



# **ISO Legacy Colloquium Closing remarks (Highlights of Active Archive Phase)**

**Alberto Salama**

**ISO Project Scientist**

**European Space Astronomy Centre (ESAC)**

**Astronomy Science Operations Division**

**ESA's Research and Scientific Support Department**

**13 December 2006**



# ISO Active Archive Phase Charter

## ❑ **Archive maintenance and improvements:**

- Stimulating **systematic data reduction** and capturing the resulting data products into the archive
- Ingestion of new ISO **catalogues** and **atlases**
- Continuing the process of increasing the **inter-operability of archives** by linking to other data sets. This implies **flagging of problems or uncertainties**, for use by the “innocent” external user
- **Tracking of refereed ISO publications** and incorporating this information
- Maintaining the archive, especially the **user interface** to maximise its usefulness and ease of use.

## ❑ **Support in data usage**

- provision of advice
- support for data reduction either remotely or via visits to the centre
- supply of, and assistance with, software for detailed data analysis



# ISO Active Archive Phase Charter

- ❑ **Supply of general information**
  - Helpdesk and WWW services
- ❑ **Promotion of awareness of ISO data**
  - conferences, workshops
- ❑ **Continuation of the cooperation with the National Data Centres**
  - Maintenance and improvement of interactive data analysis
  - Instrument-specific calibration,
  - Focussed reduction of specific data sets

==> ISOPHOT, SWS, LWS NDCs (CAM in-house)
  
- ❑ **Resources: 27 myrs spread over 5 years (2002 – 2006)**
  - (lowering towards end of phase, involvement in other missions)



# 1. Get community feedback on needs



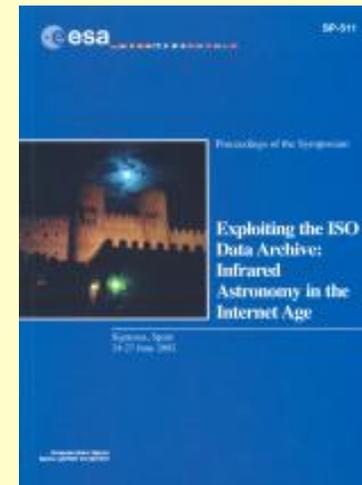
Conference:

Exploiting the ISO Data Archive -  
Infrared Astronomy in the Internet Age

Sigüenza, Spain, June 24- 27 2002

- Scientific reviews and emphasis on potential still locked
- Vivid interest of the community in ISO data
- Systematic use of the archive
- Relation to Virtual Observatories
- Served also to identify the highest priority systematic reduction projects

- 77 papers
- 81 participants





## 2. Establish data reduction projects

- ❑ Instrument expertise is with the National Data Centres (NDCs)
  - For some NDCs, resources are very limited
  - Experts are already working for other mission
  
- ❑ Dedicated short-term contracts with students
  - work based at NDCs
  - under supervision by experts
  - with strong involvement of IDC for the relations to IDA

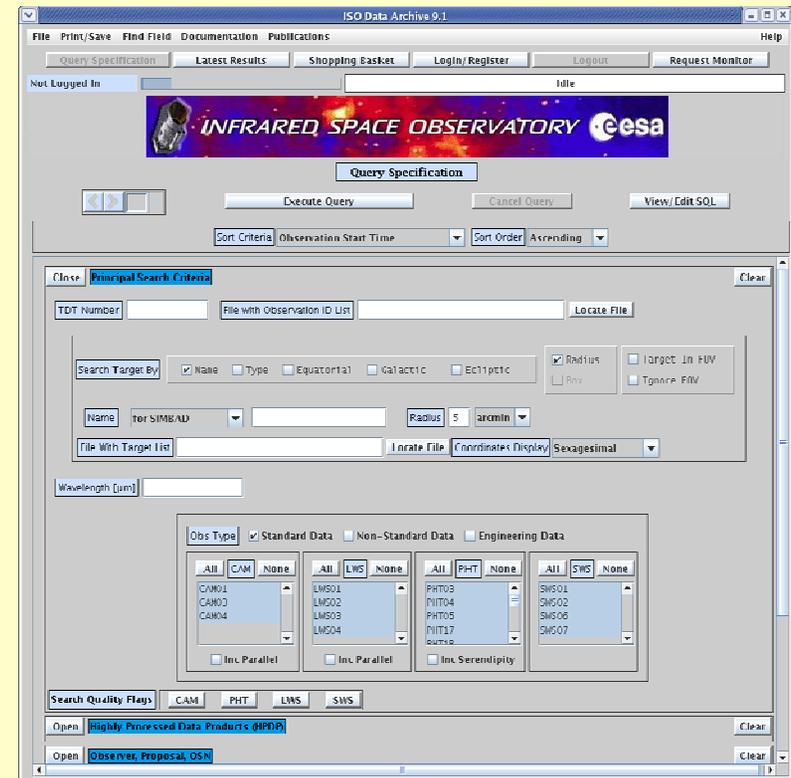
AND

- ❑ Dedicated contract of IDC with the Konkoly Observatory for reduction of selected PHT instrument modes (for the whole duration of AAP)
  
- ❑ Specific scientific collaborations IDC - community
  - E.g. CAM-CVF



## 3. ISO Data Archive improvements

- ❑ Improved data products
  - Systematic (interactive) processing of 1/3 of standard observations, including catalogues and atlases.
- ❑ Improved data characterisation
  - Data Quality Reports
- ❑ Better user interface, including
  - Improved interoperability with other archives
  - Object type queries
- ❑ Integration into Virtual Observatory
  - Direct involvement in VO science demos





## Version 6.0 (24/Jul/2003): HPDPs (Highly Processed Data Products)

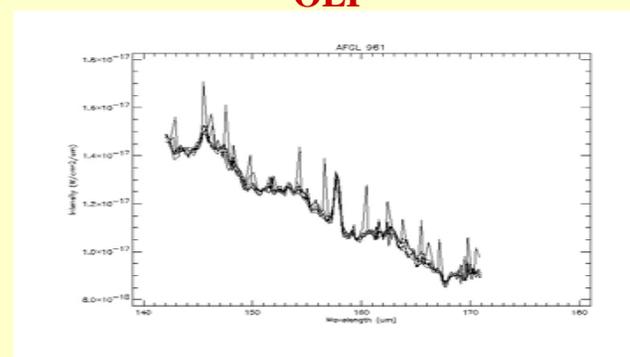
- ❑ Facility for continuous ingestion of systematic processing of selected observing modes or class of objects
  
- ❑ Products improved systematically `by-hand'
  - via Interactive Analysis or improved algorithms, to correct for residual instrumental artefacts still present in the pipeline data.
  
