Analysis of the Interstellar Medium of Isolated GAlaxies

AMIGA

Velocity Cubes of Galaxies

Discover /Propose /Extract

SIAv2 /DataLink /AccessData

User Experience on Prototype Implementation

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Public Collections

Single Object / Single Line Emission Datasets

SMA B0DEGA
Below 0 Degrees Galaxies

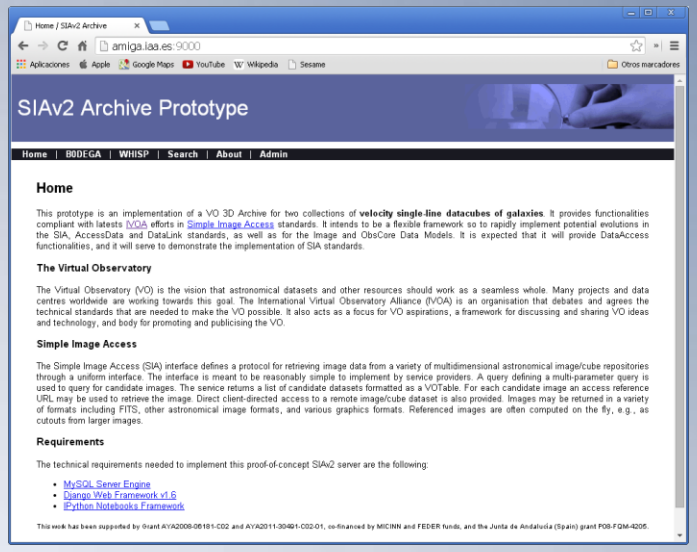
- 30 FITS Files
- **Pixel Dimensions 256x256x25**
- 2D Spatial + 1D **Velocity** + 1D Polarization
- **12 CO 21 Molecular Transition**

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

- 33 FITS Files
- **Pixel Dimensions 512x512x127**
- 2D Spatial + 1D **Frequency** + 1D Polarization
- **HI 21cm Transition**

Madrid IVOA Interop

Prototype Interfaces



Web Interface

http://amiga.iaa.es:9000

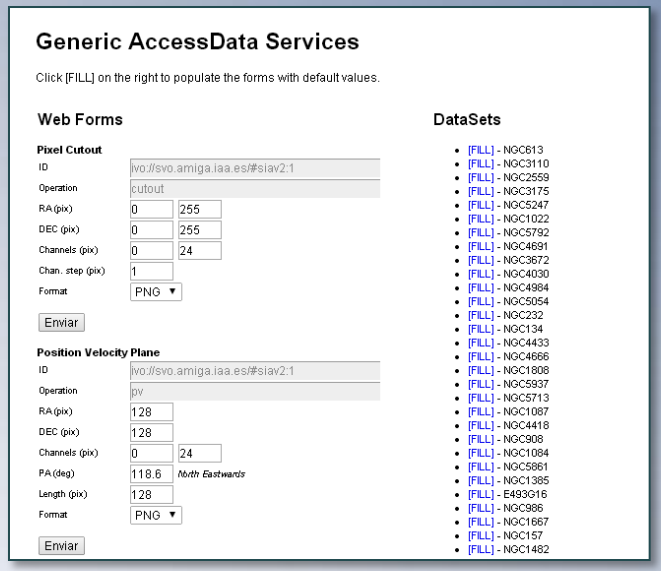
- Discovery
- Display of Characterization Metadatada
- FITS Access /SAMP Broadcasting

Extraction Operations in Pixel Space

- http://amiga.iaa.es:9000/form/accessdata
- http://amiga.iaa.es:9000/accessdata

RESTful Interfaces and Testing Web Forms

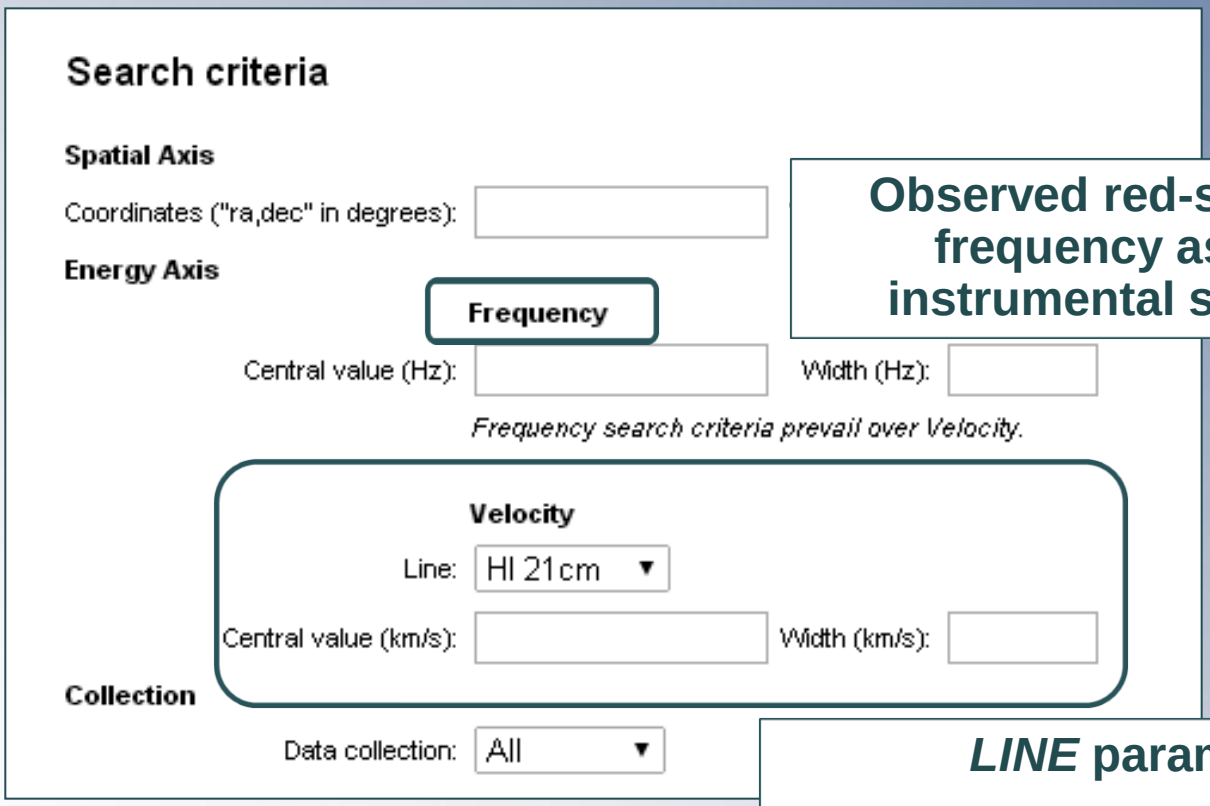
- **Discovery SIAv2**
  - http://amiga.iaa.es:9000/sia
  - http://amiga.iaa.es:9000/form/SIA2
- **Full Characterization Metadata**
  - http://amiga.iaa.es:9000/sia/metadata
  - http://amiga.iaa.es:9000/form/metadata
- **DataLink**
  - http://amiga.iaa.es:9000/datalink
  - http://amiga.iaa.es:9000/form/datalink



