ring BOOL
2 more...
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UCD VARCHAR(255)
Unit VARCHAR(255)
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Min FLOAT
Max FLOAT
SupportExtent FLOAT
StatError FLOAT
SysError FLOAT
Calibration VARCHAR(255)
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Line
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Label VARCHAR(255)
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Unit VARCHAR(255)
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Unit VARCHAR(255)
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Start FLOAT
Stop FLOAT
SupportExtent FLOAT
SampleExtent FLOAT
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StatError FLOAT
SysError FLOAT
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AxisDecCount INT
AxisSpecCount INT
AxisPolCount INT
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CharTime_ID INT
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Extent FLOAT
Start FLOAT
Stop FLOAT
SupportExtent FLOAT
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DecLoLimit FLOAT
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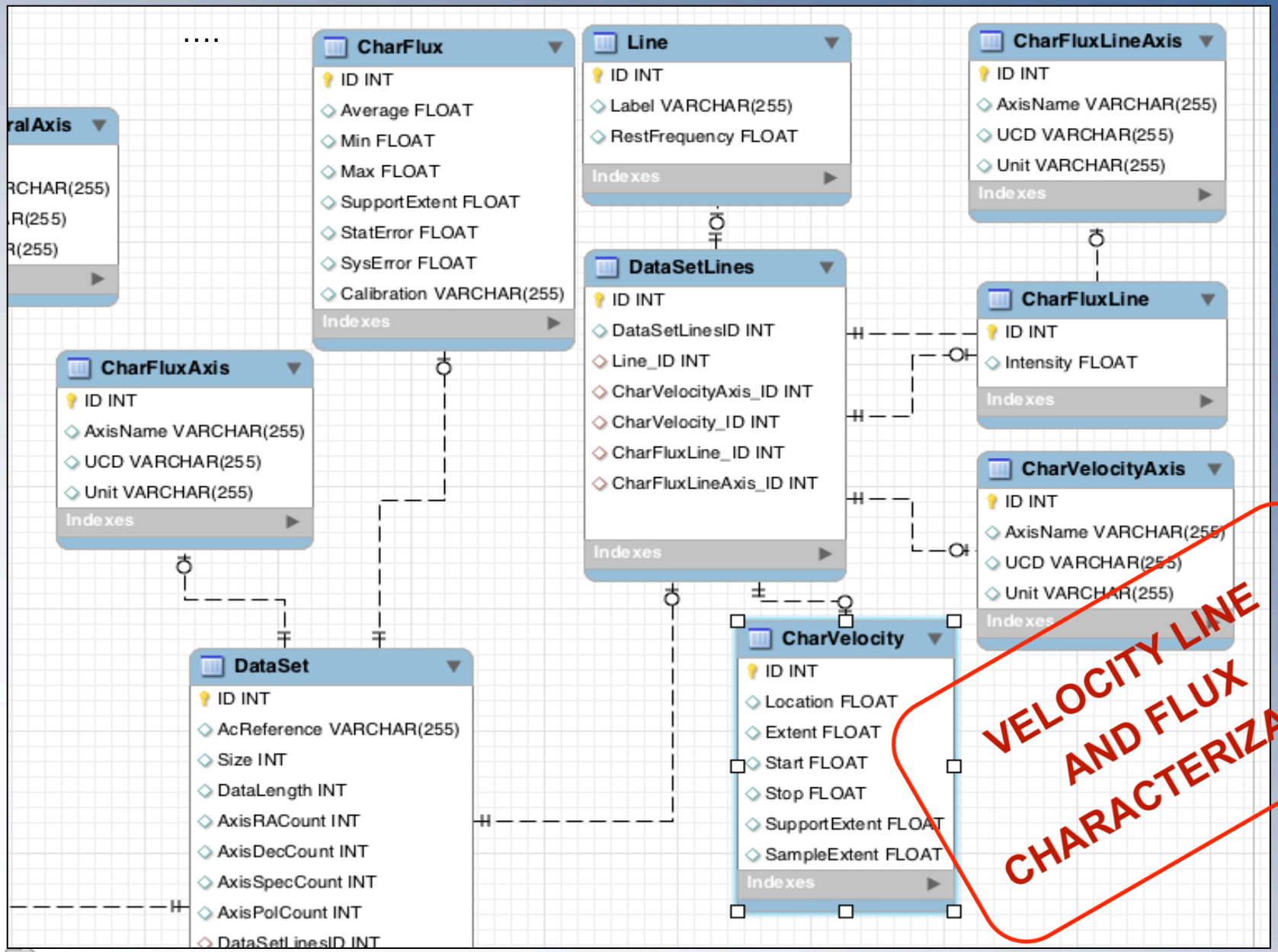
RefPos VARCHAR(255)
Definition VARCHAR(255)
Indexes

Database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Min FLOAT
Max FLOAT
SupportExtent FLOAT
StatError FLOAT
SysError FLOAT
Calibration VARCHAR(255)
Indexes
Line
ID INT
Label VARCHAR(255)
RestFrequency FLOAT
Indexes
CharFluxLineAxis
ID INT
AxisName VARCHAR(255)
UCD VARCHAR(255)
Unit VARCHAR(255)
Indexes
DataSetLines
ID INT
DataSetLinesID INT
Line_ID INT
CharVelocityAxis_ID INT
CharVelocity_ID INT
CharFluxLine_ID INT
CharFluxLineAxis_ID INT
Indexes
CharFluxLine
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Intensity FLOAT
Indexes
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UCD VARCHAR(255)
Unit VARCHAR(255)
Indexes
DataSet
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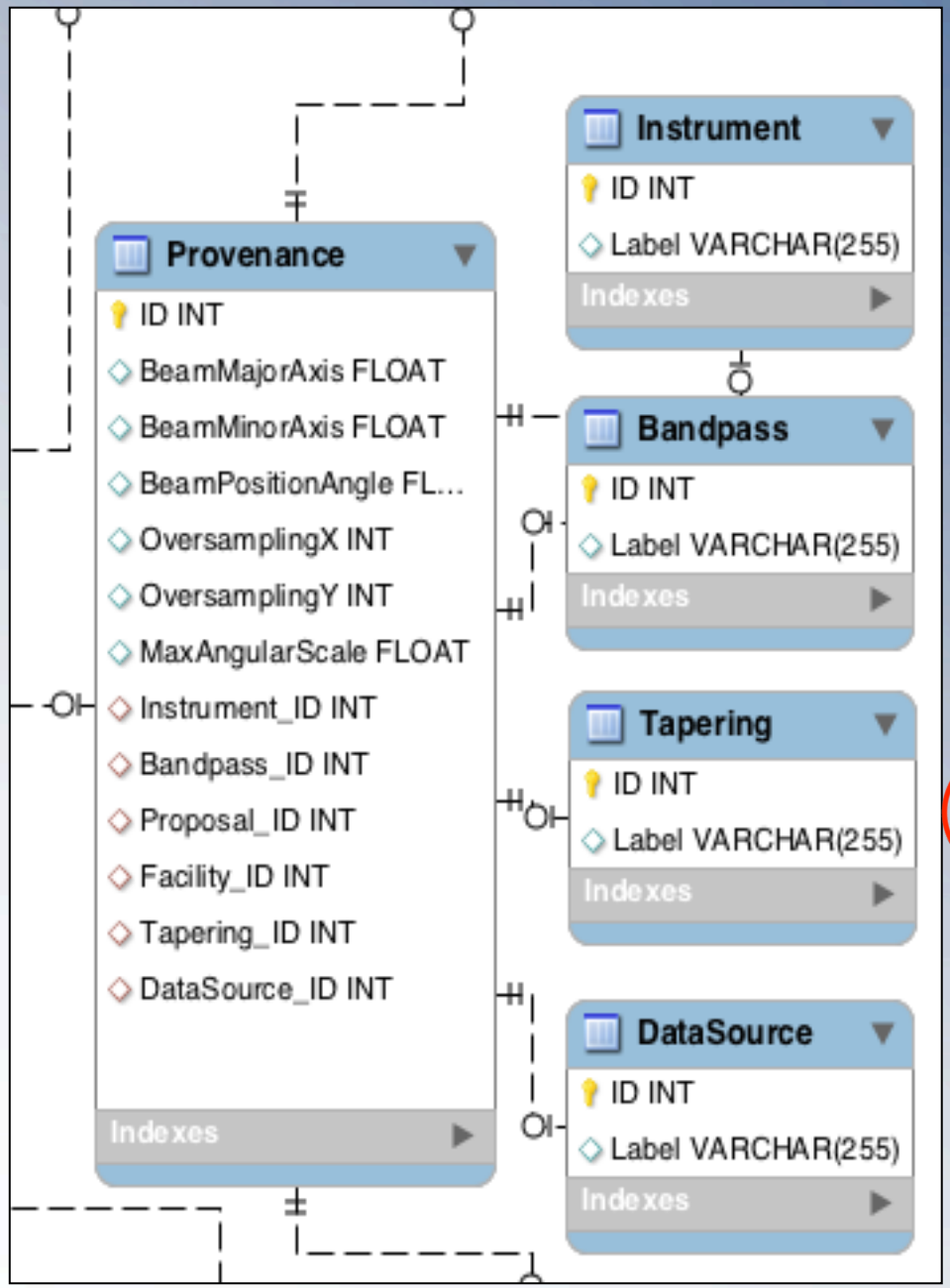
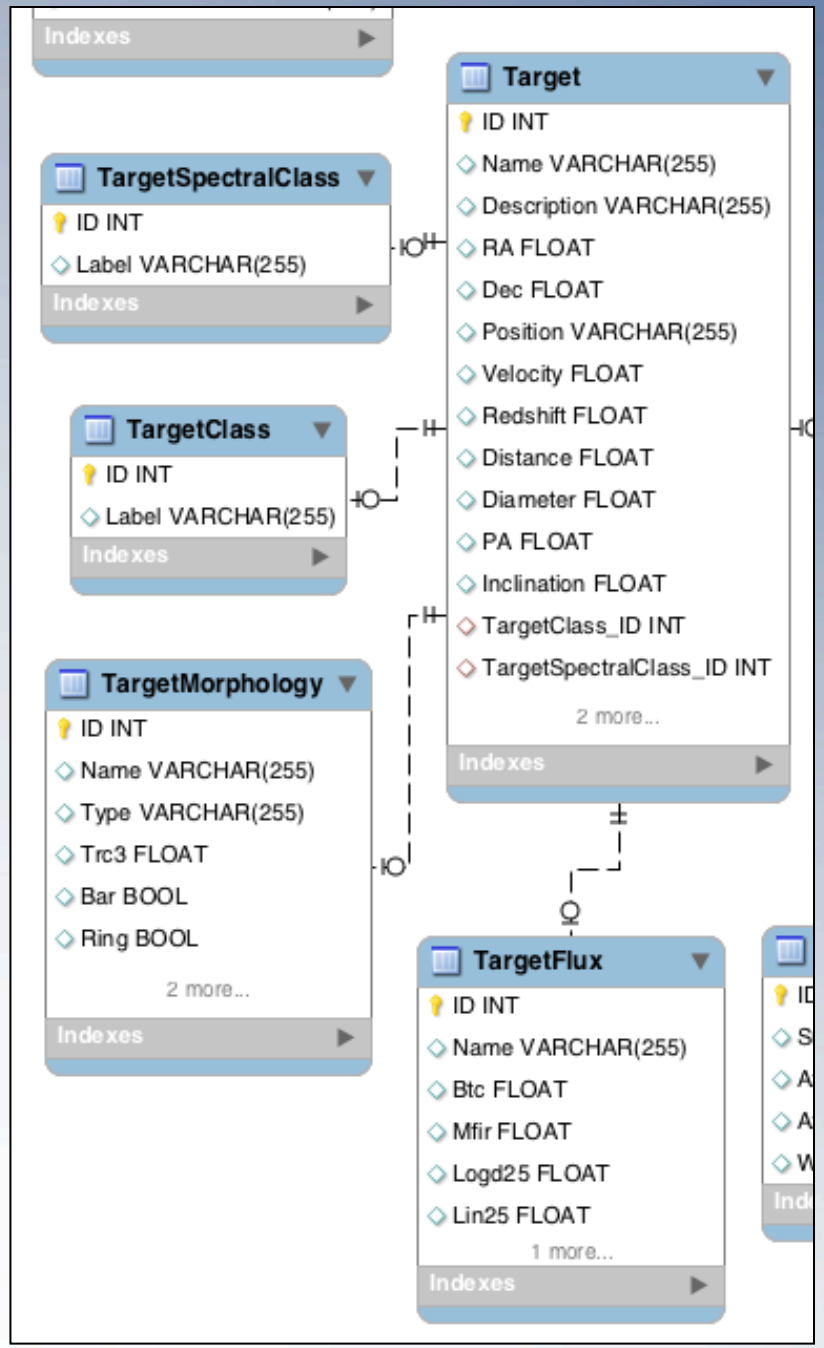
AcReference VARCHAR(255)
Size INT
DataLength INT
AxisRACount INT
AxisDecCount INT
AxisSpecCount INT
AxisPolCount INT
CharVelocity
ID INT
Location FLOAT
Extent FLOAT
Start FLOAT
Stop FLOAT
SupportExtent FLOAT
SampleExtent FLOAT
Indexes
VELOCITY LINE AND FLUX CHARACTERIZATION

Database



INSTRUMENTAL AND POST PROCESSING PROVENANCE

Database



DERIVED TARGET PROPERTIES

Database Filling

IPython Notebook Executable Recipe

Functions

The following functions generate SQL statements with values extracted from FITS files headers.