- ❑ Data, catalogues, atlases



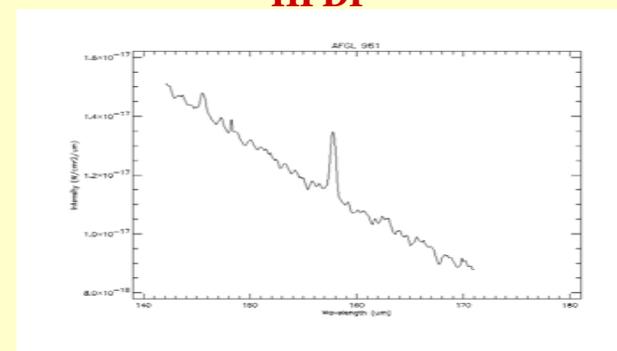
## Uniformly processed LWS01 spectra

- ✓ Deglitching
- ✓ Better wavelength assignment
- ✓ Remaining drift correction
- ✓ Averaging of scans
- ✓ Correction for the NIR-leak
- ✓ Correction for the SW1 double peak feature
- ✓ Defringing
- ✓ Assignment of quality flags

**OLP**



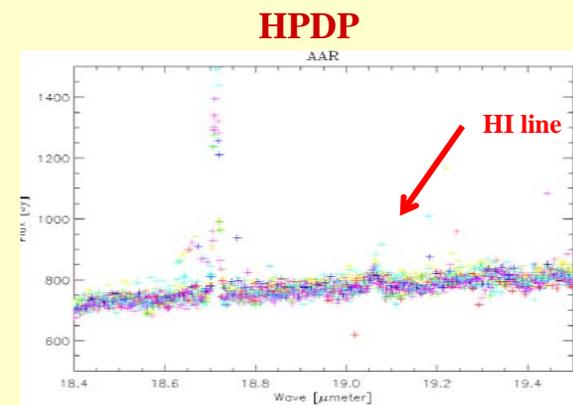
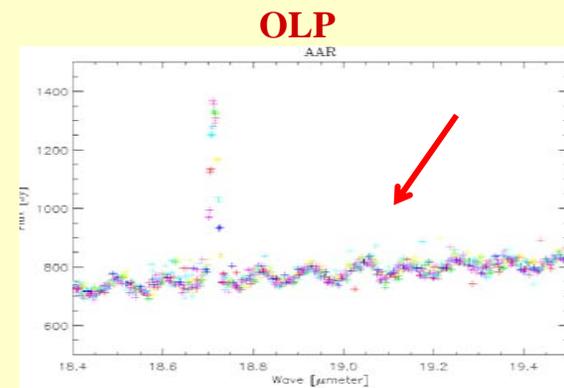
**HPDP**





## High resolution processed and defringed SWS01

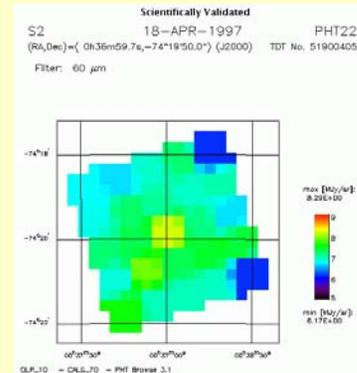
- ✓ Applicable to ~ 300 AOT1s-full grating scan at reduced resolution
- ✓ Processing brings spectra back to instrument resolution
- ✓ Defringed
- ✓ Provide the opportunity to extract bulk spectral and noise information from data-products





# Far-Infrared ISOPHOT minimaps of evolved objects

- ✓ Drift correction
- ✓ Transient correction
- ✓ Empirical correction for systematic trends
- ✓ Background determination
- ✓ Flux extraction
- ✓ Compilation of a catalogue