Discover / SIAv2 Input

Use Cases for Single-object /Single-emission-line datacubes

- Discover datasets observed with a specific **emission-line** given
- Discover datasets within a specified **range of velocity** for a specific spectral line



Discover / SIAv2 Input

Use Cases for RadioInterferometry Observations

2.1.5 FOV

2.1.6 SPATRES

MRS

Maximum Recoverable Scale
Instrumental Parameter
Provides the maximum angular scale structure that may be recoverable with a given instrumental set-up.
Larger structures in the sky are "resolved out" and cannot be detected.

Discover observations performed with values greater than a **"Maximum Recoverable Scale“** param, so we are sure we do not miss any small structures in the sky.

2.1.16 SPECRP

In spectral velocity radio datacubes, resolving power (more used in optical wavelength observations) may have its analogue in the concept of **"channel width"** usually measured in units of velocity.

Discover / SIAv2 Input

Other Input Params

2.1.7 EXPTIME

User translates into “Searching data with **flux/brightness** constrained in a specified range”
In **broadcasted discovery queries** different instrumental set-up/sensitivity makes it **useless**

2.1.9 COLLECTION	2.1.10 FACILITY	2.1.11 INSTRUMENT	2.1.14 TARGET

What to do wrt. **case-sensitivity** and **strict-equality** for these string-valued params?
These params suit well for services discovery in the **Registry**
Target could be translated to coordinates by a name/coords look-up service like Sesame.

2.1.4 POL	2.1.13 CALIB

Define constraints on **“atomic values”**
Range syntax could be replaced by multi-valued OR queries