PrecessCoordinates

```
In [42]: def PrecessCoordinates(ra, dec, epoch):
             galaxy = FK5Coordinates(ra, dec, unit=(u.degree, u.degree), equinox=astroTime(epoch, forma
         t='jyear', scale='utc'))
             galaxy.precess_to(astroTime(2000, format='jyear', scale='utc'))
             return galaxy.ra.deg, galaxy.dec.deg
```

TableFieldUpdateValue

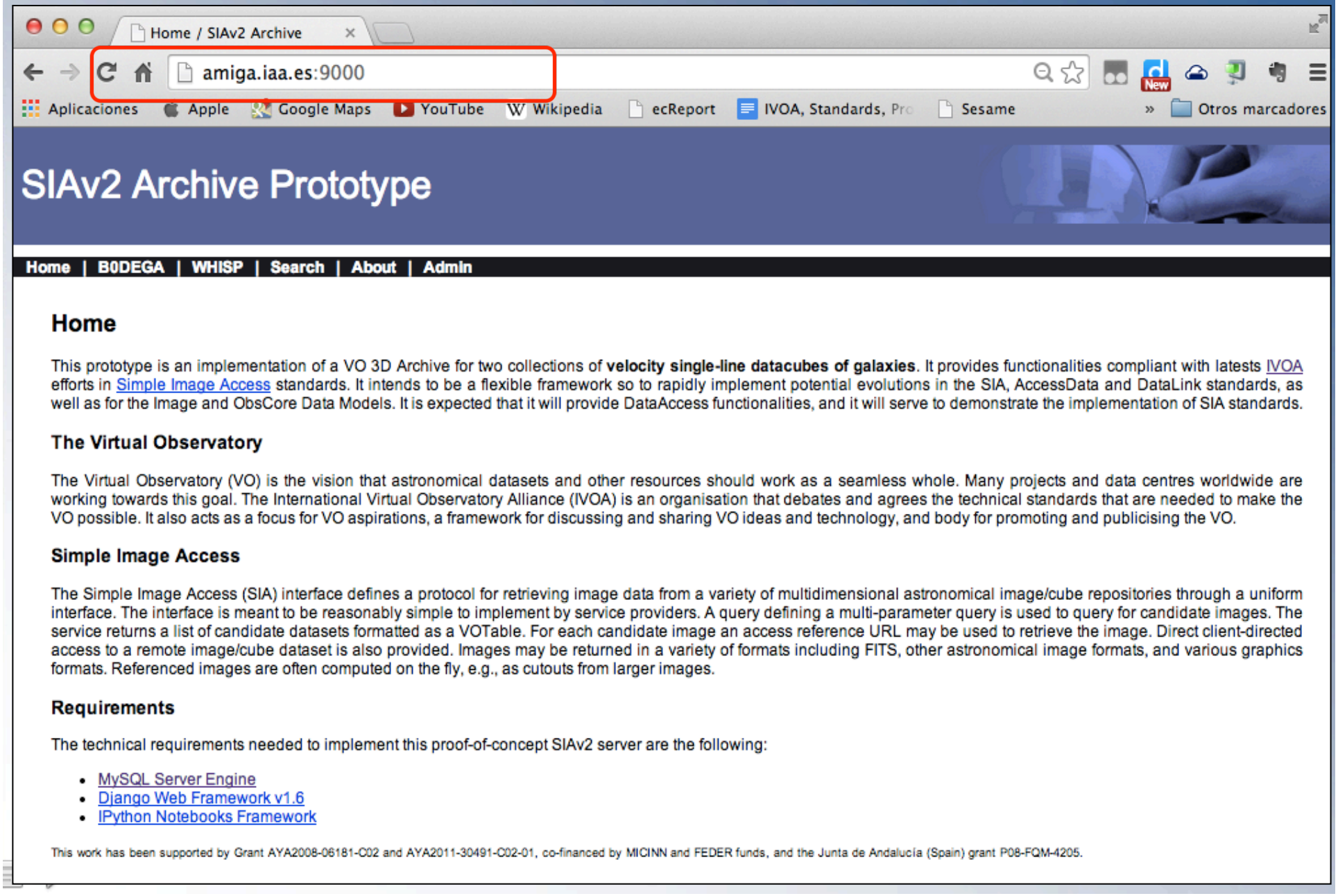
```
In [43]: # update table/field with last inserted autoincremental identifier
         def TableFieldUpdateValue(table, field, value):
             sqlupdate = """
             UPDATE `"""+table+"""` SET `"""+field+"""`="""+str(value)+""" ORDER BY `ID` DESC LIMIT 1;
             """
             return sqlupdate
```

Data Product

```
In [44]: def DataProduct(hdr, filename):

             statinfo = os.stat(filename)
             size = statinfo.st_size
             length = hdr[head['NAXIS1']] *  hdr[head['NAXIS2']] *  hdr[head['NAXIS3']]
             #removepath, tail = os.path.split(filename)

             DataSetSQL = """
             INSERT INTO `DataSet` (
             `AcReference`, `Size`, `DataLength`,
             `AxisDACount`, `AxisDecCount`, `AxisSpecCount`,
```

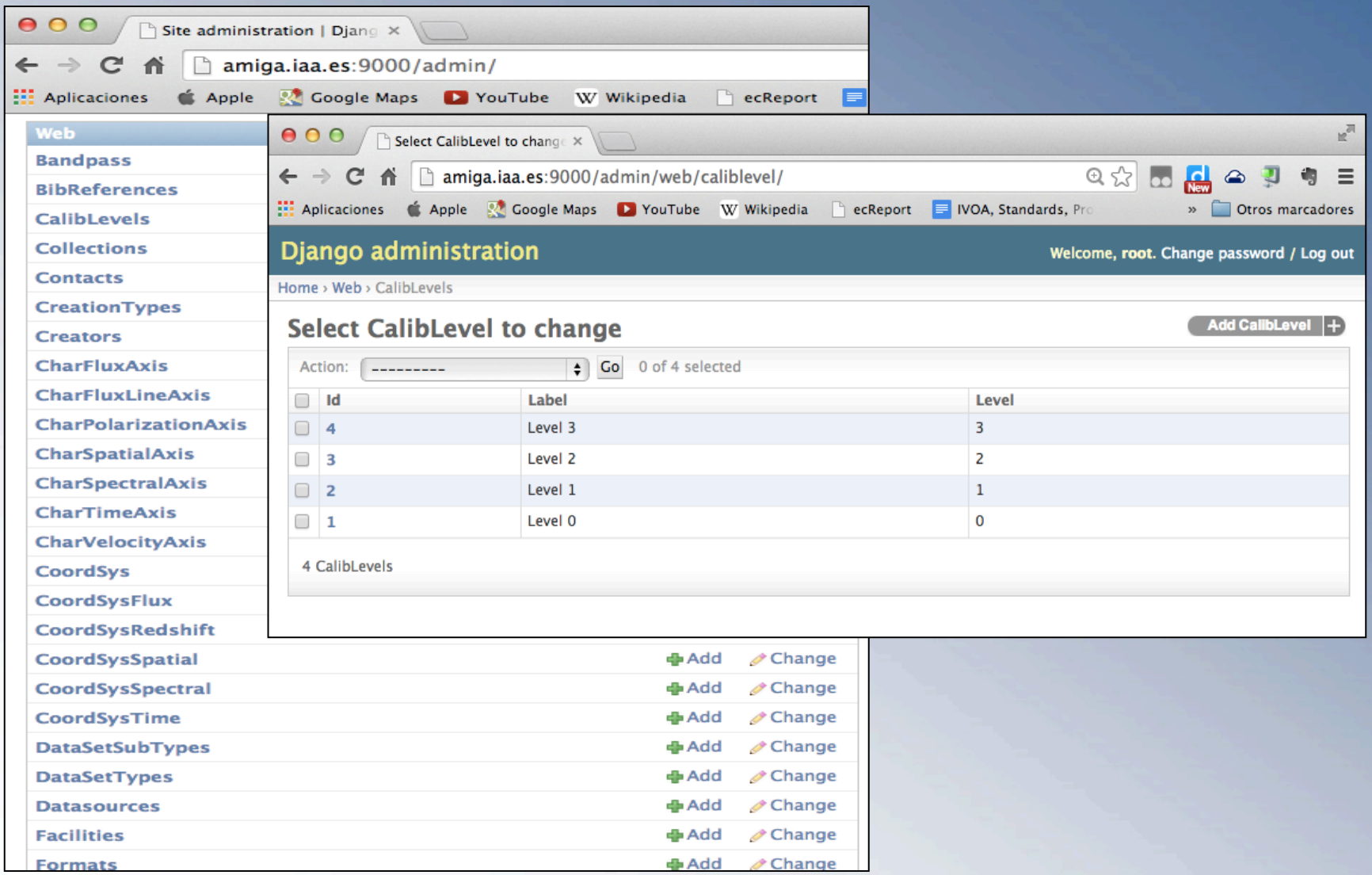
- Web tool **executable in the browser**
- Imports a **single Collection** each time
- **Single-target single-line** velocity data cubes of galaxies
- **Configuration of parameters** for each Collection
  - Type, SubType, File Format, Calibration Level
  - Collection,Access Rights, Publisher, Contact, Creator, CreationType
  - Facilicity, Instrument, Bandpass, DataSource, Proposal
  - UCD/Unit Axis Characterization, Line Characterization
- Fills a **specific MySQL BDD structure**
- DataSets are **FITS files** placed in a specified folder
- Configurable **FITS headers mapping**
- Produces a **SQL Script**
- Addition of **Derived Metadata for Targets** in a second step