From a map to a catalogue with final photometric values

Object name	Object type	ISO name	TOTNUM_ON	On Meas. #	RA(2000)	DEC(2000)	Detector	Wavelength [micron]	Epoch	TOTNUM_OFF	Off Meas. #	Flux density [Jy]	Flux uncertainty [Jy]	Background [MJy/str]	Detection [sigma]	Object size	Quality
[GB98] S02	Star	S2	51900405	01	0.616583334	-74.330527278	C1	60	18-APR-1997	51900405	01	0.088	0.017	6.9	7.0	P	R1
[GB98] S09	Star	S9	53300720	01	0.835750000	-73.524750000	C1	60	2-MAY-1997	53300720	01	0.08	0.011	12.3	2.5	P	R9
[GB98] S13	Star	S13	75000401	01	0.849583333	-73.861944444	C1	60	4-DEC-1997	75000401	01	0.232	0.024	8.3	12.9	P	R9
[GB98] S13	Star	S13	75000331	01	0.849583333	-73.861916667	C1	100	4-DEC-1997	75000331	01	0.184	0.016	7.3	7.3	P	R9
[GB98] S13	Star	S13	85901135	01	0.849583333	-73.861916667	C2	200	23-MAR-1998	85901135	01	0.0050	0.02	7.8	-0.1	P	R6R10R12R13
[GB98] S16	Star	S16	51901737	01	0.951361111	-73.587222222	C1	60	18-APR-1997	51901737	01	0.027	0.0050	7.0	2.0	P	R1
[GB98] S22	V*	S22	53300849	01	1.150555556	-71.403888889	C1	60	2-MAY-1997	53300849	01	0.0070	0.0090	7.2	1.0	P	R1
[GB98] S23	Star	S23	51901852	01	1.175777778	-73.084750000	C1	60	18-APR-1997	51901852	01	0.0070	0.0080	8.0	0.9	P	R1
IRAS 04374-6831	Star	PSC04374-6831	66300936	01	4.623000000	-68.417500000	C1	60	9-SEP-1997	66300936	01	0.025	0.0070	7.8	2.3	P	R1
IRAS 04407-7000	Star	PSC04407-7000	56702037	01	4.674555556	-69.320277778	C1	60	5-JUN-1997	56702037	01	0.064	0.013	7.4	4.4	P	R1
IRAS 04496-6958	C*	IRAS04496-6958	86800502	01	4.821833333	-69.887222222	C1	60	1-APR-1998	86800502	01	0.023	0.0090	7.0	2.5	P	R1
IRAS 04545-7000	Star	PSC04545-7000	56701440	01	4.902750000	-69.932722222	C1	60	5-JUN-1997	56701440	01	0.124	0.019	9.5	3.6	P	R1
IRAS 05146+2521	V*	05146+2521	68801094	01	5.293588889	25.416388889	C2	200	4-OCT-1997	68801094	01	0.155	0.329	40.3	0.0	P	R8R13
SVV HV 2446	V*	HV2446	58401843	01	5.333750000	-67.578666667	C1	60	22-JUN-1997	58401843	01	0.023	0.01	9.7	1.0	P	R1
IRAS 05289-6617	C*	PSC05289-6617	63003745	01	5.484055556	-66.298583333	C1	60	7-AUG-1997	63003745	01	0.142	0.015	7.8	7.3	P	R10
IRAS 05402-6956	Mira	PSC05402-6956	62401648	01	5.662583333	-69.921527778	C1	60	1-AUG-1997	62401648	01	0.182	0.083	35.6	1.4	P	R9
IRAS 07486-7753	Mira	07486-7753	73501601	01	7.775583334	-78.018777778	C2	200	20-NOV-1997	73501601	01	0.064	0.107	14.3	0.0	P	R6R13
IRAS 08478-7919	Star	08478-7919	73501809	01	8.765834444	-79.503888889	C2	200	20-NOV-1997	73501809	01	0.377	0.075	12.7	0.0	P	R8
IRAS 10283-8048	Star	10283-8048	67404231	01	10.470166667	-81.059472222	C2	200	20-SEP-1997	67404231	01	0.042	0.045	7.7	0.0	P	R6R13
OH359.508+0.179	Mira	OH359.508+0.179	50401333	01	17.29083334	-29.262500000	C1	60	3-APR-1997	50401333	01	12.346	3.586	1745.9	2.1	P	R9R10
OH359.513+0.174	Mira	OH359.513+0.174	49800630	01	17.29611111	-29.260250000	C1	60	28-MAR-1997	49800630	01	11.623	4.027	1987.5	2.0	P	R9
OH359.889+0.361	Mira	OH359.889+0.361	48502533	01	17.732472223	-28.841750000	C1	60	15-MAR-1997	48502533	01	2.481	0.438	651.1	1.7	P	R10
OHO.019+0.345	Mira	OHO.019+0.345	49402145	01	17.738638889	-28.738611111	C1	60	24-MAR-1997	49402145	01	2.713	0.523	729.2	2.4	P	R1
OH359.943+0.260	Mira	OH359.943+0.260	48502436	01	17.741138889	-28.848888889	C1	60	15-MAR-1997	48502436	01	-0.082	0.673	893.4	-0.3	P	R1
OH359.800+0.165	Mira	OH359.800+0.165	49801418	01	17.741666667	-29.025777778	C1	60	28-MAR-1997	49801418	01	-0.08	3.26	1426.4	0.2	P	R9R10
OH359.899+0.222	OH/IR	OH359.899+0.222	31802061	01	17.741888889	-28.906750000	C1	60	30-SEP-1996	31802061	01	4.235	1.225	974.8	2.8	P	R10
OH359.890+0.155	Mira	OH359.890+0.155	48502109	01	17.745055556	-28.943888889	C1	60	15-MAR-1997	48502109	01	7.542	3.498	1363.8	3.8	P	R1
OH359.783-0.392	Mira	OH359.783-0.392	50800648	01	17.777222222	-29.325466667	C1	60	7-APR-1997	50800648	01	6.925	3.583	1779.6	1.2	P	R9
OHO.096-0.427	OH/IR	OHO.096-0.427	48501806	01	17.791916667	-29.076000000	C1	60	15-MAR-1997	48501806	01	3.506	1.018	918.1	1.6	P	R1
OHO.495-0.211	OH/IR	OHO.495-0.211	50801193	01	17.793555556	-28.623166667	C1	60	7-APR-1997	50801193	01	18.851	2.701	1716.0	3.4	P	R10
OHO.523-0.206	Mira	OHO.523-0.206	49400990	01	17.794333333	-28.596027778	C1	60	24-MAR-1997	49400990	01	3.501	0.875	1792.4	0.5	P	R1