Discover /SIAv2 Result

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	0	17.5	118.6	46.9	10.4	12 CO 21	1490.08	20.0011			BODEGA
NGC3110	151.009	-6.47528	SBb	1	0	69.0	176.0	64.89		12 CO 21	4989.95	19.9998			BODEGA
NGC2559	124.275	-27.4558	SBbc	1	0	20.0	3.68	64.2		12 CO 21	1540.04	20.0005			BODEGA
NGC3175	153.676	-28.8717	Sab	1	0	14.9	55.5	76.2	10.1	12 CO 21	1040.03	20.0005			BODEGA
NGC5247	204.512	-17.8842	SABb	1	0	22.2	170.17	38.1	10.57	12 CO 21	1339.98	19.9997			BODEGA
NGC1022	39.6362	-6.6775	SBa	1	0	18.5	67.63	59.87	9.87	12 CO 21	1430.07	20.001			BODEGA
NGC5792	224.595	-1.09111	Sb	1	0	30.6	88.48	72.37	10.52	12 CO 21	1899.88	19.9987			BODEGA
NGC4691	192.057	-3.33278	S0-a	1	0	22.5	15.28	38.67	10.24	12 CO 21	1090.02	20.0004			BODEGA
NGC3672	171.26	-9.79528	Sc	0	0	28.4	6.5	56.16	10.66	12 CO 21	1840.12	20.0013			BODEGA
NGC4030	180.098	-1.1	Sbc	0	0	25.9	8.59	40.0	10.3	12 CO 21	1440.04	20.0005			BODEGA
NGC4984	197.239	-15.5164	S0-a	1	0	21.3	45.0	47.1	10.21	12 CO 21	1239.87	19.9979			BODEGA
NGC5054	199.244	-16.6347	Sbc	0	0	27.3	171.11	57.05	10.66	12 CO 21	1680.0	20.0			BODEGA
NGC232	10.6908	-23.5617	SBa	1	1	89.0	17.18	47.36		12 CO 21	6649.71	24.9989			BODEGA
NGC134	7.59083	-33.2442	SABb	1	0	19.0	49.88	77.3	10.63	12 CO 21	1540.08	20.0011			BODEGA
NGC4433	186.911	-8.27833	SABa	1	0	41.8	3.27	79.41	10.52	12 CO 21	2940.14	20.001			BODEGA
NGC4666	191.286	-0.461944	SABc	1	0	14.1	39.73	69.67	10.1	12 CO 21	1540.03	20.0004			BODEGA
NGC1808	76.9262	-37.5131	Sa	1	1	10.8	136.01	83.87	10.0	12 CO 21	1020.03	20.0005			BODEGA
NGC5937	232.692	-2.82944	SABb	1	0	41.0	175.27	57.97		12 CO 21	2779.83	19.9987			BODEGA
NGC5713	220.048	-0.29	SABb	1	0	30.4	11.0	48.18	10.43	12 CO 21	1839.86	19.9985			BODEGA
NGC1087	41.605	-0.498611	SABc	1	1	19.0	12.03	33.2	10.28	12 CO 21	1530.08	20.0011			BODEGA
NGC4418	186.727	-0.8775	SABa	1	0	33.0	65.36	68.19		12 CO 21	2090.1	20.001			BODEGA
NGC908	35.7692	-21.2339	SABc	1	0	17.8	76.83	57.8	10.51	12 CO 21	1480.04	20.0005			BODEGA
NGC1084	41.4996	-7.57861	Sc	0	0	17.1	35.5	46.0	10.3	12 CO 21	1390.07	20.001			BODEGA
NGC5861	227.317	-11.3217	SABc	1	1	28.9	149.2	69.47	10.51	12 CO 21	1839.84	19.9982			BODEGA
NGC1385	54.3679	-24.5014	SBc	1	0	17.5	3.5	53.0	10.1	12 CO 21	1480.1	20.0013			BODEGA
E493G16	117.183	-26.2464	Sbc	0	0	34.0	149.32	82.67		12 CO 21	2630.14	20.0011			BODEGA
NGC986	38.3929	-39.045	Sab	1	1	23.2	28.06	38.06	10.26	12 CO 21	1940.06	20.0006			BODEGA
NGC1667	72.1542	-6.32	SABc	1	1	61.0	20.0	39.99		12 CO 21	4479.96	19.9998			BODEGA
NGC157	8.69417	-8.39639	SABb	1	0	20.9	28.1	61.74	10.53	12 CO 21	1640.09	20.0011			BODEGA
NGC1482	58.6621	-20.5025	S0-a	0	0	19.6	107.29	63.58		12 CO 21	1840.05	20.0005			BODEGA
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

Analysis of the Interstellar Medium of Isolated GAlaxies

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Discover /SIAv2 Metadata Result