Web Interface

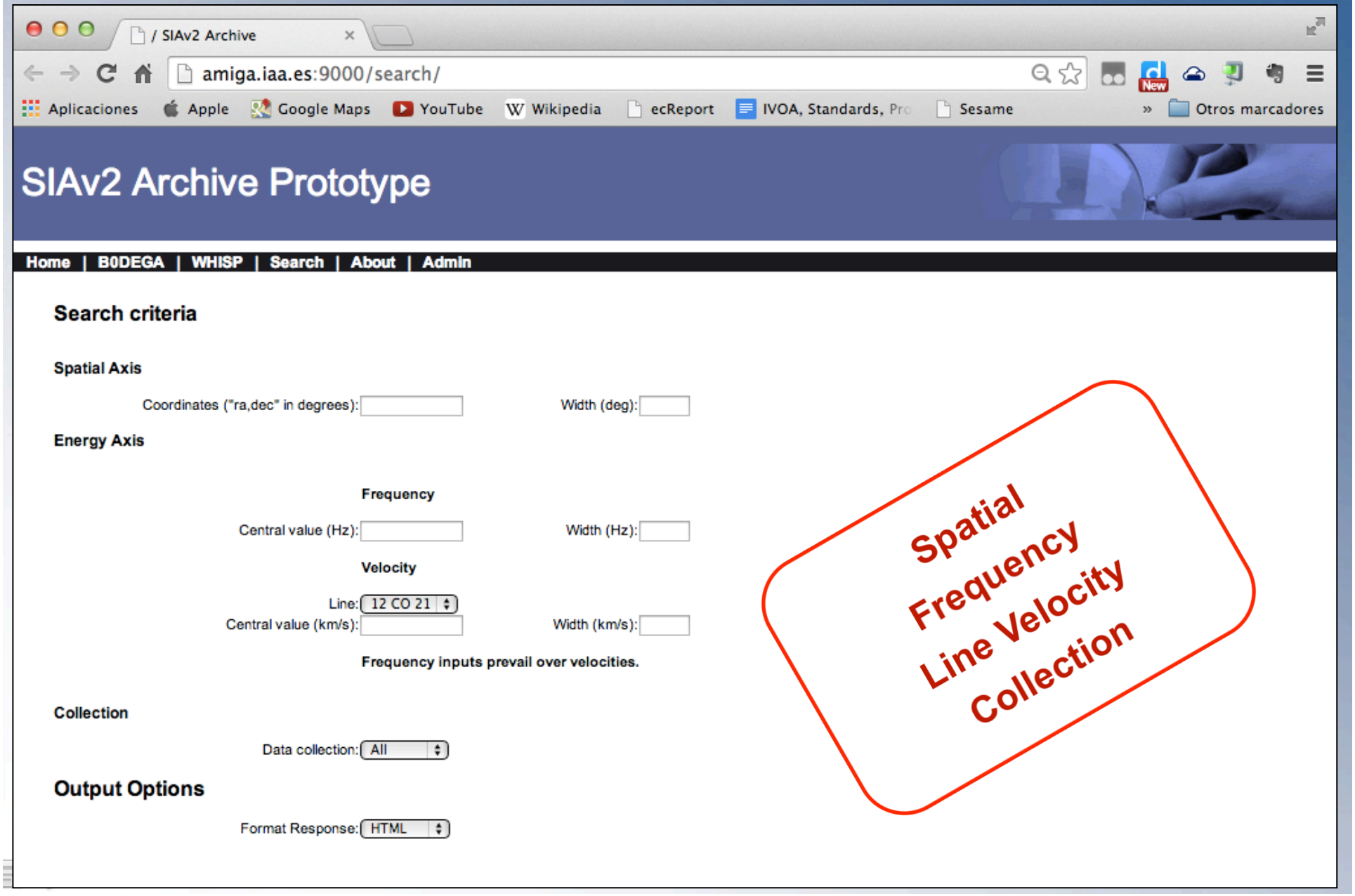


Database Admin

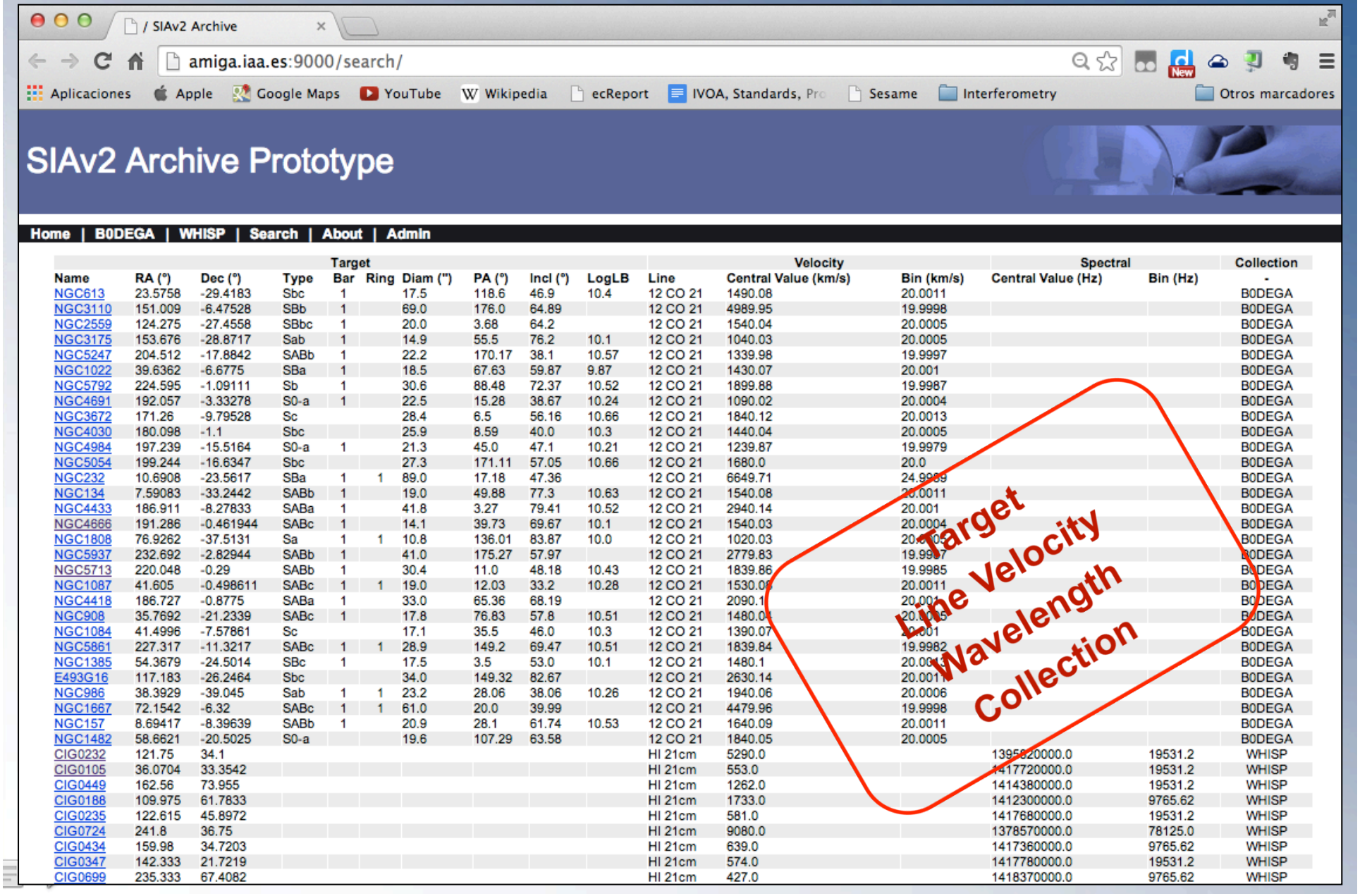
Django Web Framework Integrated Database Admin



Discovery


/ SIAv2 Archive
amiga.iaa.es:9000/search/
Aplicaciones
Apple
Google Maps
YouTube
Wikipedia
ecReport
IVOA, Standards, Pro
Sesame
Otros marcadores
SIAv2 Archive Prototype
Home | B0DEGA | WHISP | Search | About | Admin
Search criteria
Spatial Axis
Coordinates ("ra,dec" in degrees):
Width (deg):
Energy Axis
Frequency
Central value (Hz):
Width (Hz):
Velocity
Line: 12 CO 21
Central value (km/s):
Width (km/s):
Frequency inputs prevail over velocities.
Collection
Data collection: All
Output Options
Format Response: HTML
Spatial
Frequency
Line Velocity
Collection

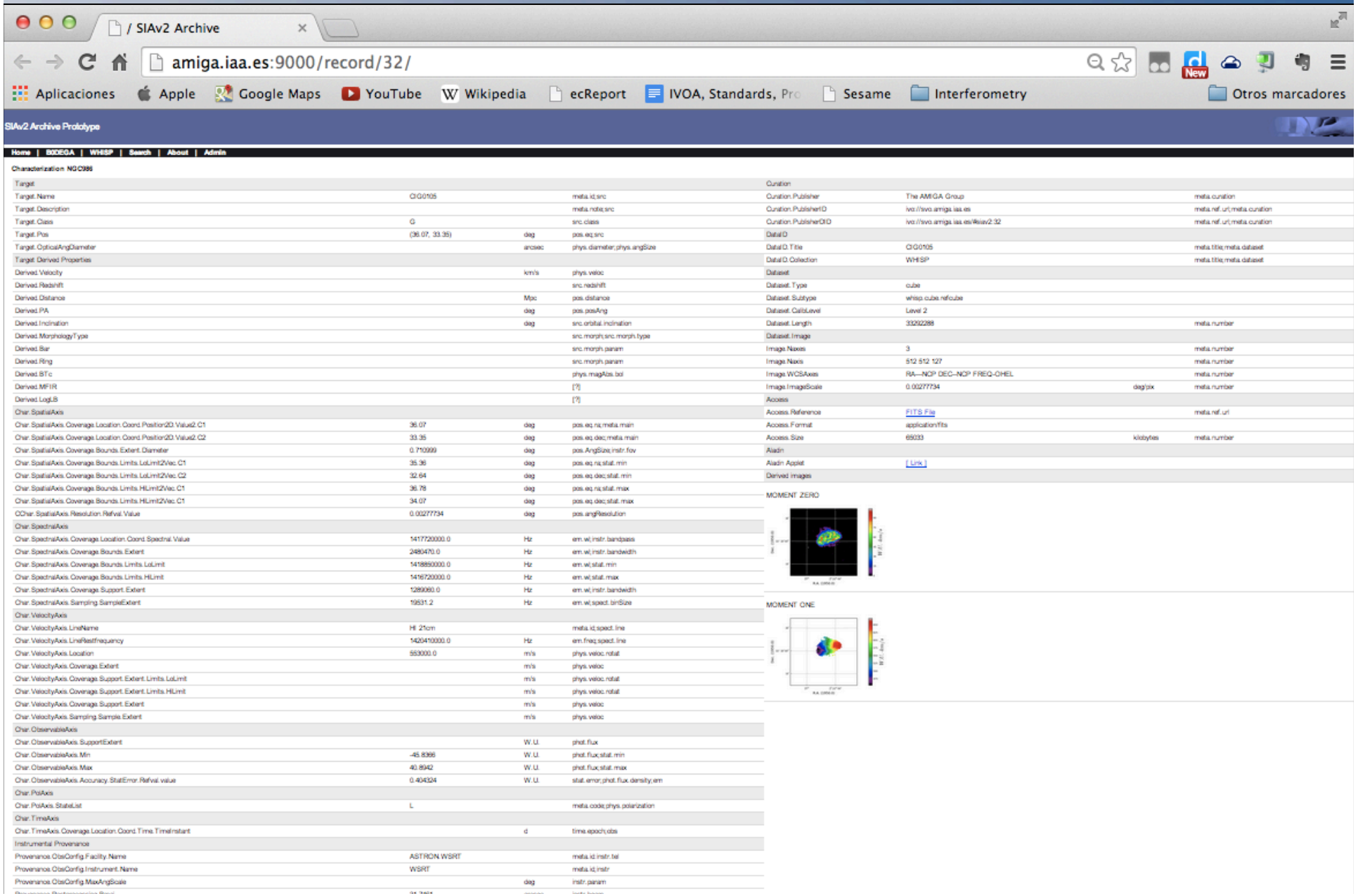
Response List



			Target							Velocity			Spectral		Collection
Name	RA (°)	Dec (°)	Type	Bar	Ring	Diam (")	PA (°)	Incl (°)	LogLB	Line	Central Value (km/s)	Bin (km/s)	Central Value (Hz)	Bin (Hz)	-
NGC613	23.5758	-29.4183	Sbc	1		17.5	118.6	46.9	10.4	12 CO 21	1490.08	20.0011			B0DEGA
NGC3110	151.009	-6.47528	SBb	1		69.0	176.0	64.89		12 CO 21	4989.95	19.9998			B0DEGA
NGC2559	124.275	-27.4558	SBbc	1		20.0	3.68	64.2		12 CO 21	1540.04	20.0005			B0DEGA
NGC3175	153.676	-28.8717	Sab	1		14.9	55.5	76.2	10.1	12 CO 21	1040.03	20.0005			B0DEGA
NGC5247	204.512	-17.8842	SABb	1		22.2	170.17	38.1	10.57	12 CO 21	1339.98	19.9997			B0DEGA
NGC1022	39.6362	-6.6775	SBa	1		18.5	67.63	59.87	9.87	12 CO 21	1430.07	20.001			B0DEGA
NGC5792	224.595	-1.09111	Sb	1		30.6	88.48	72.37	10.52	12 CO 21	1899.88	19.9987			B0DEGA
NGC4691	192.057	-3.33278	S0-a	1		22.5	15.28	38.67	10.24	12 CO 21	1090.02	20.0004			B0DEGA
NGC3672	171.26	-9.79528	Sc			28.4	6.5	56.16	10.66	12 CO 21	1840.12	20.0013			B0DEGA
NGC4030	180.098	-1.1	Sbc			25.9	8.59	40.0	10.3	12 CO 21	1440.04	20.0005			B0DEGA
NGC4984	197.239	-15.5164	S0-a	1		21.3	45.0	47.1	10.21	12 CO 21	1239.87	19.9979			B0DEGA
NGC5054	199.244	-16.6347	Sbc			27.3	171.11	57.05	10.66	12 CO 21	1680.0	20.0			B0DEGA
NGC232	10.6908	-23.5617	SBa	1	1	89.0	17.18	47.36		12 CO 21	6649.71	24.9969			B0DEGA
NGC134	7.59083	-33.2442	SABb	1		19.0	49.88	77.3	10.63	12 CO 21	1540.08	20.0011			B0DEGA
NGC4433	186.911	-8.27833	SABa	1		41.8	3.27	79.41	10.52	12 CO 21	2940.14	20.001			B0DEGA
NGC4666	191.286	-0.461944	SABc	1		14.1	39.73	69.67	10.1	12 CO 21	1540.03	20.0004			B0DEGA
NGC1808	76.9262	-37.5131	Sa	1	1	10.8	136.01	83.87	10.0	12 CO 21	1020.03	20.0005			B0DEGA
NGC5937	232.692	-2.82944	SABb	1		41.0	175.27	57.97		12 CO 21	2779.83	19.9997			B0DEGA
NGC5713	220.048	-0.29	SABb	1		30.4	11.0	48.18	10.43	12 CO 21	1839.86	19.9985			B0DEGA
NGC1087	41.605	-0.498611	SABc	1	1	19.0	12.03	33.2	10.28	12 CO 21	1530.06	20.0011			B0DEGA
NGC4418	186.727	-0.8775	SABa	1		33.0	65.36	68.19		12 CO 21	2090.1	20.001			B0DEGA
NGC908	35.7692	-21.2339	SABc	1		17.8	76.83	57.8	10.51	12 CO 21	1480.04	20.0005			B0DEGA
NGC1084	41.4996	-7.57861	Sc			17.1	35.5	46.0	10.3	12 CO 21	1390.07	20.001			B0DEGA
NGC5861	227.317	-11.3217	SABc	1	1	28.9	149.2	69.47	10.51	12 CO 21	1839.84	19.9982			B0DEGA
NGC1385	54.3679	-24.5014	SBc	1		17.5	3.5	53.0	10.1	12 CO 21	1480.1	20.001			B0DEGA
E493G16	117.183	-26.2464	Sbc			34.0	149.32	82.67		12 CO 21	2630.14	20.0011			B0DEGA
NGC986	38.3929	-39.045	Sab	1	1	23.2	28.06	38.06	10.26	12 CO 21	1940.06	20.0006			B0DEGA
NGC1667	72.1542	-6.32	SABc	1	1	61.0	20.0	39.99		12 CO 21	4479.96	19.9998			B0DEGA
NGC157	8.69417	-8.39639	SABb	1		20.9	28.1	61.74	10.53	12 CO 21	1640.09	20.0011			B0DEGA
NGC1482	58.6621	-20.5025	S0-a			19.6	107.29	63.58		12 CO 21	1840.05	20.0005			B0DEGA
CIG0232	121.75	34.1								HI 21cm	5290.0		1395820000.0	19531.2	WHISP
CIG0105	36.0704	33.3542								HI 21cm	553.0		1417720000.0	19531.2	WHISP
CIG0449	162.56	73.955								HI 21cm	1262.0		1414380000.0	19531.2	WHISP
CIG0188	109.975	61.7833								HI 21cm	1733.0		1412300000.0	9765.62	WHISP
CIG0235	122.615	45.8972								HI 21cm	581.0		1417680000.0	19531.2	WHISP
CIG0724	241.8	36.75								HI 21cm	9080.0		1378570000.0	78125.0	WHISP
CIG0434	159.98	34.7203								HI 21cm	639.0		1417360000.0	9765.62	WHISP
CIG0347	142.333	21.7219								HI 21cm	574.0		1417780000.0	19531.2	WHISP
CIG0699	235.333	67.4082								HI 21cm	427.0		1418370000.0	9765.62	WHISP