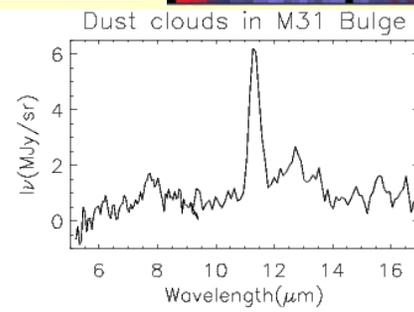
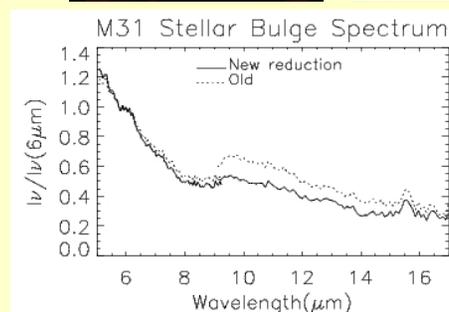
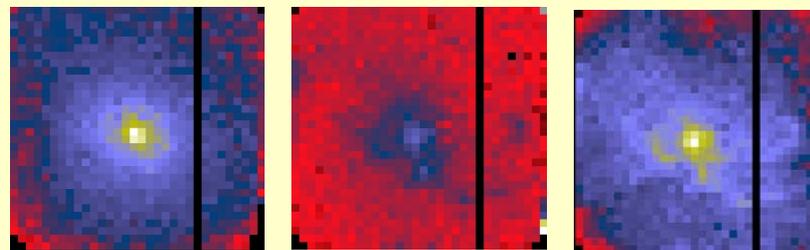


# ISOCAM CVF observations

- ◆ 5-17 $\mu\text{m}$
- ◆  $R = \lambda/\Delta\lambda \sim 50$
- ◆ 1.5,3,6,12 arcsec pfov, 32X32
- ✓ zodiacal light subtraction
- ✓ straylight from uniform illumination correction
- ✓ wavelength shift correction
- ✓ distortion correction
- ✓ astrometric accuracy  $\leq 1$  pixel

Corrected: 6 and 11.3  $\mu\text{m}$

Uncorrected 11.3  $\mu\text{m}$





## **HPDPs now in the ISO Data Archive**

**CAM photometry of faint 6.7 um sources in the SSA13 field**

**ISOCAM 12 micron Atlas of Bright Spiral Galaxies**

**Mid-IR Spectro Imaging ISOCAM CVF Observations**

**CAM CVF spectra of the circumstellar environment of YSO**

**Uniformly processed LWS L01 spectra**

**LWS Observations of Asteroids**

**An atlas of SWS+LWS spectra of galactic HII regions**

**LWS01 corrected for near IR leak**

**The ISO-SWS Post-He Atlas of Near-IR Stellar Spectra**

**SWS observations of Asteroids and Planetary Satellites**

**High resolution processed and defringed SWS01s**

**A uniform database of SWS 2.4-45.4 micron spectra**



## HPDPs now in the ISO Data Archive

- ISOPHOT Observations of compact sources at 3.6  $\mu\text{m}$**
- Far-infrared ISOPHOT scans of compact objects**
- Far-Infrared ISOPHOT minimaps of solar-system objects**
- ISOPHOT C200 chopped observations of compact objects**
- Far-infrared ISOPHOT minimaps of normal stars**
- Far-Infrared ISOPHOT minimaps of miscellaneous objects**
- Far-Infrared ISOPHOT minimaps of evolved objects**
- Far-infrared ISOPHOT minimaps of extragalactic objects**
- PHT chopped mode spectroscopy processing**
- PHT mini-map photometry processing**
- An Atlas of PHT 2.5-12 micron spectra of Normal Galaxies**



## □ Data Quality Report:

Innovate mechanism for characterization of observations.

- ✓ Compile all info
- ✓ html file (“linkable”)
- ✓ looking at the future (VO)



### Data Quality Report

Observation number: 791002040

**Observation flags:**

[Incomplete Raster Maps](#)

**Pipeline data reduction flags and caveats:**

[Signals not stable](#) [Check Related File](#)

[FCS signal not stable](#) [Check Related File](#)

[Caveats](#)

**Highly Processed Data Products** are the result of further processing beyond the pipeline and/or using new, refined algorithms for which some of the pipeline data reduction flags and caveats may no longer be applicable:

**Recommended HPDP (Default Dataset)**

**No Highly Processed Data Products for this observation.**

**Comments:**

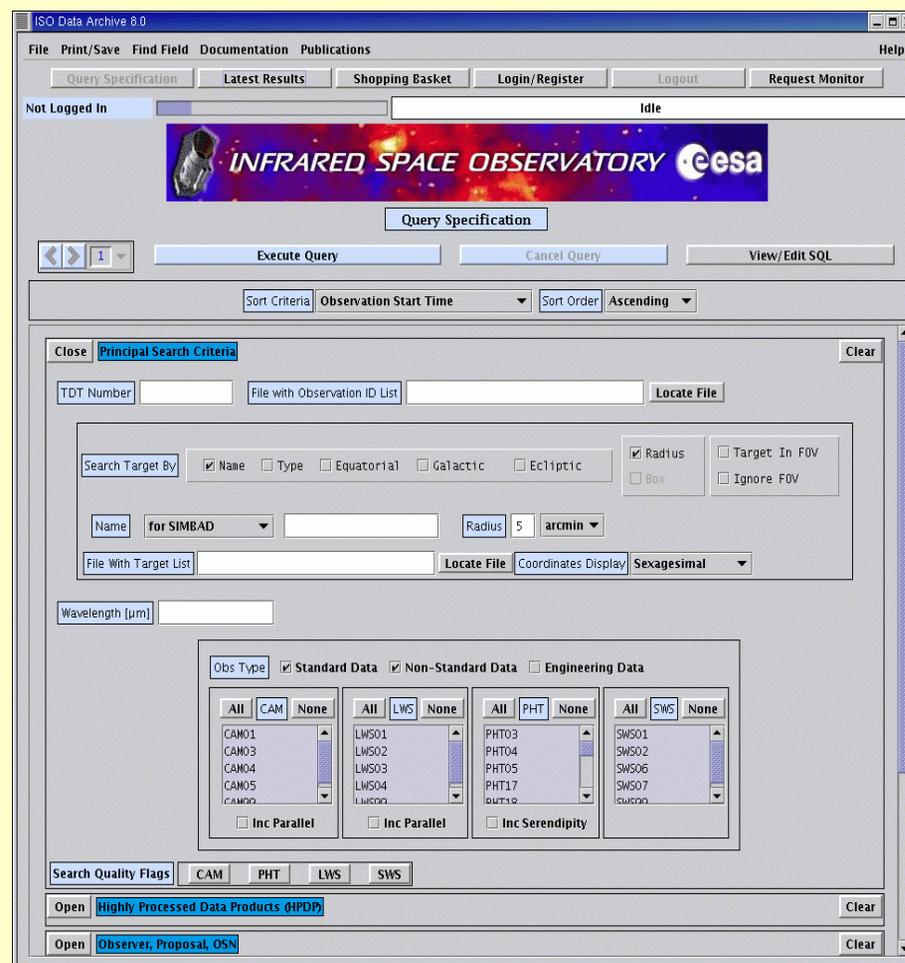
This map is affected in the following way:

- 1) Partial saturation due to bright areas insight the map occur for 4 raster positions (377, 378, 383, 384) with up to 42%. As this map is performed on the SMC with bright regions, saturation events are expected.
- 2) An on-target flag jitter occurs on raster positions 29, 277, 317, 341, 352, 368, 390. Loss of ramps is minimal (at maximum 4 out of 15). No problem.
- 3) On raster position 234 a huge glitch hits pixel 4. This leads for several raster points to unusable ramps for this pixel. It looses its reset level (up to +0.5 V!) which leads on many subsequent raster points to partially saturated ramps. The signals of this pixel should be considered as unreliable (and noisy!). The pixel does not recover any more, though towards the end of this map some raster points with nominal reset levels are found; this may be due to partial curing after passage of the bright spot at around raster position 380. After interrupt of the exposure and start of the second FCS measurement, the pixel shows nominal signals (as compared to the 1st FCS measurement) and the reset level is nominal, though slightly increased w.r.t. the neighbouring pixels. Pixel 4 does not show normally such an erratic behaviour (this is attributed to pixel 1) and in the course of quality analysis this hit is a really unique event. 41.5% of the data taken with this pixel are doubtful. As the map has nearly no redundancy (only 20% overlap from different raster points) 10% of the total map is affected.
- 4) The orientation of the array (3 deg. w.r.t. N) is different from the orientation of the raster (225 deg. w.r.t. N). Therefore, it is expected that the map shows holes, which amount to about 15% of the total map area.



## □ Bring IDA in line with other ESA Archives

- ✓ More flexible User Interface and easier maintenance for IDA in the future
- ✓ Incorporates new functionalities developed for other archives at ESAC (XMM-Newton, Planetary Science,...)



## Version 9.0 (27/Jul/2005): Default Dataset



- The "Default Dataset" can be: The best Highly Processed Data Products (HPDP) associated to the observation or the Off-Line Processing Pipeline v10.1 products.
- Survey products, icon and postcards created from the HPDP
- Data Quality Reports sorted to include best HPDP info

Details	Related	HD114762	PHT22	13h12m19.81s	+17d31'01.9"	-----
Articles	HPDP	Multi-filter photometry			Scientifically Validated	
<b>Retrieve Default Dataset</b>		170.00µm			f.o.v. 273"x273"	
Retrieve Other Products		39000533	HHABING	HJHVEGA5	1996-12-10 13:04:30.▶	570 sec
						Quality Report



# Version 9.1 (15/Mar/2006): Query other archives



Query Other Archives

IC 4329 A : 13h49m19.15s -30d18'34.2"

Search Radius (arcmin): 10

**ESA Archives**

- XMM-Newton (XSA)
- Integral (ISDA)
- IUE

**Source Catalogue Archives**

- Simbad
- Vizier
- NED
- RASS

**Archives for radio-to-UV observatory data**

- IRAS
- MAST/HLSP
- Spitzer
- 2MASS
- MSX

**Archives for high-energy observatory data**

- BeppoSAX/NFI
- BeppoSAX/WFC
- Chandra
- Ginga
- GRO
- Einstein
- EXOSAT
- ASCA
- ROSAT
- RXTE

Search this observation in the selected Archives

ISO Data Archive 9.1b4

File Print/Save Find Field Documentation Publications Help

Query Specification Latest Results Shopping Basket Login/Register Logout Request Monitor

Not Logged In Idle

**INFRARED SPACE OBSERVATORY** esa

Move Selected to Basket Move All to Basket Mark All Delete Selected Refresh List VOSpec

25 in Page Each One

Observations 1. Shown: 1st and each until and including 1st

Observations  Description  Wavelengths  Admin Info.

Details	Related	Articles	HPDP
Cen A	PHT40	13h25m27.50s	-43d01'10.9"
Spectrophotometry Scientifically Validated			
2.47-4.87µm f.o.v. 24"x24"			
09000503	RGENZEL	MPEXGAL3	1996-02-15 07:01:26.1
			1132 sec
<input type="button" value="Quality Report"/>			

Cross Correlation Search

ISO Home Page | IDA | ISO Internal | IDC Software Maintenance

Data Search / Missions / Contacts / STScI / MAST

**Cross Correlation Search**

User-given position: 13h25m27.50s, -43d01'10.9"

HST:WFPC1 (radius = 3 arcmin)

number of rows returned = 18

Click on Dataset or Target Name entries to preview information on data.  
Click on Ref entries to display list of published papers.  
Click on Proposal ID entries to display information on observing program.  
Records with a @ character next to the mark button are proprietary.

Mark	Dataset	Target Name	RA (J2000)	Dec (J2000)
<input type="checkbox"/>	W1R100MT	CINA-KNOTAB	13 25 29.43	-43 00 58.2
<input type="checkbox"/>	W1R100IT	CINA-KNOTAB	13 25 29.43	-43 00 58.2
<input type="checkbox"/>	W1R100ST	CINA-KNOTAB	13 25 29.43	-43 00 58.2

SSS Archive: Search Results/Select Items - Mozilla Firefox

ISO Home Page | IDA | ISO Internal | IDC Software Maintenance | Eva Venegas Home Page | Konkoly Observatory

**SPITZER SPACE TELESCOPE ARCHIVE**

HOME SEARCH RETRIEVE HELP ABOUT

Items Selected: 1 Estimated Size: 166 MB (uncompressed) Not Logged In

Status: Click on the links below to download the archive data

RETRIEVE SELECTION

Select the items to retrieve from the archive by checking the boxes in the Select column. Click the Update button to add the items to the retrieve list. Uncheck a Select box and click Update to remove it from the list. Click Download to immediately download the data. Search to perform another search. NOTE: Clicking search does not add the selected items to the retrieve list.