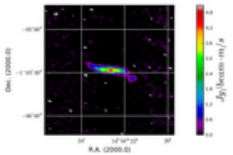
SIAv2 Archive Prototype

Home | 80DEGA | WHISP | Search | About | Admin

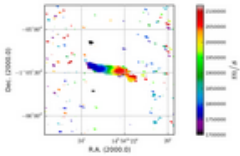
Characterization NGC5792

Target				Curation			
Target.Name	NGC5792		meta.id;src	Curation.Publisher	The AMIGA Group		meta.curation
Target.Description			meta.note;src	Curation.PublisherID	ivo://ivo.amiga.iaa.es		meta.ref.url;meta.curation
Target.Class	G		src.class	Curation.PublisherDID	ivo://ivo.amiga.iaa.es/#siav2.7		meta.ref.url;meta.curation
Target.Pos	(224.60, -1.09)	deg	pos.eq;src	DataID			
Target.Properties				DataID.Title	NGC5792		meta.title;meta.dataset
TargetProperties.OpticalAngDiameter	30.6	arcsec	phys.diameter;phys.angSize	DataID.Collection	80DEGA		meta.title;meta.dataset
TargetProperties.Velocity	1924.4	km/s	phys.veloc	Dataset			
TargetProperties.Redshift			src.redshift	Dataset.Type	cube		
TargetProperties.Distance		Mpc	pos.distance	Dataset.Subtype	bdpiaga.cube.nrfcube		
TargetProperties.PA	88.48	deg	pos.posAng	Dataset.CalibLevel	Level 2		
TargetProperties.Inclination	72.37	deg	src.orbital.inclination	Dataset.Length	2250000		meta.number
TargetProperties.MorphologyType	3.0		src.morph;src.morph.type	Dataset.Image			
TargetProperties.Bar	1		src.morph.param	Image.Naxis	3		meta.number
TargetProperties.Ring	0		src.morph.param	Image.Naxis	300 300 25		meta.number
TargetProperties.BTc	11.274		phys.magAbs.bol	Image.WCSAxes			meta.number
TargetProperties.MFIR	10.677		[*]	Image.ImageScale	8.33333e-05	deg/pix	meta.number
TargetProperties.LogLB	10.92		[*]	Access			
Char.SpatialAxis				Access.Reference	FITS File - Broadcast		meta.ref.url
Char.SpatialAxis.Coverage.Location.Coord.Position2D.Value2.C1	224.60	deg	pos.eq.ra;meta.main	Access.Format	application/fits		
Char.SpatialAxis.Coverage.Location.Coord.Position2D.Value2.C2	-1.09	deg	pos.eq.dec;meta.main	Access.Size	8800	kilobytes	meta.number
Char.SpatialAxis.Coverage.Bounds.Extent.Diameter	0.0125	deg	pos.AngSize;instr.fov	Aladin			
Char.SpatialAxis.Coverage.Bounds.Limits.LoLimit2Vac.C1	224.58	deg	pos.eq.ra;stat.min	Aladin Applet	[Link]		
Char.SpatialAxis.Coverage.Bounds.Limits.LoLimit2Vac.C2	-1.10	deg	pos.eq.dec;stat.min	Derived images			
Char.SpatialAxis.Coverage.Bounds.Limits.HiLimit2Vac.C1	224.61	deg	pos.eq.ra;stat.max				
Char.SpatialAxis.Coverage.Bounds.Limits.HiLimit2Vac.C1	-1.08	deg	pos.eq.dec;stat.max				
Char.SpatialAxis.Resolution.Refval.Value	3.41093	arcsec	pos.angResolution				
Char.SpectralAxis							
Char.SpectralAxis.Coverage.Location.Coord.Spectral.Value		Hz	em.wl;instr.bandpass				
Char.SpectralAxis.Coverage.Bounds.Extent		Hz	em.wl;instr.bandwidth				
Char.SpectralAxis.Coverage.Bounds.Limits.LoLimit		Hz	em.wl;stat.min				
Char.SpectralAxis.Coverage.Bounds.Limits.HiLimit		Hz	em.wl;stat.max				
Char.SpectralAxis.Coverage.Support.Extent		Hz	em.wl;instr.bandwidth				
Char.SpectralAxis.Sampling.Sample.Extent		Hz	em.wl;spect.binSize				
Char.VelocityAxis							
Char.VelocityAxis.LineName	12 CO 21		meta.id;spect.line				
Char.VelocityAxis.LineRestFrequency	2.3093797e+11	Hz	em.freq;spect.line				
Char.VelocityAxis.Location	1899880.0	m/s	phys.veloc.rotat				
Char.VelocityAxis.Coverage.Bounds.Extent	466880.0	m/s	phys.veloc				
Char.VelocityAxis.Coverage.Support.Extent.Limits.LoLimit	1699900.0	m/s	phys.veloc.rotat				
Char.VelocityAxis.Coverage.Support.Extent.Limits.HiLimit	2139880.0	m/s	phys.veloc.rotat				
Char.VelocityAxis.Coverage.Support.Extent		m/s	phys.veloc				
Char.VelocityAxis.Sampling.Sample.Extent	19998.7	m/s	phys.veloc				
Char.ObservableAxis							
Char.ObservableAxis.SupportExtent		Jy/Beam	phot.flux				
Char.ObservableAxis.Min	-0.189539	Jy/Beam	phot.flux;stat.min				
Char.ObservableAxis.Max	0.904454	Jy/Beam	phot.flux;stat.max				
Char.ObservableAxis.Accuracy.StatError.Refval.value	0.0171888	Jy/Beam	stat.error;phot.flux.density;em				
Char.PolAxis							
Char.PolAxis.StatsList			meta.code;phys.polarization				
Char.TimeAxis							
Char.TimeAxis.Coverage.Location.Coord.Time.TimeInstant		d	time.epoch;obs				
Instrumental Provenance							
Provenance.ObsConfig.Facility.Name	MK.SMA		meta.id;instr.tel				
Provenance.ObsConfig.Instrument.Name	SMA		meta.id;instr				
Provenance.ObsConfig.MaxAngScale		deg	instr.param				
Provenance.Postprocessing.Bmaj	3.41093	arcsec	instr.beam				
Provenance.Postprocessing.Bmin	1.90051	arcsec	instr.beam				
Provenance.Postprocessing.Bpa	70.7954	arcsec	instr.beam;instr.param				
Provenance.Postprocessing.Tapering			instr.param				
Provenance.Postprocessing.Oversampling			instr.param				

MOMENT ZERO



MOMENT ONE



Display Metadata as VOTable

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Discover /SIAv2 Metadata Result

Target Properties			
TargetProperties.OpticalAngDiameter	30.6	arcsec	phys.diameter;phys.angSize
TargetProperties.Velocity	1924.4	km/s	phys.veloc
TargetProperties.Redshift			src.redshift
TargetProperties.Distance		Mpc	pos.distance
TargetProperties.PA	88.48	deg	pos.posAng
TargetProperties.Inclination	72.37	deg	src.orbital.inclination
TargetProperties.MorphologyType	3.0		src.morph;src.morph.type
TargetProperties.Bar	1		src.morph.param
TargetProperties.Ring	0		src.morph.param
TargetProperties.BTc	11.274		phys.magAbs.bol
TargetProperties.MFIR	10.677		[?]
TargetProperties.LogLB	10.52		[?]

Discover /SIAv2 Metadata Result

Char.VelocityAxis			
Char.VelocityAxis.LineName	12 CO 21		meta.id;spect.line
Char.VelocityAxis.LineRestfrequency	2.3053797e+11	Hz	em.freq;spect.line
Char.VelocityAxis.Location	1899880.0	m/s	phys.veloc.rotat
Char.VelocityAxis.Coverage.Bounds.Extent	499968.0	m/s	phys.veloc
Char.VelocityAxis.Coverage.Support.Extent.Limits.LoLimit	1639900.0	m/s	phys.veloc.rotat
Char.VelocityAxis.Coverage.Support.Extent.Limits.HiLimit	2139860.0	m/s	phys.veloc.rotat
Char.VelocityAxis.Coverage.Support.Extent		m/s	phys.veloc
Char.VelocityAxis.Sampling.Sample.Extent	19998.7	m/s	phys.veloc