Target
Line Velocity
Wavelength
Collection

Record


/ SIAv2 Archive
amiga.iaa.es:9000/record/32/
Aplicaciones
Apple
Google Maps
YouTube
Wikipedia
ecReport
IVOA, Standards, Pro
Sesame
Interferometry
Otros marcadores
SIAv2 Archive Prototype
Home | BDDEGA | WHISP | Search | About | Admin
Characterization NGC986
Target
Target.Name | CIG0105 | | meta.id;src
Target.Description | | | meta.note;src
Target.Class | G | | src.class
Target.Pos | (36.07, 33.35) | deg | pos.eq;src
Target.OpticalAngDiameter | | arcsec | phys.diameter;phys.angSize
Target.Derived Properties
Derived.Velocity | | km/s | phys.veloc
Derived.Redshift | | | src.redshift
Derived.Distance | | Mpc | pos.distance
Derived.PA | | deg | pos.posAng
Derived.Inclination | | deg | src.orbital.inclination
Derived.MorphologyType | | | src.morph;src.morph.type
Derived.Bar | | | src.morph.param
Derived.Ring | | | src.morph.param
Derived.BTc | | | phys.magAbs.bol
Derived.MFIR | | | [?]
Derived.LogLB | | | [?]
Char.SpatialAxis
Char.SpatialAxis.Coverage.Location.Coord.Position2D.Value2.C1 | 36.07 | deg | pos.eq.ra;meta.main
Char.SpatialAxis.Coverage.Location.Coord.Position2D.Value2.C2 | 33.35 | deg | pos.eq.dec;meta.main
Char.SpatialAxis.Coverage.Bounds.Extent.Diameter | 0.710999 | deg | pos.AngSize;instr.fov
Char.SpatialAxis.Coverage.Bounds.Limits.LoLimit2Vec.C1 | 35.36 | deg | pos.eq.ra;stat.min
Char.SpatialAxis.Coverage.Bounds.Limits.LoLimit2Vec.C2 | 32.64 | deg | pos.eq.dec;stat.min
Char.SpatialAxis.Coverage.Bounds.Limits.HiLimit2Vec.C1 | 36.78 | deg | pos.eq.ra;stat.max
Char.SpatialAxis.Coverage.Bounds.Limits.HiLimit2Vec.C1 | 34.07 | deg | pos.eq.dec;stat.max
COhar.SpatialAxis.Resolution.Refval.Value | 0.00277734 | deg | pos.angResolution
Char.SpectralAxis
Char.SpectralAxis.Coverage.Location.Coord.Spectral.Value | 1417720000.0 | Hz | em.wl;instr.bandpass
Char.SpectralAxis.Coverage.Bounds.Extent | 2480470.0 | Hz | em.wl;instr.bandwidth
Char.SpectralAxis.Coverage.Bounds.Limits.LoLimit | 1418880000.0 | Hz | em.wl;stat.min
Char.SpectralAxis.Coverage.Bounds.Limits.HiLimit | 1416720000.0 | Hz | em.wl;stat.max
Char.SpectralAxis.Coverage.Support.Extent | 1289060.0 | Hz | em.wl;instr.bandwidth
Char.SpectralAxis.Sampling.SampleExtent | 19531.2 | Hz | em.wl;spect.binSize
Char.VelocityAxis
Char.VelocityAxis.LineName | HI 21cm | | meta.id;spect.line
Char.VelocityAxis.LineRestfrequency | 1420410000.0 | Hz | em.freq;spect.line
Char.VelocityAxis.Location | 553000.0 | m/s | phys.veloc.rotat
Char.VelocityAxis.Coverage.Extent | | m/s | phys.veloc
Char.VelocityAxis.Coverage.Support.Extent.Limits.LoLimit | | m/s | phys.veloc.rotat
Char.VelocityAxis.Coverage.Support.Extent.Limits.HiLimit | | m/s | phys.veloc.rotat
Char.VelocityAxis.Coverage.Support.Extent | | m/s | phys.veloc
Char.VelocityAxis.Sampling.Sample.Extent | | m/s | phys.veloc
Char.ObservableAxis
Char.ObservableAxis.SupportExtent | | W.U. | phot.flux
Char.ObservableAxis.Min | -45.8366 | W.U. | phot.flux;stat.min
Char.ObservableAxis.Max | 40.8942 | W.U. | phot.flux;stat.max
Char.ObservableAxis.Accuracy.StatError.Refval.value | 0.404324 | W.U. | stat.error;phot.flux.density;em
Char.PolAxis
Char.PolAxis.StateList | L | | meta.code;phys.polarization
Char.TimeAxis
Char.TimeAxis.Coverage.Location.Coord.Time.TimeInstant | | d | time.epoch;obs
Instrumental Provenance
Provenance.ObsConfig.Facility.Name | ASTRON.WSRT | | meta.id.instr.tel
Provenance.ObsConfig.Instrument.Name | WSRT | | meta.id;instr
Provenance.ObsConfig.MaxAngScale | | deg | instr.param
Curation
Curation.Publisher | The AMIGA Group | | meta.curation
Curation.PublisherID | ivo://svo.amiga.iaa.es | | meta.ref.url;meta.curation
Curation.PublisherDID | ivo://svo.amiga.iaa.es/#siav2.32 | | meta.ref.url;meta.curation
DataID
DataID.Title | CIG0105 | | meta.title;meta.dataset
DataID.Collection | WHISP | | meta.title;meta.dataset
Dataset
Dataset.Type | cube | |
Dataset.Subtype | whisp.cube.refcube | |
Dataset.CalibLevel | Level 2 | |
Dataset.Length | 33292288 | | meta.number
Dataset.Image
Image.Naxes | 3 | | meta.number
Image.Naxis | 512 512 127 | | meta.number
Image.WCSAxes | RA---NCP DEC--NCP FREQ-OHEL | | meta.number
Image.ImageScale | 0.00277734 | deg/pix | meta.number
Access
Access.Reference | FITS File | | meta.ref.url
Access.Format | application/fits | |
Access.Size | 65033 | kilobytes | meta.number
Aladin
Aladin Applet | [Link] | |
Derived images
MOMENT ZERO
MOMENT ONE

Target and Derived Properties

Target			
Target.Name	NGC4666		meta.id;src
Target.Description			meta.note;src
Target.Class	G		src.class
Target.Pos	(191.29, -0.46)	deg	pos.eq;src
Target.OpticalAngDiameter	14.1	arcsec	phys.diameter;phys.angSize
Target Derived Properties			
Derived.Velocity	1518.3	km/s	phys.veloc
Derived.Redshift			src.redshift
Derived.Distance		Mpc	pos.distance
Derived.PA	39.73	deg	pos.posAng
Derived.Inclination	69.67	deg	src.orbital.inclination
Derived.MorphologyType	4.9		src.morph;src.morph.type
Derived.Bar	1		src.morph.param
Derived.Ring			src.morph.param
Derived.BTc	10.666		phys.magAbs.bol
Derived.MFIR			[?]
Derived.LogLB	10.1		[?]

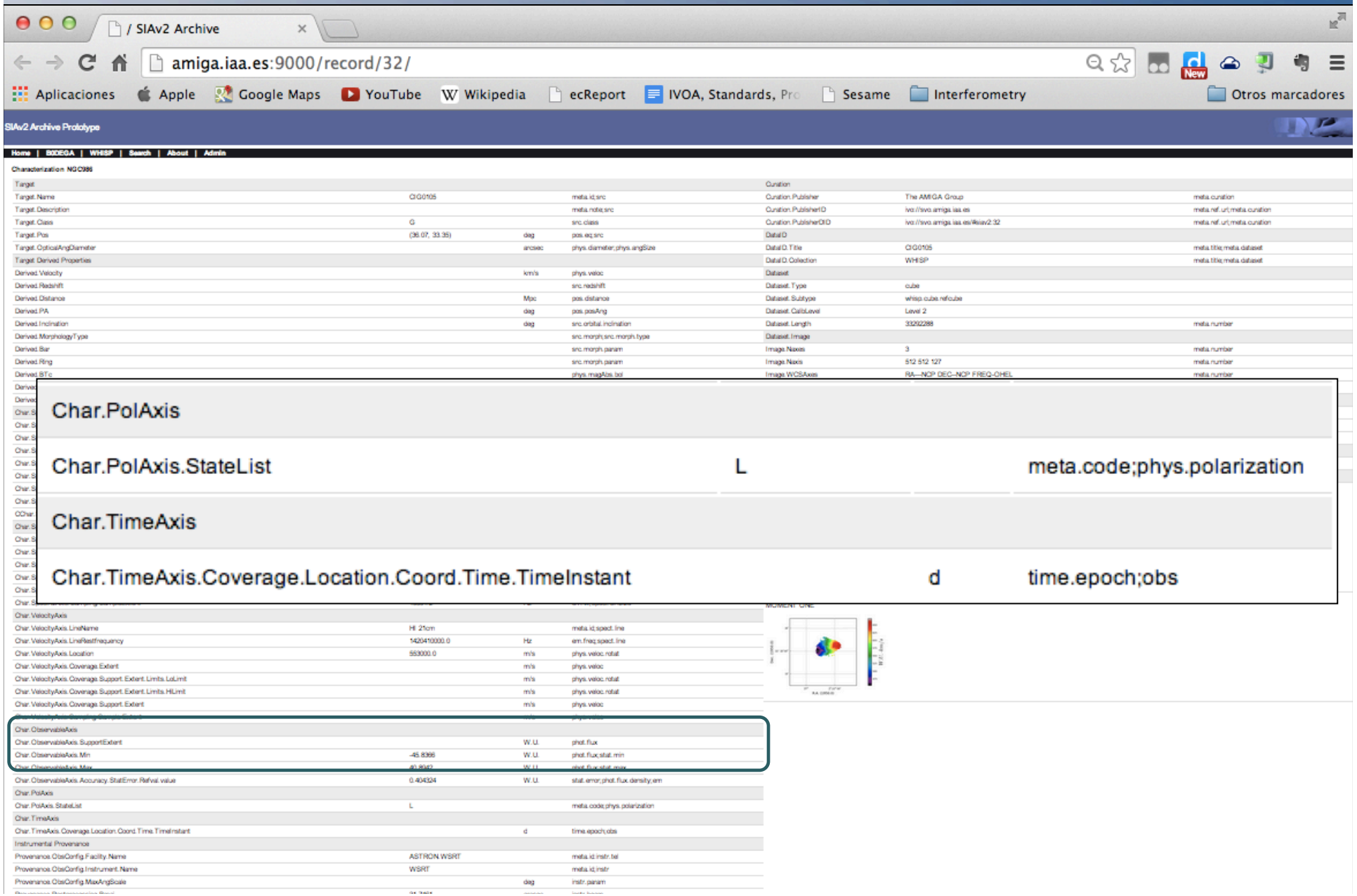
Spatial and Spectral Characterization

Char.SpatialAxis			
Char.SpatialAxis.Coverage.Location.Coord.Position2D.Value2.C1	36.07	deg	pos.eq.ra;meta.main
Char.SpatialAxis.Coverage.Location.Coord.Position2D.Value2.C2	33.35	deg	pos.eq.dec;meta.main
Char.SpatialAxis.Coverage.Bounds.Extent.Diameter	0.710999	deg	pos.AngSize;instr.fov
Char.SpatialAxis.Coverage.Bounds.Limits.LoLimit2Vec.C1	35.36	deg	pos.eq.ra;stat.min
Char.SpatialAxis.Coverage.Bounds.Limits.LoLimit2Vec.C2	32.64	deg	pos.eq.dec;stat.min
Char.SpatialAxis.Coverage.Bounds.Limits.HiLimit2Vec.C1	36.78	deg	pos.eq.ra;stat.max
Char.SpatialAxis.Coverage.Bounds.Limits.HiLimit2Vec.C1	34.07	deg	pos.eq.dec;stat.max
CChar.SpatialAxis.Resolution.Refval.Value	0.00277734	deg	pos.angResolution
Char.SpectralAxis			
Char.SpectralAxis.Coverage.Location.Coord.Spectral.Value	1417720000.0	Hz	em.wl;instr.bandpass
Char.SpectralAxis.Coverage.Bounds.Extent	2480470.0	Hz	em.wl;instr.bandwidth
Char.SpectralAxis.Coverage.Bounds.Limits.LoLimit	1418850000.0	Hz	em.wl;stat.min
Char.SpectralAxis.Coverage.Bounds.Limits.HiLimit	1416720000.0	Hz	em.wl;stat.max
Char.SpectralAxis.Coverage.Support.Extent	1289060.0	Hz	em.wl;instr.bandwidth
Char.SpectralAxis.Sampling.SampleExtent	19531.2	Hz	em.wl;spect.binSize