10 items found First Previous Next Last

SELECT	INSTRUMENT
<input type="checkbox"/>	IRS_STARE
<input type="checkbox"/>	IRS_STARE
<input type="checkbox"/>	IRAC_MAP
<input type="checkbox"/>	IRS_STARE
<input type="checkbox"/>	IRS_STARE
<input type="checkbox"/>	IRAC_MAP
<input type="checkbox"/>	IRS_STARE
<input type="checkbox"/>	IRAC_MAP
<input type="checkbox"/>	MIPS_SCAN

XMM-Newton Science Archive 3.0

File Print/Save Find Field Documentation Shopping Basket Login/Register Logout Request Monitor

Not Logged In Idle

**XMM-NEWTON SCIENCE ARCHIVE**

Move Selected to Basket Move All to Basket Mark All Delete Selected Refresh List ADMIN

25 in Page Each One

Observations 2. Shown: 1st and each until and including 2nd

Observations  Exposures  Sources  Observation Info  Exposure Info  Proposal Info  Data Image

Observation	Instrument	RA (J2000)	Dec (J2000)	Start Time	End Time	Exposure	Proposal
009000001	EPIC	13 25 29.43	-43 00 58.2	2001-02-02 07:47:19.0	2001-02-02 08:24:26.0	15369	Stapan Murray
009000001	EPIC	13 25 29.43	-43 00 58.2	2001-02-02 07:47:19.0	2001-02-02 08:24:26.0	15369	Stapan Murray

# Version 10.0 (29/Jun/2006): Object type queries



- 34845 observations classified
- 109 different object types
- Hierarchical classification based on SIMBAD +specific ISO types (ISOGAL, ELAIS Survey...) & SSO

Radio source	494
Infra-Red source	1042
X-ray source	11
Gamma-ray Burst	48
Multiple object	3655
Nebula of unknown nature	5763
Star	12100
Galaxy	7295
IRAS Faint Galaxy	598
ISOGAL Survey	693
ELAIS Survey	924
SSO	2014



## 4. ISO and the Virtual Observatory

### □ ISO has played a key role in

- The definition of standards for interoperability within the International Virtual Observatory Alliance
- The provision of data best suited for access by the VO
- The scientific participation to VO activities
  - science AVO demos in 2004 and 2005
  - member of EURO-VO Science Advisory Committee in 2006+

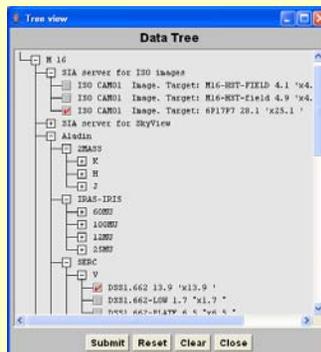
### □ Active link with the ESAC VO Team

- ISO Archive Scientist ↔ VO Archive Scientist



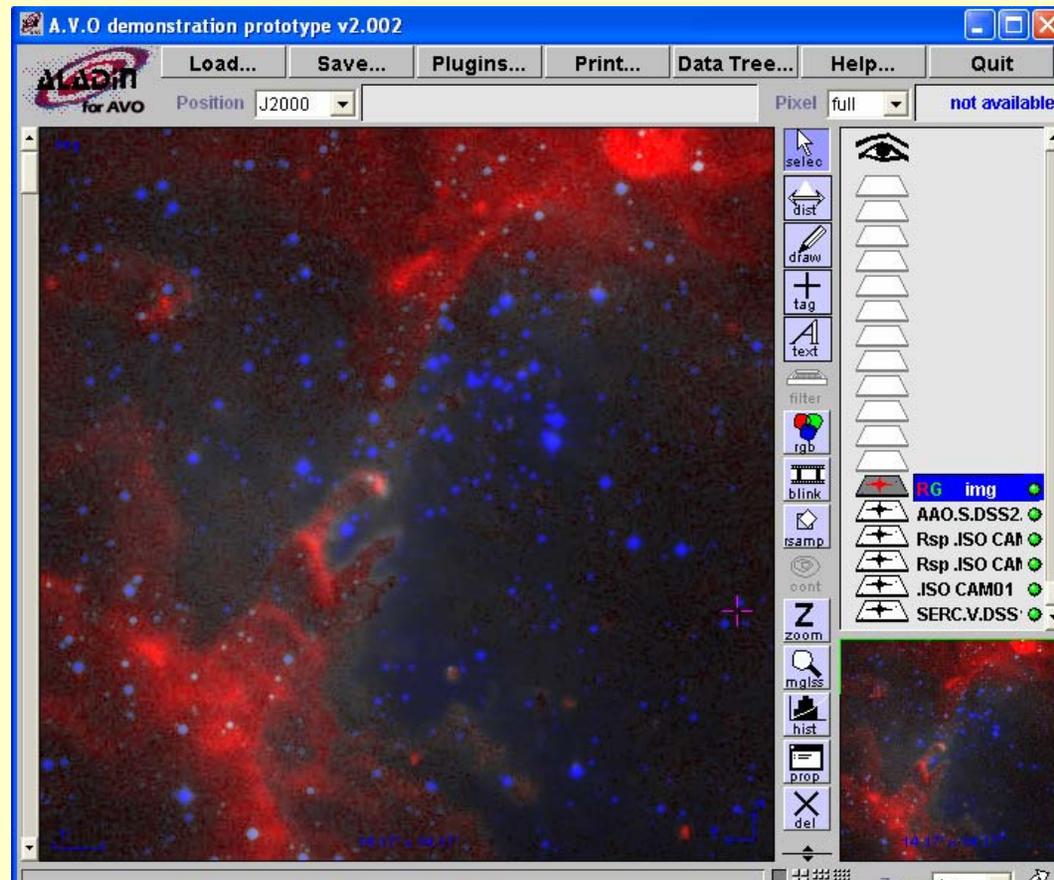
# ISO images access

- ISO images provided via the IVOA Simple Image Access Protocol (SIAP)
  - Part of AVO demos 2004-2005, together with XMM-Newton
  - Accessible from Aladin, other Archives