Instrumental Provenance			
Provenance.ObsConfig.Facility.Name	MK.SMA		meta.id:instr.tel
Provenance.ObsConfig.Instrument.Name	SMA		meta.id;instr
Provenance.ObsConfig.MaxAngScale		deg	instr.param
Provenance.Postprocessing.Bmaj	3.41093	arcsec	instr.beam
Provenance.Postprocessing.Bmin	1.90051	arcsec	instr.beam
Provenance.Postprocessing.Bpa	70.7954	arcsec	instr.beam;instr.param
Provenance.Postprocessing.Tapering			instr.param
Provenance.Postprocessing.Oversampling			instr.param

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Dataset Access

Analysis of the Interstellar Medium of Isolated GAlaxies

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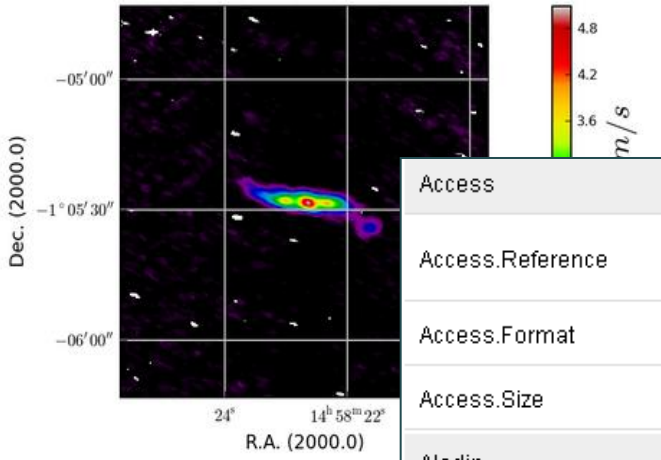
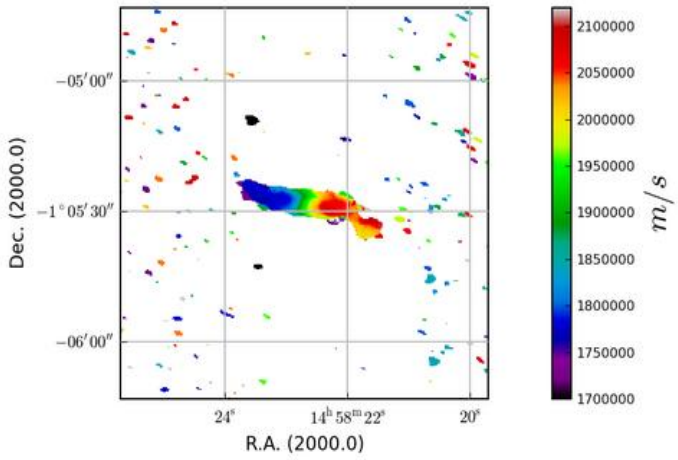
Derived images

MOMENT ZERO



MOMENT ONE



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

WebSAMP Profile

Propose /DataLink

DataLink service info in Discovery and Metadata VOTables response

```
▼<RESOURCE type="meta" utype="adhoc:service">
   <PARAM name="resourceIdentifier" datatype="char" arraysize="*" value="ivo://amiga.iaa.es/sia/datalink"/>
   <PARAM name="standardID" datatype="char" arraysize="*" value="ivo://ivoa.net/std/DataLink#links-1.0"/>
   <PARAM name="accessURL" datatype="char" arraysize="*" value="http://http://amiga.iaa.es:9000/datalink"/>
  ▼<GROUP name="inputParams">
     <PARAM name="RESPONSEFORMAT" datatype="char" arraysize="*" value=""/>
    ▼<VALUES>
       <OPTION value=""/>
       <OPTION value="votable"/>
       <OPTION value="application/x-votable+xml"/>
     </VALUES>
     <PARAM name="ID" datatype="char" arraysize="*" value="" ref="primaryID"/>
   </GROUP>
 </RESOURCE>
```

What is this DataLink service proposing as additional related links?

- The service must be invoked to answer this question
- It could be useful to add a mechanism (e.g. <GROUP name="outputParams">)
- Provide a **description** of the DataLink service as number and nature of the links given
- This may be done only if the **pack of links** is the same for all the IDs in the archive
- The same mechanism could be applied for the **description of ad-hoc services**
- DALI already offers the MAXREC=0 mechanism to provide empty VOTables responses

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Propose /DataLink

Pack of Links proposed by DataLink Service

1. **Characterization metadata in VOTable format**
   - http://amiga.iaa.es:9000/search/sia/metadata?ID=ivo://svo.amiga.iaa.es/#siav2:28
   - http://www.ivoa.net/rdf/datalink#model
2. **Datacube in FITS format**
   1. http://amiga.iaa.es:9000/media/data/B0DEGA/FITS/3Dngc1667.fits
   2. http://www.ivoa.net/rdf/datalink#preview
3. **Pixel cutout based on specified user params / FITS or PNG format**
   1. http://amiga.iaa.es:9000/accessdata
   2. http://www.ivoa.net/rdf/datalink#cutout
4. **Position velocity plane based on specified user params / FITS or PNG format**
   1. http://amiga.iaa.es:9000/accessdata
   2. http://www.ivoa.net/rdf/datalink#cutout
5. **Moment zero based on specified user params / FITS or PNG format**
   1. http://amiga.iaa.es:9000/accessdata
   2. http://www.ivoa.net/rdf/datalink#moments<
6. **Moment one based on specified user params / FITS or PNG format**
   1. http://amiga.iaa.es:9000/accessdata
   2. http://www.ivoa.net/rdf/datalink#moments
7. **Velocity profile for a spatial aperture based on specified user params / PNG format**
   1. http://amiga.iaa.es:9000/accessdata
   2. http://www.ivoa.net/rdf/datalink#sciencedata
8. **Azimuthally averaged radial profile of zero moment provided in PNG format**
   1. http://amiga.iaa.es:9000/accessdata
   2. http://www.ivoa.net/rdf/datalink#sciencedata