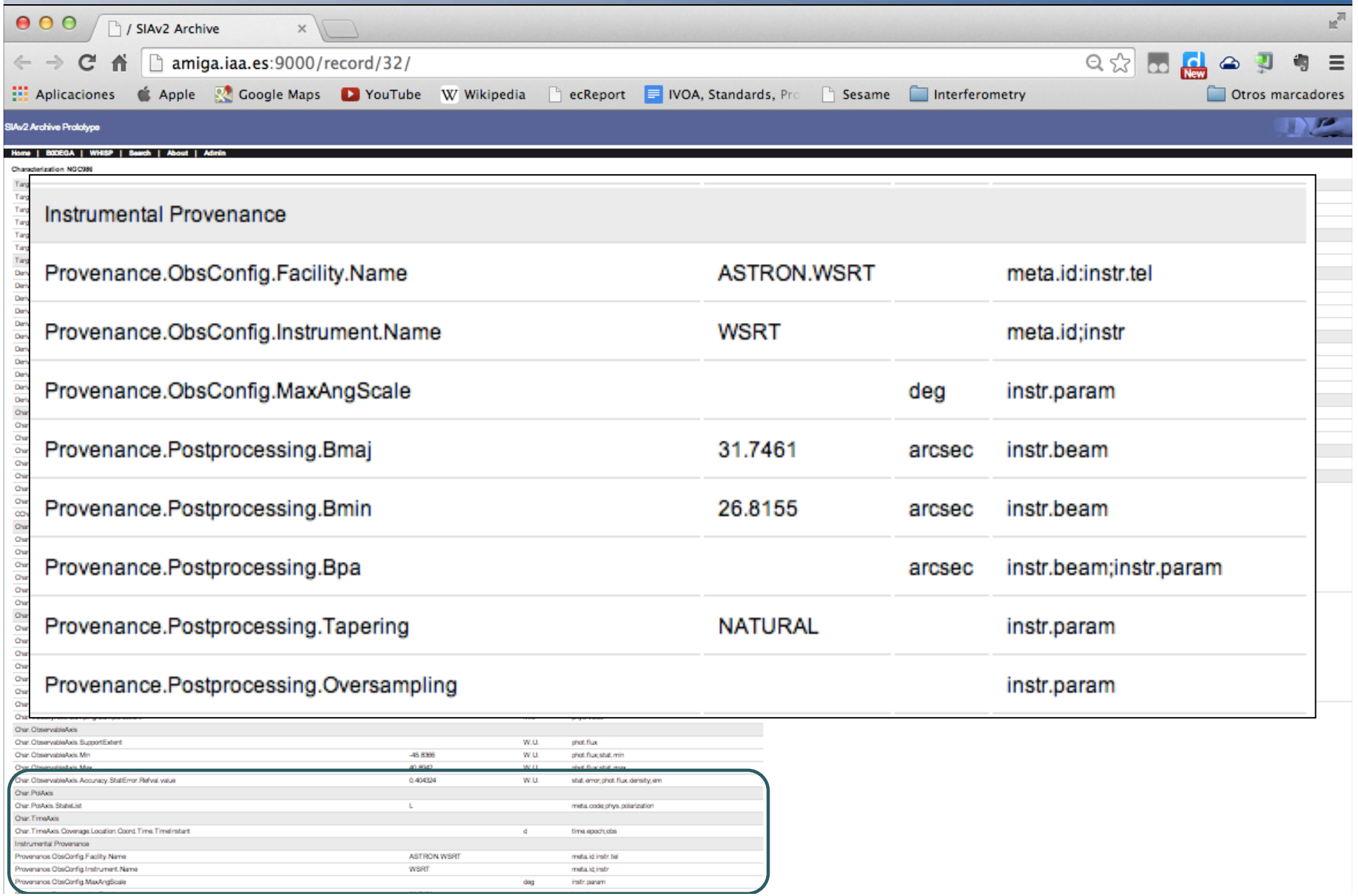
Line Velocity Characterization

Char.VelocityAxis			
Char.VelocityAxis.LineName	12 CO 21		meta.id;spect.line
Char.VelocityAxis.LineRestfrequency	2.30538e+11	Hz	em.freq;spect.line
Char.VelocityAxis.Location	1540030.0	m/s	phys.veloc.rotat
Char.VelocityAxis.Coverage.Extent	500010.0	m/s	phys.veloc
Char.VelocityAxis.Coverage.Support.Extent.Limits.LoLimit	1280030.0	m/s	phys.veloc.rotat
Char.VelocityAxis.Coverage.Support.Extent.Limits.HiLimit	1780040.0	m/s	phys.veloc.rotat
Char.VelocityAxis.Coverage.Support.Extent		m/s	phys.veloc
Char.VelocityAxis.Sampling.Sample.Extent	20000.4	m/s	phys.veloc
Char.ObservableAxis			
Char.ObservableAxis.SupportExtent		Jy/Beam	phot.flux
Char.ObservableAxis.Min	-0.34842	Jy/Beam	phot.flux;stat.min
Char.ObservableAxis.Max	1.06195	Jy/Beam	phot.flux;stat.max
Char.ObservableAxis.Accuracy.StatError.Refval.value	0.0160589	Jy/Beam	stat.error;phot.flux.density;em

Polarization and Time

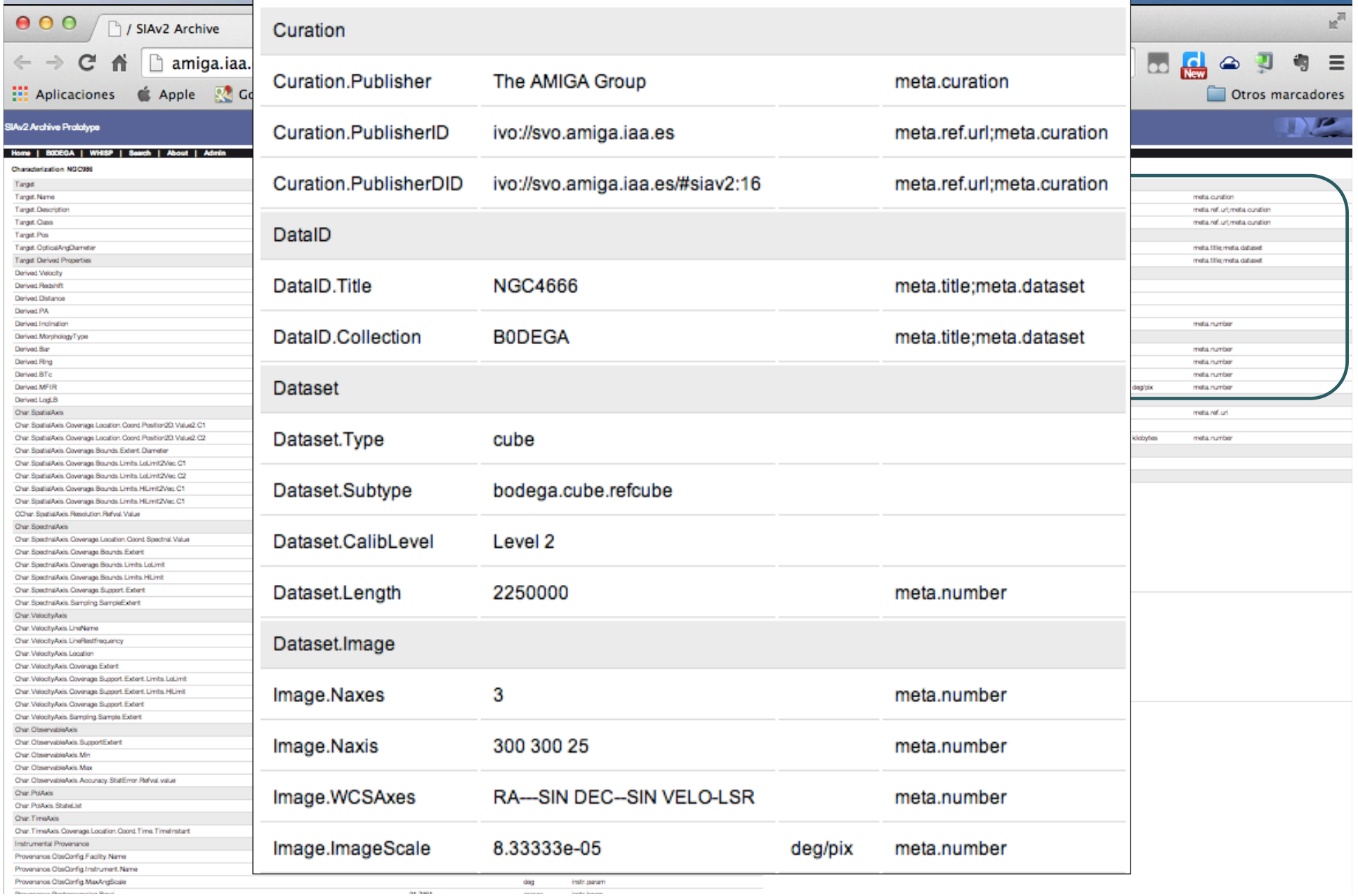


Instrumental and Post Processing Provenance



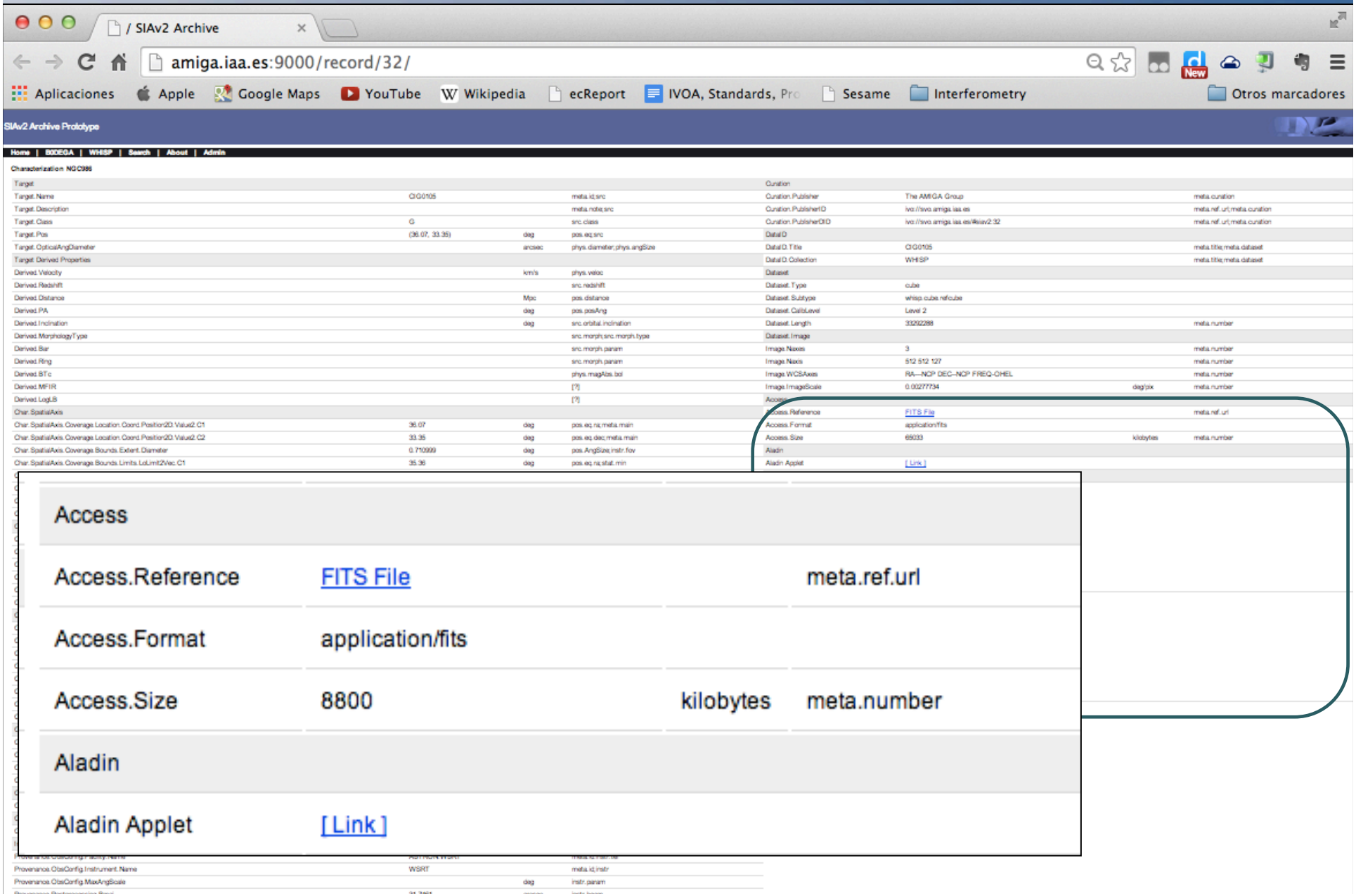
Instrumental Provenance			
Provenance.ObsConfig.Facility.Name	ASTRON.WSRT		meta.id:instr.tel
Provenance.ObsConfig.Instrument.Name	WSRT		meta.id;instr
Provenance.ObsConfig.MaxAngScale		deg	instr.param
Provenance.Postprocessing.Bmaj	31.7461	arcsec	instr.beam
Provenance.Postprocessing.Bmin	26.8155	arcsec	instr.beam
Provenance.Postprocessing.Bpa		arcsec	instr.beam;instr.param
Provenance.Postprocessing.Tapering	NATURAL		instr.param
Provenance.Postprocessing.Oversampling			instr.param