■ DSS  
■ ISOCAM

**M 16**

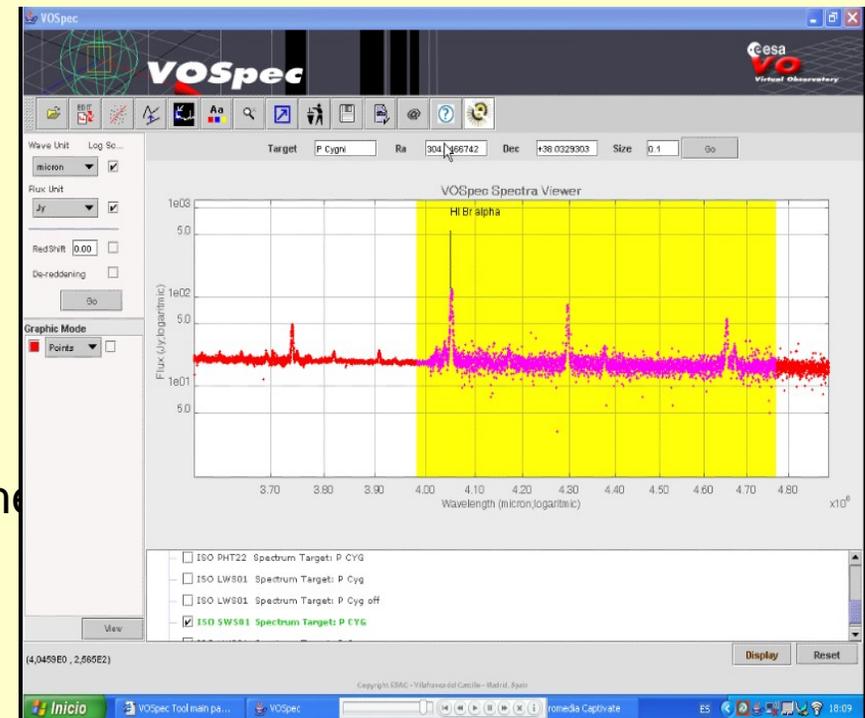




# ISO Spectra access

□ ISO spectra provided via the IVOA Simple Spectrum Access Protocol (SSAP)

- ISO first facility ever in the VO world
- Reference implementation and test bed for proper specification and improvement of the protocol
  - Part of AVO demos 2005
  - Accessible from Aladin, Astroscope, other Archives
  - Also including ISO Photometric Catalogues





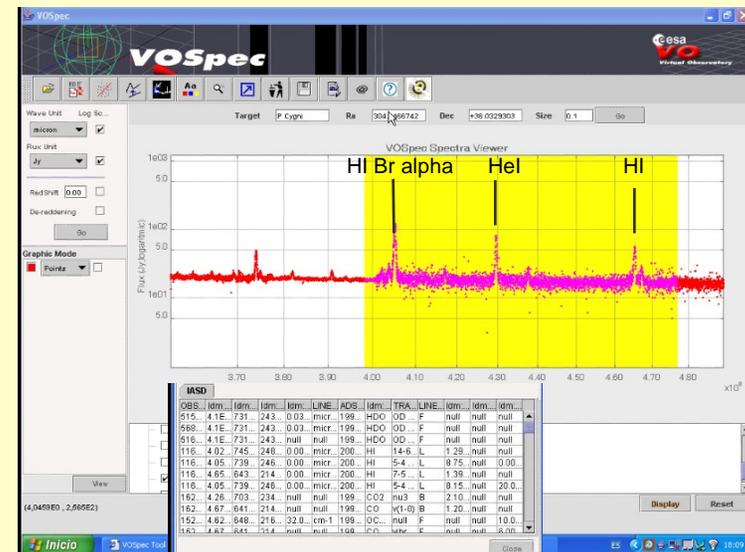


# Spectral Line Database Access

□ ISO has also contributed to the definition of a completely new standard, the Simple Line Access Protocol (SLAP), by giving access through the VOSpec to the Infrared Astronomical Spectroscopic Database (IASD)

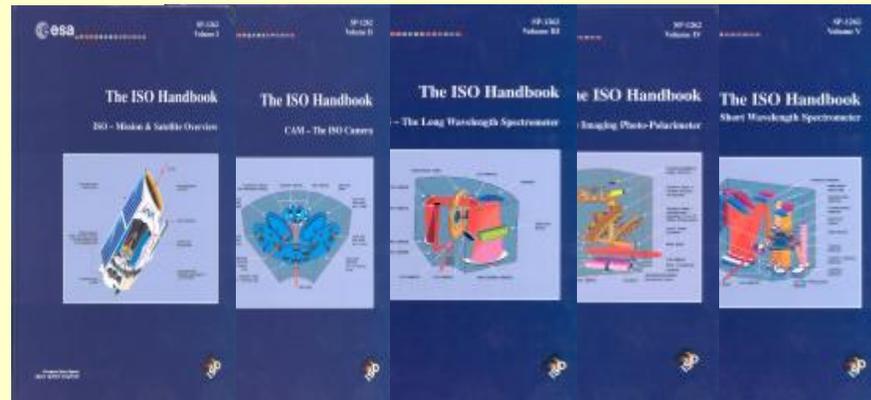
IASD is a database of spectral line transition information transcribed from the literature (*from Jourdain de Muizon et al.*)

The Line Data Model supports atomic and molecular “laboratory” databases as well as catalogue of observed lines





# 5. ISO Legacy Documentation (in AAP)

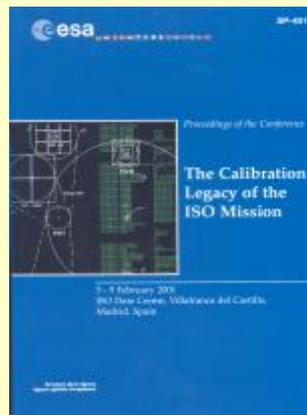


ISO Handbook  
1100 pp.