Extract /Pixel Space Operations

Ad-hoc services info in DataLink VOTable response

```
▼<RESOURCE type="meta" utype="adhoc:service" ID="momentzero">
   <PARAM name="accessURL" datatype="char" arraysize="*" value="http://http://amiga.iaa.es:9000/accessdata"/>
  ▼<GROUP name="inputParams">
     <PARAM name="operation" datatype="char" arraysize="*" value="moment"/>
     <PARAM name="ra_min" datatype="double" units="pix" value=""/>
     <PARAM name="ra_max" datatype="double" units="pix" value=""/>
     <PARAM name="dec_min" datatype="double" units="pix" value=""/>
     <PARAM name="dec_max" datatype="double" units="pix" value=""/>
     <PARAM name="chan_min" datatype="double" units="pix" value=""/>
     <PARAM name="chan_max" datatype="double" units="pix" value=""/>
     <PARAM name="flux_min" datatype="double" units="" value=""/>
     <PARAM name="flux_max" datatype="double" units="" value=""/>
     <PARAM name="ID" datatype="char" arraysize="*" value="" ref="primaryID"/>
     <PARAM name="order" datatype="char" arraysize="*" value="zero"/>
    ▼<PARAM name="format" datatype="char" arraysize="*" value="">
      ▼<VALUES>
         <OPTION VALUE="image/fits"/>
         <OPTION VALUE="image/png"/>
       </VALUES>
     </PARAM>
   </GROUP>
 </RESOURCE>
```

Which input params are mandatory?

- <PARAM use="required"> mechanism

Are these single-valued or multi-valued params?

How to declare default values?

Which is the nature of the response?

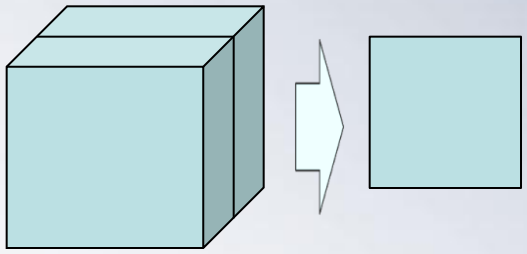
- VOTable
- Image product

Extract /Pixel Cutout

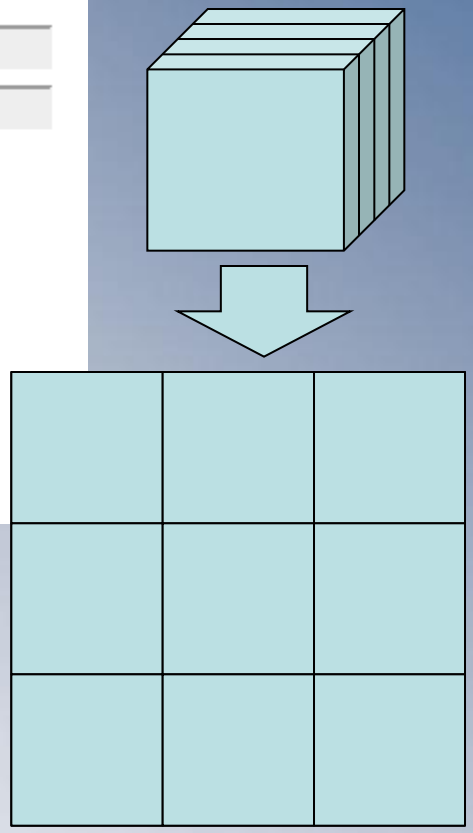
Pixel Cutout

ID	ivo://svo.amiga.iaa.es/#siav2:3	
Operation	cutout	
RA (pix)	0	255
DEC (pix)	0	255
Channels (pix)	0	24
Chan. step (pix)	2	
Format	PNG ▼ (PNG, FITS)	