Dataset Curation and Characterization



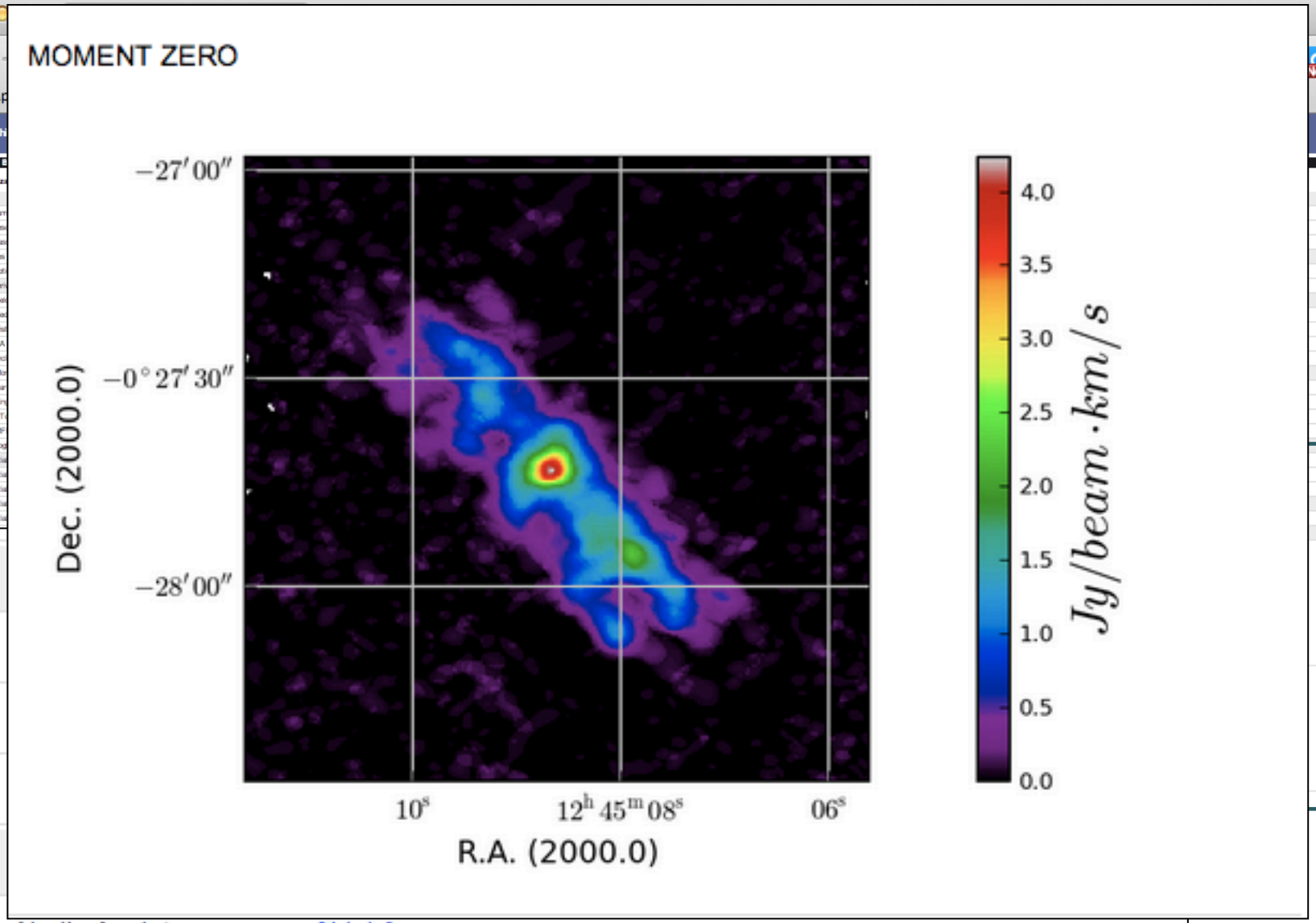
Curation			
Curation.Publisher	The AMIGA Group		meta.curation
Curation.PublisherID	ivo://svo.amiga.iaa.es		meta.ref.url;meta.curation
Curation.PublisherDID	ivo://svo.amiga.iaa.es/#siav2:16		meta.ref.url;meta.curation
DataID			
DataID.Title	NGC4666		meta.title;meta.dataset
DataID.Collection	B0DEGA		meta.title;meta.dataset
Dataset			
Dataset.Type	cube		
Dataset.Subtype	bodega.cube.refcube		
Dataset.CalibLevel	Level 2		
Dataset.Length	2250000		meta.number
Dataset.Image			
Image.Naxes	3		meta.number
Image.Naxis	300 300 25		meta.number
Image.WCSAxes	RA---SIN DEC--SIN VELO-LSR		meta.number
Image.ImageScale	8.33333e-05	deg/pix	meta.number

Access and Thumbnails



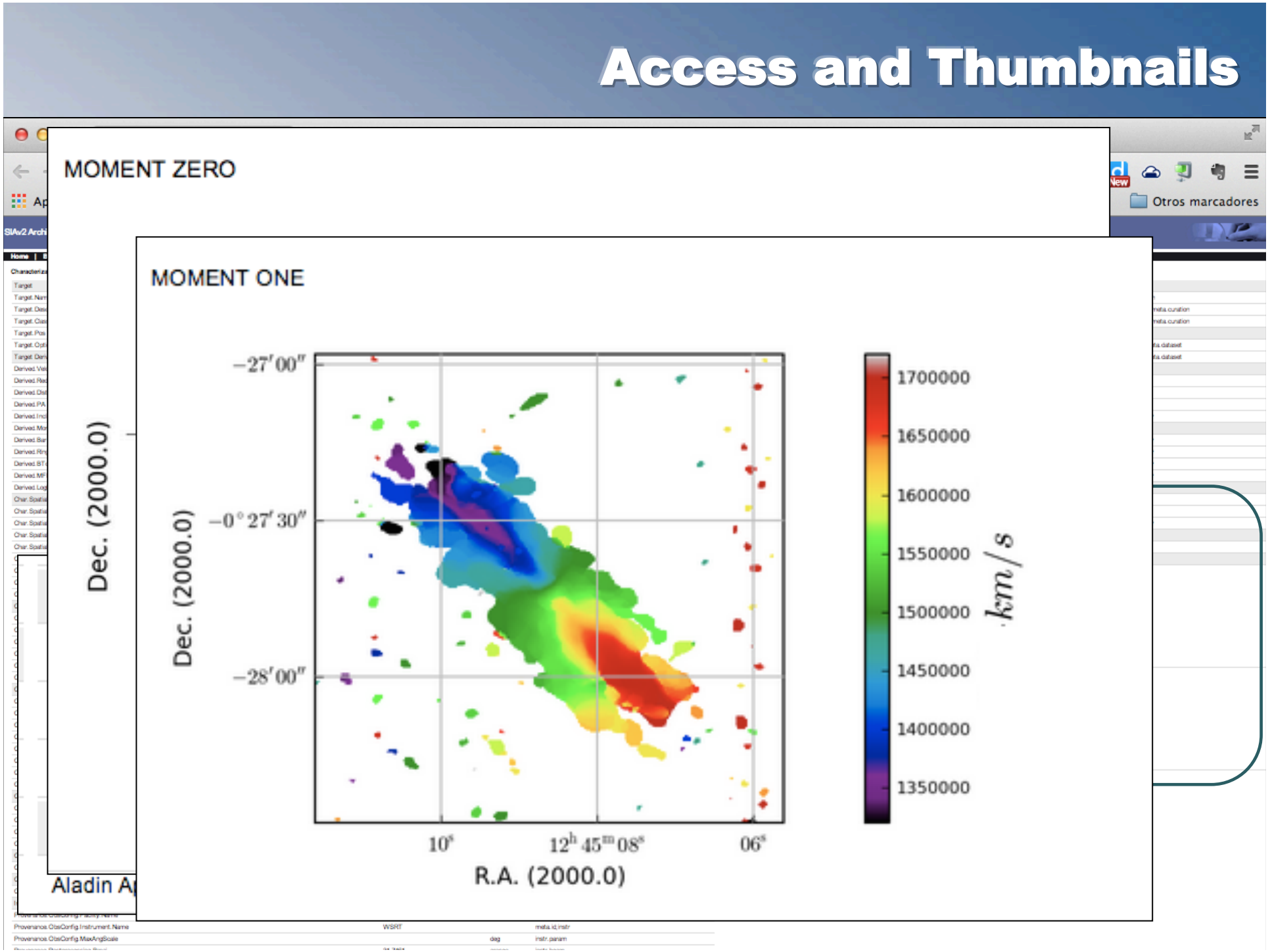
Access			
Access.Reference	FITS File		meta.ref.url
Access.Format	application/fits		
Access.Size	8800	kilobytes	meta.number
Aladin			
Aladin Applet	[Link]		

Access and Thumbnails



Aladin Applet [Link]

Access and Thumbnails



VOTables

Table Columns for 4: SIAv2VOTable.vot

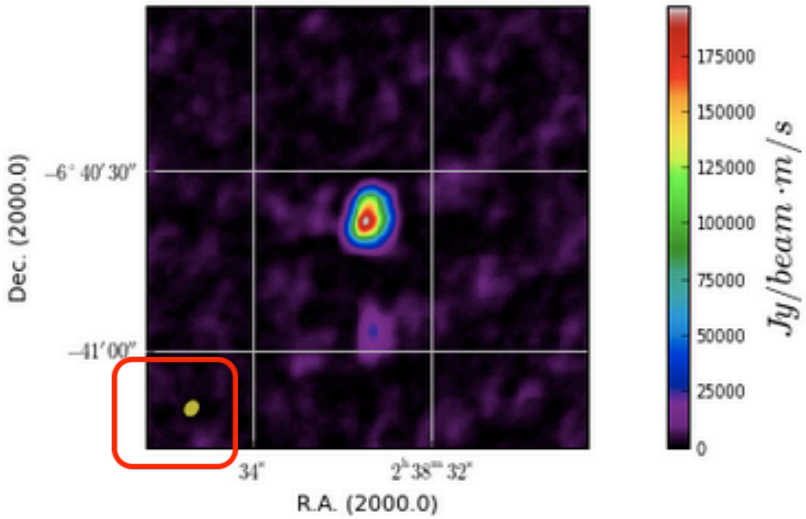
	$ID	Class	Shape	Units	Description	UCD	Utype
24	$24	Double			Derived corrected bolometric absolute magnitude in B band	phys.magAbs.bol	im:Derived.BTc
25	$25	Double			Derived absolute magnitude in far infrared		im:Derived.MFIR
26	$26	Double			Log of derived total luminosity in solar units for B band		im:Derived.LogLB
27	$27	Double		deg	Spatial position first coordinate	pos.eq.ra;meta.main	im:Char.SpatialAxis.Coverage.Loca
28	$28	Double		deg	Spatial position second coordinate	pos.eq.dec;meta.main	im:Char.SpatialAxis.Coverage.Loca
29	$29	Double		deg	Diameter of field of view	pos.AngSize;instr.fov	im:Char.SpatialAxis.Coverage.Boun
30	$30	Double		deg	Lower bounds of image spatial coordinates	pos.eq.ra;stat.min	im:Char.SpatialAxis.Coverage.Boun
31	$31	Double		deg	Lower bounds of image spatial coordinates	pos.eq.dec;stat.min	im:Char.SpatialAxis.Coverage.Boun
32	$32	Double		deg	Higher bounds of image spatial coordinates	pos.eq.ra;stat.max	im:Char.SpatialAxis.Coverage.Boun
33	$33	Double		deg	Higher bounds of image spatial coordinates	pos.eq.dec;stat.max	im:Char.SpatialAxis.Coverage.Boun
34	$34	Double		arcsec	Spatial resolution of data	pos.angResolution	im:Char.SpatialAxis.Resolution.Refv
35	$35	Double		Hz	Spectral coord value	em.wl;instr.bandpass	im:Char.SpectralAxis.Coverage.Loc
36	$36	Double		Hz	Width of spectrum	em.wl;instr.bandwidth	im:Char.SpectralAxis.Coverage.Bou
37	$37	Double		Hz	Start in spectral coordinate	em.wl;stat.min	im:Char.SpectralAxis.Coverage.Bou
38	$38	Double		Hz	Stop in spectral coordinate	em.wl;stat.max	im:Char.SpectralAxis.Coverage.Bou
39	$39	Double		Hz	Effective width of spectrum	em.wl;instr.bandwidth	im:Char.SpectralAxis.Coverage.Sup
40	$40	Double		Hz	Wavelength bin size	em.wl;spect.binSize	im:Char.SpectralAxis.SamplingPrec
41	$41	String			Name of spectral line	meta.id;spect.line	im:Char.VelocityAxis.Name
42	$42	Double		Hz	Line rest frequency	em.freq;spect.line	im:Char.VelocityAxis.RestFrequenc
43	$43	Double		m/s	Central velocity in datacube	phys.veloc.rotat	im:Char.VelocityAxis.Location.Coor
44	$44	Double		m/s	Velocity axis length	phys.veloc	im:Char.VelocityAxis.Coverage.Ext
45	$45	Double		m/s	Start value for measured velocity in line	phys.veloc	im:Char.VelocityAxis.Coverage.Sup
46	$46	Double		m/s	Last value for measured velocity in line	phys.veloc	im:Char.VelocityAxis.Coverage.Sup
47	$47	Double		m/s	Velocity line length	phys.veloc	im:Char.VelocityAxis.Coverage.Sup
48	$48	Double		m/s	Velocity bin size	phys.veloc	im:Char.VelocityAxis.Sampling.Sam
49	$49	Double			Flux dynamic range	phot.flux	im:Char.ObservableAxis.Coverage.
50	$50	Double			Flux min value	phot.flux	im:Char.ObservableAxis.Coverage.
51	$51	Double			Flux max value	phot.flux	im:Char.ObservableAxis.Coverage.
52	$52	Double			Flux statistical error	stat.error;phot.flux.density;em	im:Char.ObservableAxis.Accuracy.I
53	$53	String			Unit for observable	meta.unit	im:Char.ObservableAxis.Unit
54	$54	String			List of polarization states present	meta.code;phys.polarization;meta.fits	im:Char.PolAxis.StateList
55	$55	Double		d	Midpoint of exposure on MJD scale	time.epoch;obs	im:Char.TimeAxis.Coverage.Locatic
56	$56	String			Facility name	meta.id:instr.tel	im:Provenance.ObsConfig.Facility.N
57	$57	String			Instrument name	meta.id;instr	im:Provenance.ObsConfig.Instrume
58	$58	Double		deg	Maximum angular scale for radiointerferometric observations	pos.AngDistance;instr.fov	im:Provenance.ObsConfig.MaxAngu
59	$59	Double		arcsec	Major axis (FWHM) of beam	instr.beam	im:Provenance.Postprocessing.Bma
60	$60	Double		arcsec	Minor axis (FWHM) of beam	instr.beam	im:Provenance.Postprocessing.Bmi
61	$61	Double		deg	Position angle of major axis of beam (N->E)	instr.beam;instr.param	im:Provenance.Postprocessing.Bpa
62	$62	String			Taper type in cleaning process	instr.param	im:Provenance.Postprocessing.Tap
63	$63	double[]	2		Number of pixels considered as spatial resolution for CLEAN	instr.param	im:Provenance.Postprocessing.Bpa