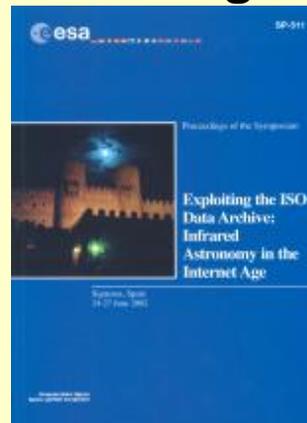
ISO Web ~200 docs.



## Conference proceedings

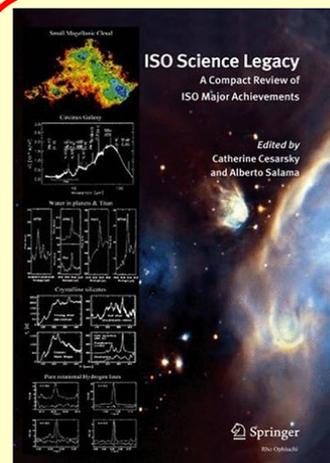


ISO Calibration Legacy



Exploiting the archive

ISO Colloquium Closing Remarks



## ISO Science Legacy

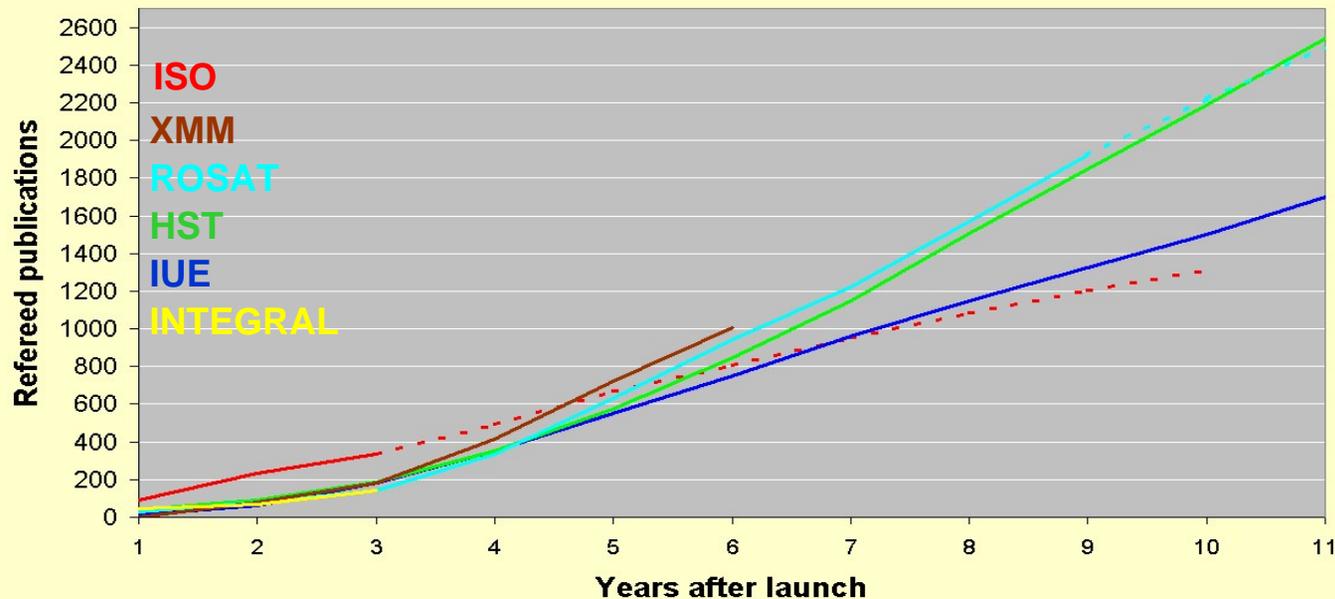
Space Science Reviews  
Springer, 2006

Based on 1200 ref. papers  
450 pp.

## 6. ISO Published Results



Publications after launch



- **1388 refereed publications** and **more than 115 PhD thesis**
  - Available from <http://iso.esac.esa.int/>
- ISO operational phase short w.r.t to other missions
  - Not enough cumulative gain during operations
  - Post ops phase value reflected in publication rate (cf. ROSAT)

# ISO Data Centre in 2002-2006



<b>Pedro Garcia-Lario</b>	until Aug 2005
<b>Cecile Gry</b>	until Oct 2004
<b>Rosario Lorente</b>	from Oct 2002
<b>Jean Matagne</b>	until Oct 2005
<b>Leo Metcalfe</b>	until Jun 2002
<b>Sibylle Peschke</b>	until Apr 2003
<b>Carlos Rodrigo</b>	from Oct 2006
<b>Alberto Salama</b>	throughout
<b>Mar Sierra</b>	from Nov 2003
<b>Eva Verdugo</b>	from Oct 2002

- The ISO Data Centre also contributes to AKARI (ASTRO-F)
- Starting in 2005, some staff also contribute to Herschel



# ISO Colloquium acknowledgments

Many thanks to ...

- all the speakers for the excellent & compact presentations
- the ISO Data Centre for providing long-lasting ISO material (and be patient when dealing with other missions as well)
  
- Monica Oerke for the nice organisation of the display room
- Diego Martinez Ripoll for rescuing ISO spare hardware for display
- Ana Willis for the organisation assistance
  
- Christophe Carreau and the Science Communication Support Service for the production of the poster and brochure