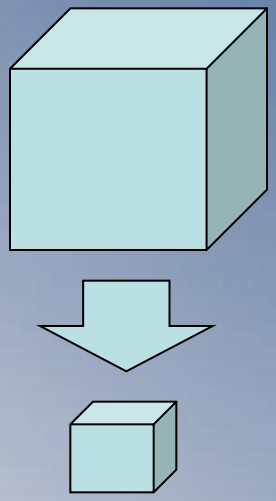
Enviar



SingleChannel Slicing



MultiChannel Slicing



Subcube Extraction

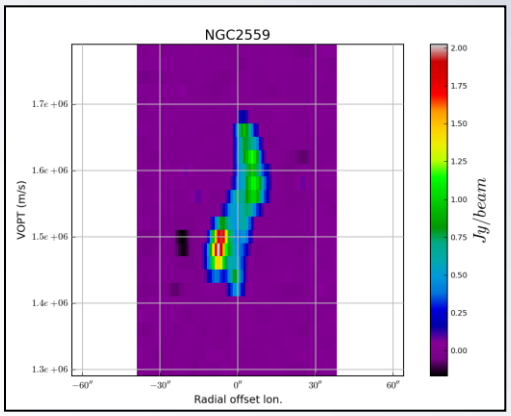
Extract /Position velocity Plane

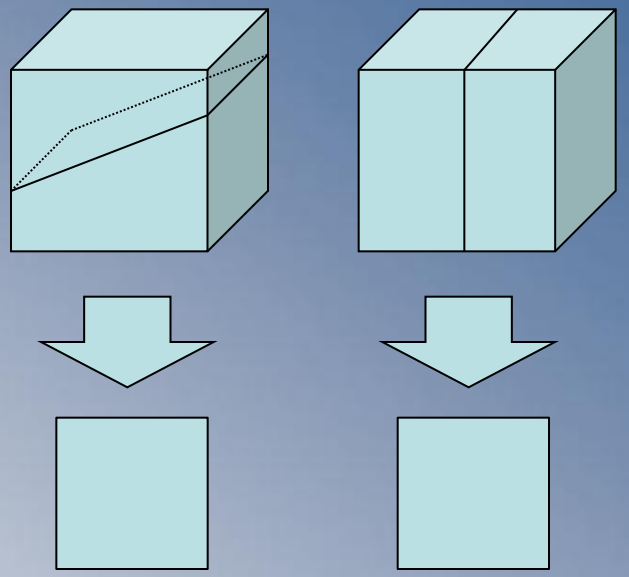
Position Velocity Plane

ID	ivo://svo.amiga.iaa.es/#siav2:3
Operation	pv
RA (pix)	128
DEC (pix)	128
Channels (pix)	0 24
PA (deg)	3.68 *North Eastwards*
Length (pix)	128
Format	PNG ▼ (PNG, FITS)

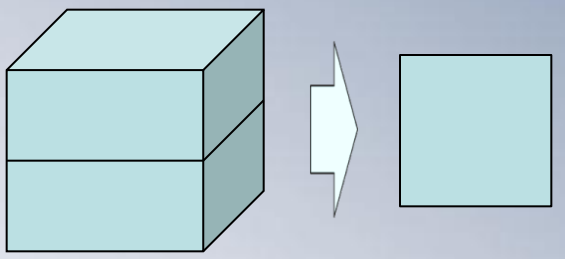
Enviar

Form is pre-filled with galaxy PA value





Cutting along arbitrary angles in velocity axis



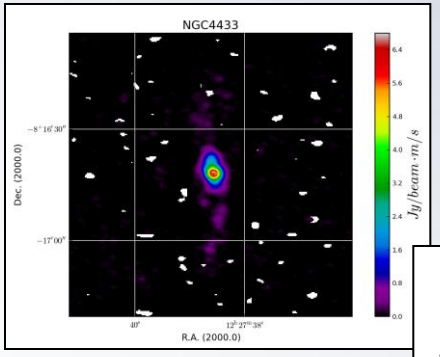
Extract /Moments

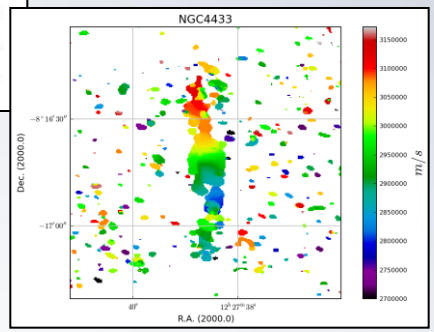
Moments

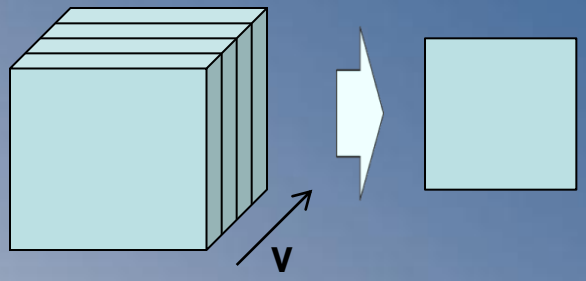
Order	Zero ▼ (Zero / One)	
ID	amiga.iaa.es/#siav2:3	
Operation	moment	
RA (pix)	0	255
DEC (pix)	0	255
Channels (pix)	0	24
Flux	0.05769	2.02273
Format	PNG ▼ (PNG / FITS)	