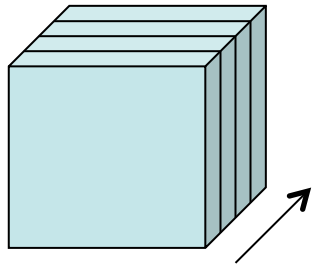
3D Exploration /Access Data Use Cases

Collapsing the cube: Moment Zero

```
In [1]: from kapteyn import maputils
        disable_notebook()

In [2]: fitsfile = "/var/opt/VO3DArchive/VO3DArchive/media/data/B0DEGA/FITS/ngc1022_MOM0.fits"
        pngfile ="ngc1022_MOM0.png"
        fitsobj = maputils.FITSimage(fitsfile)

        mplim = fitsobj.Annotatedimage(cmap="spectral")
        mplim.Image()
        pos = '39.6445 deg, -6.686 deg'
        mplim.Beam(3.23253, 2.64966, units='arcsec', pa=-36.731,
        mplim.Graticule()
        units = r'$Jy/beam\cdot m/s$'
        colbar = mplim.Colorbar(fontsize=8)
        colbar.set_label(label=units, fontsize=18)
        mplim.plot()
        savefig(pngfile, dpi=150)
```

Range in velocity
Range in flux
Beam





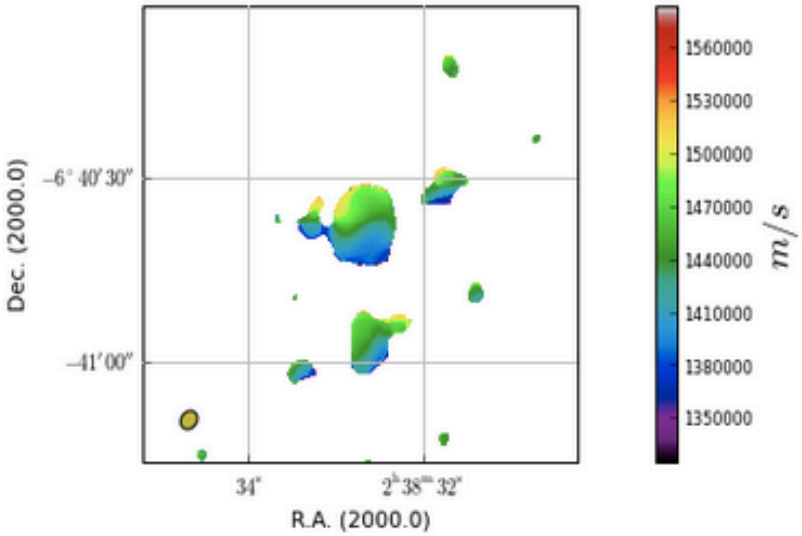
Integrated Emission

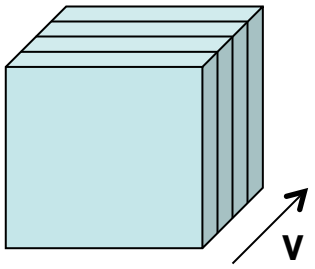
3D Exploration /Access Data Use Cases

Collapsing the cube: Moment One

```
In [4]: fitsfile = "/var/opt/VO3DArchive/VO3DArchive/media/data/B0DEGA/FITS/ngc1022_MOM1.fits"
pngfile ="ngc1022_MOM1.png"
fitsobj = maputils.FITSimage(fitsfile)

mplim = fitsobj.Annotatedimage(cmap="spectral")
mplim.Image()
pos = '39.6445 deg, -6.686 deg'
mplim.Beam(3.23253, 2.64966, units='arcsec', pa=-36.731
mplim.Graticule()
units = r'$m/s$'
colbar = mplim.Colorbar(fontsize=8)
colbar.set_label(label=units, fontsize=18)
mplim.plot()
savefig(pngfile, dpi=150)
```

Range in velocity
Range in flux
Beam



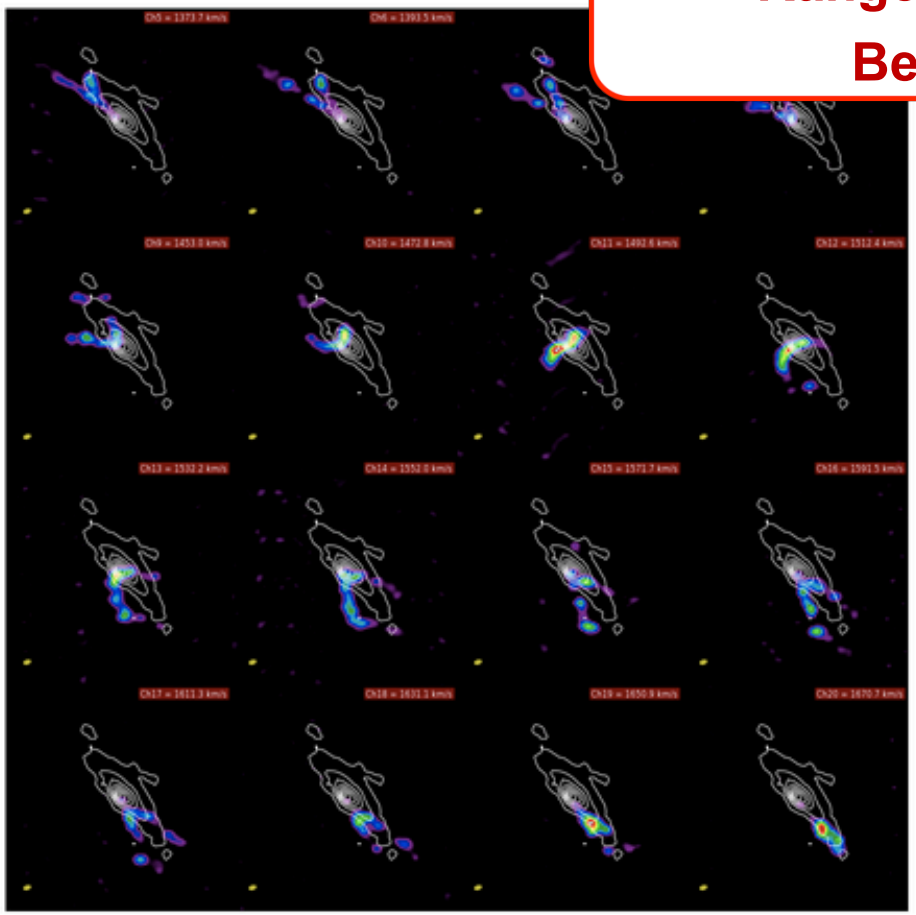


Velocity Weighted Integrated Emission

3D Exploration /Access Data Use Cases

Channel Maps and Contour Overlay

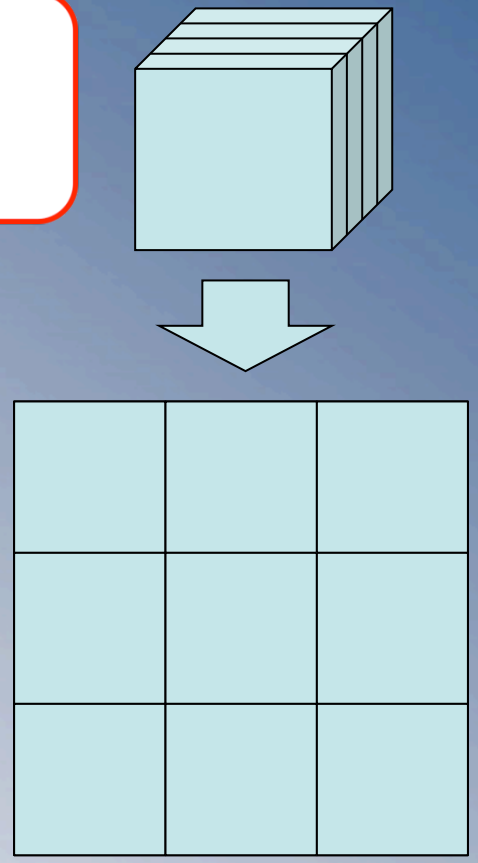
```
In [8]: ReprImgobject.get_dataminmax()
Out[8]: (3.1621261, 2739.1116)

In [9]: # Contour levels
        contourlevels = np.linspace(0, 2700, num=9)

In [10]: channelMap_Bck3D(4, channels, cubeobject, ReprImgobject, contourlevels
```



Range in velocity

Range in flux

Beam



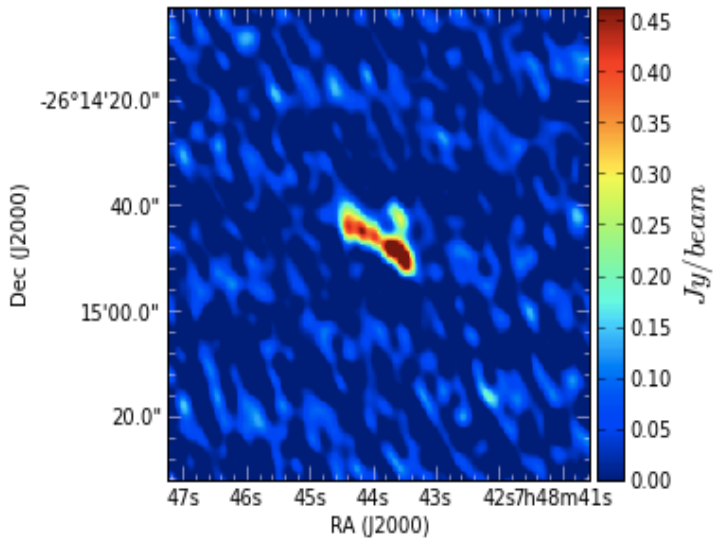
Channel Slicing

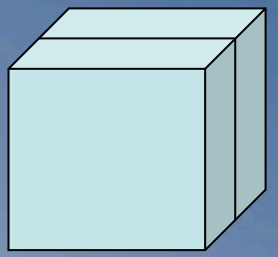
3D Exploration /Access Data Use Cases

Channel Slicing

```
In [6]: # Channel 12
fig = plt.figure()
F2 = aplpy.FITSFigure(filecube, figure=fig, dimensions=[0,1], slices=[11])
F2.tick_labels.set_xformat('hh:mm:ss')
F2.show_colorscale(vmin=0)
F2.add_colorbar()
F2.colorbar.set_axis_label_text(r'$Jy/beam$')
F2.colorbar.set_axis_label_font(size=15)
```

```
INFO:astropy:Auto-setting vmax to  4.638e-01
INFO: Auto-setting vmax to  4.638e-01 [aplpy.aplpy]
```





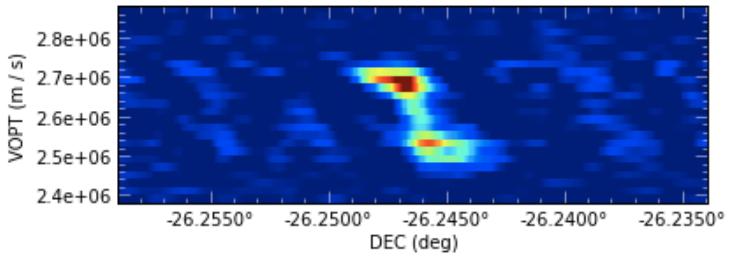
Range in flux

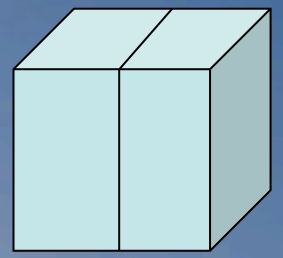
3D Exploration /Access Data Use Cases

Position Velocity at Fixed RA

```
In [11]: # Position-velocity plot at RA=160pix
         fig = plt.figure()
         F2 = aplpy.FITSFigure(filecube, figure=fig, dimensions=[1,2], slices=[150])
         F2.show_colorscale(vmin=0,aspect=4)
```

```
INFO:astropy:Auto-setting vmax to  8.070e-01
INFO: Auto-setting vmax to  8.070e-01 [aplpy.aplpy]
```