Enviar

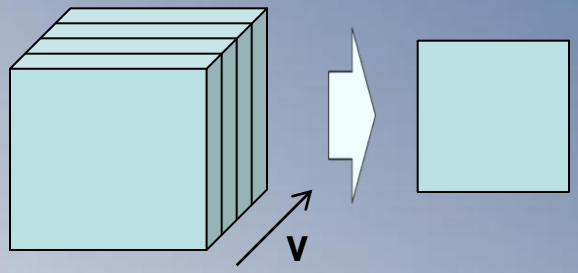
Form is pre-filled with flux values







Integrated Emission



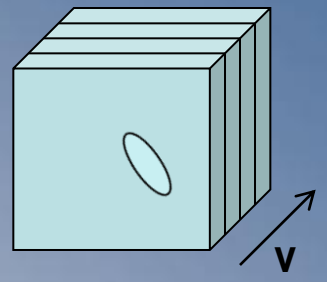
Velocity Weighted Integrated Emission

Extract /Spectral Profile

Spectral Profile

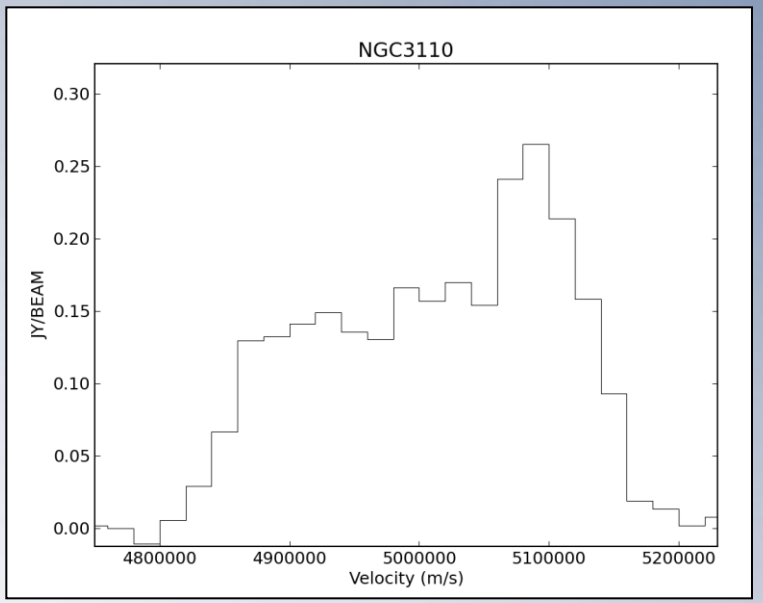
ID	ivo://svo.amiga.iaa.es/#siav2:2
Operation	velocityprofile
RA (pix)	128
DEC (pix)	128
Height (pix)	10
Width (pix)	10
PA (deg)	176.0

Enviar



Integrated Spectral Profile

Form is pre-filled with galaxy PA value

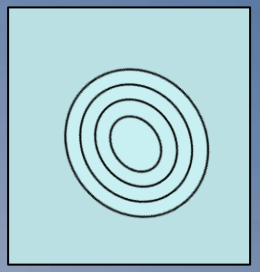


Extract /Radial Profile

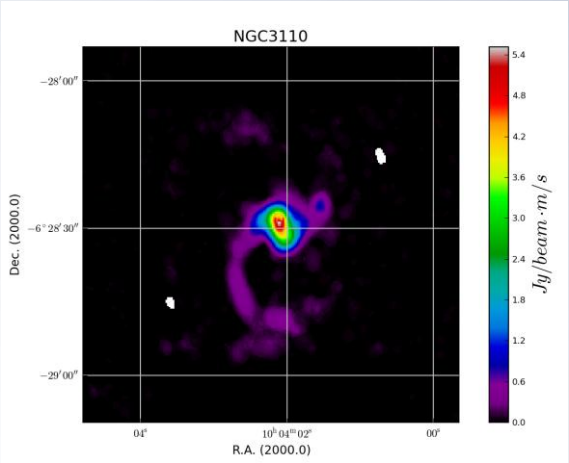
Radial Profile on Moment Zero

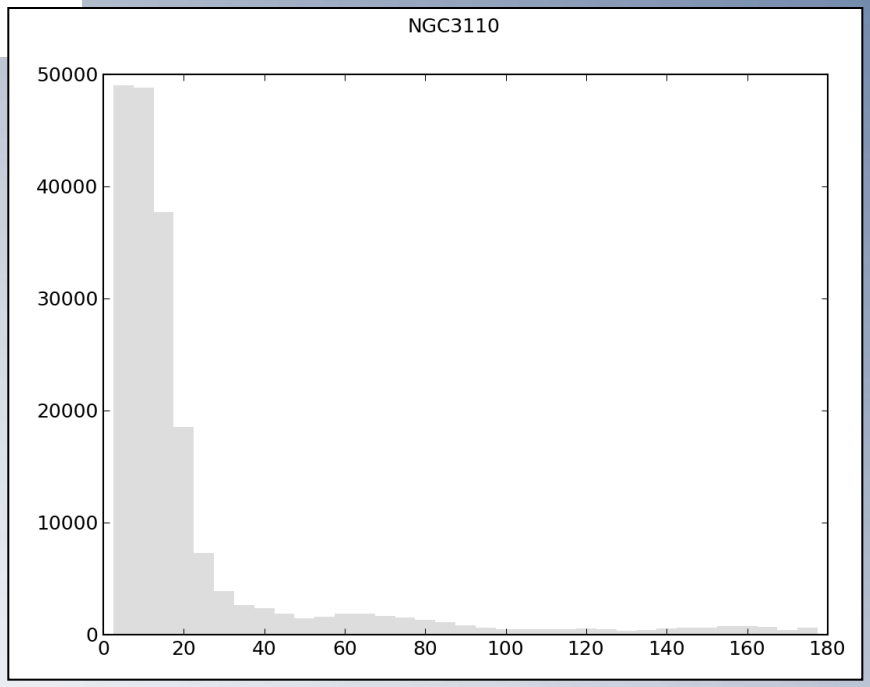
ID	ivo://svo.amiga.iaa.es/#siav2:2
Operation	radialprofile
RA (pix)	128
Dec (pix)	128
Radius (pix)	128
Axis ratio (b/a)	1
Binsize (pix)	5

Enviar



Integration of flux along rings on Moment Zero image





Analysis of the Interstellar Medium of Isolated GAlaxies

AMIGA

AccessData Draft

- Well suited for operations and extraction operations on **Images**
- COORD and SELECT params (Theoretical Simulations Data) slightly out of scope
- The name AccessData may be confusing -> AccessImage
- Keep it simple - **over sizing** standards may be counter-productive

- **Single param/axis and compatibility with SIA discovery params**
  - AccessImage
  - Complex Transformations on Images /Cubes
- **Atomic 3-factor semantics in input params**
  - Generic Dataset Access in Multidimensional Space
  - Filtering Operations in Pixel Space performed on single datasets

- Well suited for **broadcasted** queries producing **virtual images of the sky** on-the-fly
- Specific operations on **single datasets** may be provided as ad-hoc services

- **VO Registry**
  - Complex services like AccessImage mean complex discovery of services
  - Users would like to discover very specific services for specific purposes