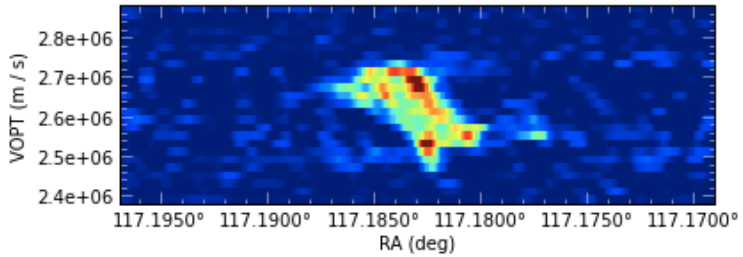
Range in velocities

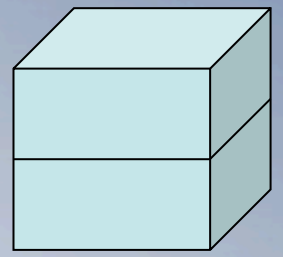
Range in flux

Position Velocity at Fixed Dec

```
In [12]: # Position-velocity plot at DEC=160pix
         fig = plt.figure()
         F2 = aplpy.FITSFigure(filecube, figure=fig, dimensions=[0,2], slices=[150])
         F2.show_colorscale(vmin=0,aspect=4)
```

```
INFO:astropy:Auto-setting vmax to  6.292e-01
INFO: Auto-setting vmax to  6.292e-01 [aplpy.aplpy]
```

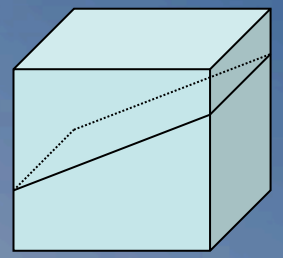




3D Exploration /Access Data Use Cases

Position Velocity at Defined Position Angle

In [22]:
```
# Use Gipsy
# SLICE
#
task = """
SLICE
INSET="""+gipsySet+""" VELO
POSITION=0,0
ANGLE=135
GRIDOUT=1
POINTS=250
SLICES=2,2
SPACE=2
OUTSET=SlicedCubeVelo
"""
print(Gipsy(task))
```

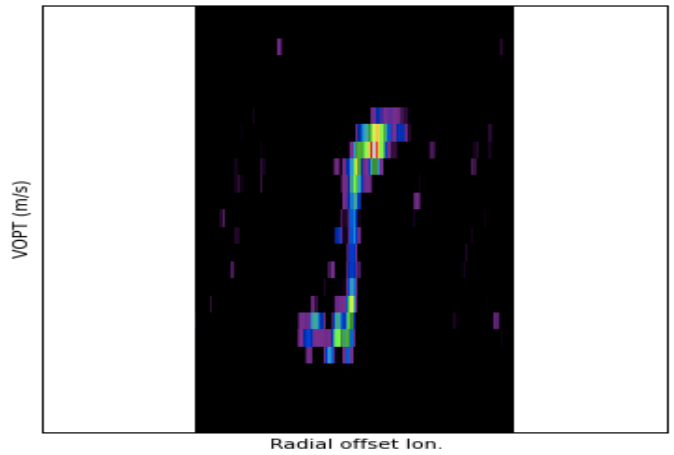


Range in velocities

Range in flux

Position angle

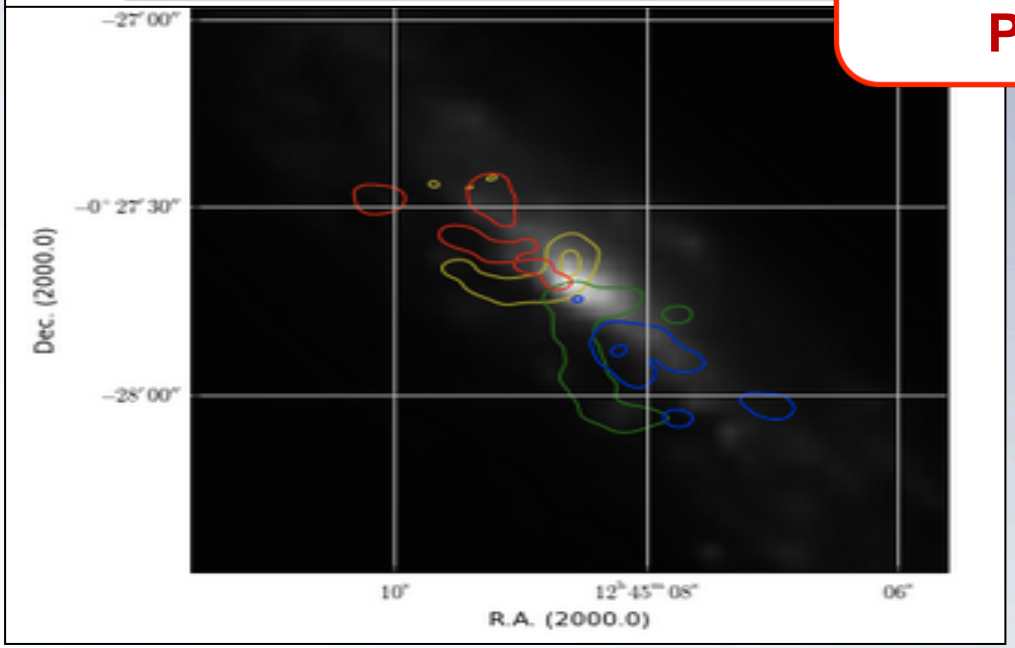
In [25]:
```
# Create canvas
fig = plt.figure(figsize=(6,6))
frame = fig.add_subplot(1,1,1)

# Central Plane
fitsobject.set_imageaxes(1,3,slicepos=3)
mplim = fitsobject.Annotatedimage(frame=frame, cmap="spectral", clipmin=0.08)
mplim.Graticule(visible=False, skipx=True, skipy=True)
mplim.Image()
mplim.plot()
```



3D Exploration /Access Data Use Cases

Renzogram: 2D overlay of contour channels with different colors

```
In [12]: # Create canvas
         fig = plt.figure(figsize=(6,6))
         frame = fig.add_subplot(1,1,1)

         # Display Optical Image
         baseim = Reprojfits.Annotatedimage(frame, cmap="gist_gray")
         baseim.Image()
         baseim.Graticule()
         baseim.plot()

         # Renzogram
         # Slicing the cube
         slices = {'6':'r','10':'y','14':'g','18':'b'}
         for slicepos, color in slices.iteritems():
             planeindex = int(slicepos)
             cubeobject.set_imageaxes(1,2,slicepos=planeindex)

             # Contour levels overlay
             overlay = cubeobject.Annotatedimage(frame, clipmin=
             minval, maxval = cubeobject.get_dataminmax()
             contourlevels = np.linspace(minval, maxval,4)
             overlay.Contours(levels=contourlevels, colors=colo
             overlay.plot()
```



Range in velocities

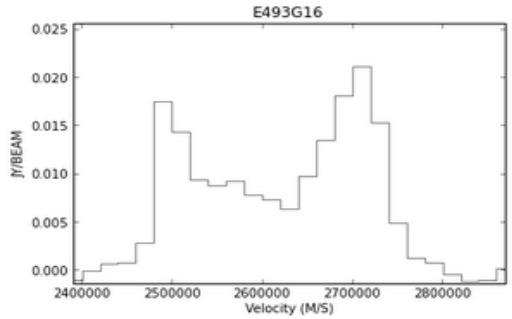
Range in flux

Position angle

3D Exploration /Access Data Use Cases

Aperture Velocity Profile

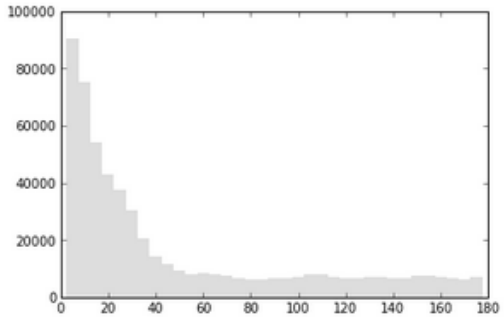
```
In [32]: # circular aperture (xcen,ycen,radius)
         # elliptical aperture (xcen,ycen,height,width,PA)
         # method mean or sum

         spcube = pyspeckit.SpectralCube.Cube(filecube)
         spcube.plot_apspec(aperture=(150,150,80,180,135), method='mean')
```



Spatial aperture
Range in velocities
Range in flux

Integrated Emission Radial Profile

```
In [36]: binsize=5
         radii, vals = agpy.azimuthalAverage(scidata, binsize=binsize, retu
         rnradii=True)
         plt.bar(radii, vals, width=binsize, align='edge', linewidth=0, fil
         l=True, color='#dddddd')
         plt.show()
```



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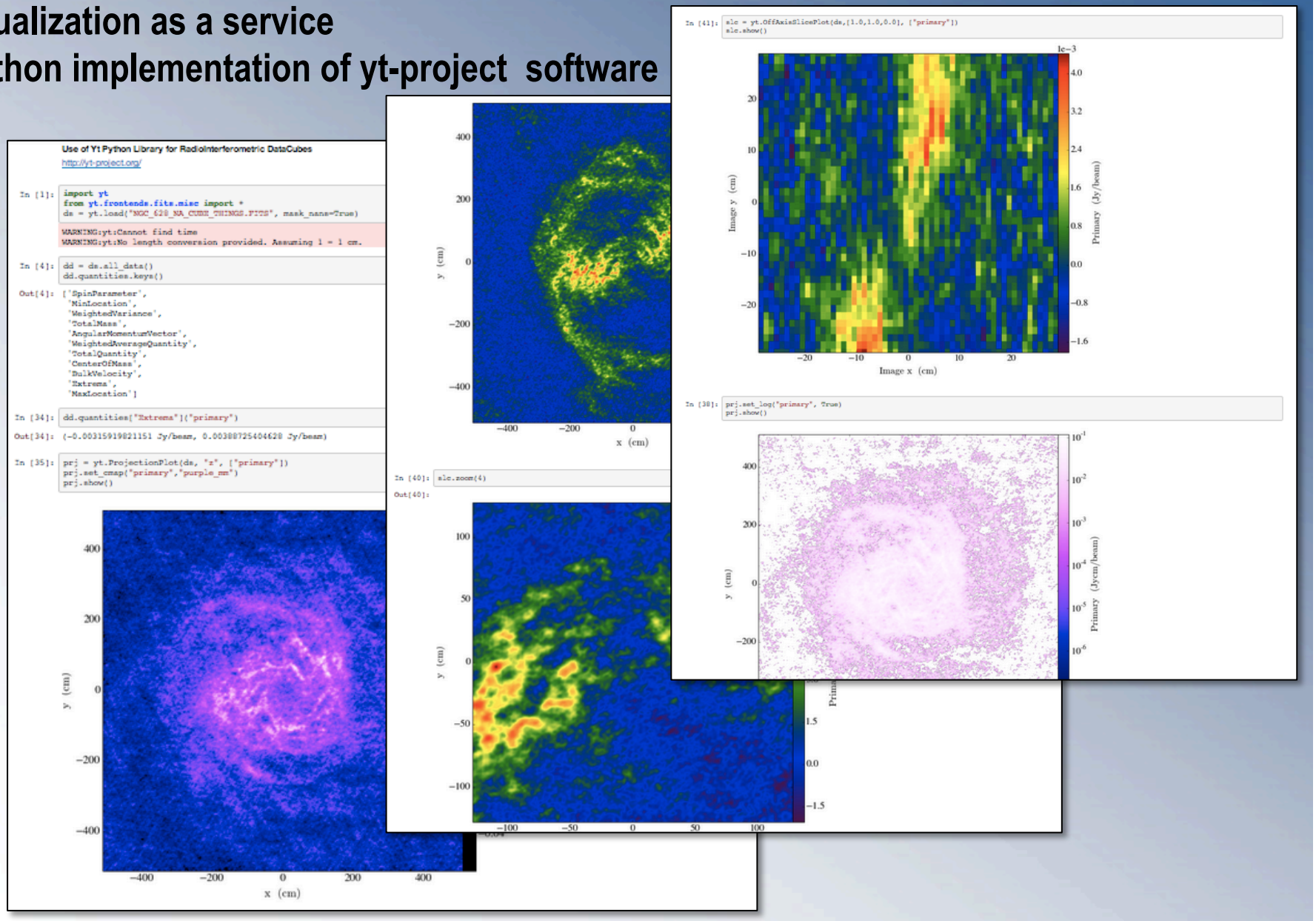
Range in velocities
Range in flux
Position angle
Elliptical rings

3D Exploration /Access Data Use Cases

Visualization as a service
IPython implementation of yt-project software



Conclusions

- SIAv2 prototype/testbed **evolving with in progress standards**
- Two different collections **of single target /single line-emission** velocity cubes of galaxies
- Import from FITS into MySQL database with IPython executable notebook /tool
- Web Interface for discovery and display of **SIAv2/ImageDM UCDs and Utypes**
- accesData UseCases implemented as **programmatic access services**
- **Additions performed into DM** to provide better knowledge of the dataSet:
  - Emission-line characterization (**velocity and flux**)
  - **Post-processing provenance** in radio interferometric cleaned datacubes
  - Archive-specific physical properties of Targets

Links

SIAv2 Prototype
http://amiga.iaa.es:9000

IPython Notebooks Recipes

Datafiller
http://nbviewer.ipython.org/gist/Bultako/690e88d3548745ca194e

Moments
http://nbviewer.ipython.org/gist/Bultako/6522a416d749701d1310

Slicing Datacubes
http://nbviewer.ipython.org/gist/Bultako/badb836e659599b104db

Contour Overlays on Channel Maps
http://nbviewer.ipython.org/gist/Bultako/73f82690e90e2dbb3d76

Renzograms /Contour Overlays on 2DImage
http://nbviewer.ipython.org/gist/Bultako/11427424

Visualization with yt-project software package
http://nbviewer.ipython.org/gist/bultako/11137094

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