

ISO and AKARI: paving the road to Herschel

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ISO Data Centre
European Space Astronomy Centre (ESAC)

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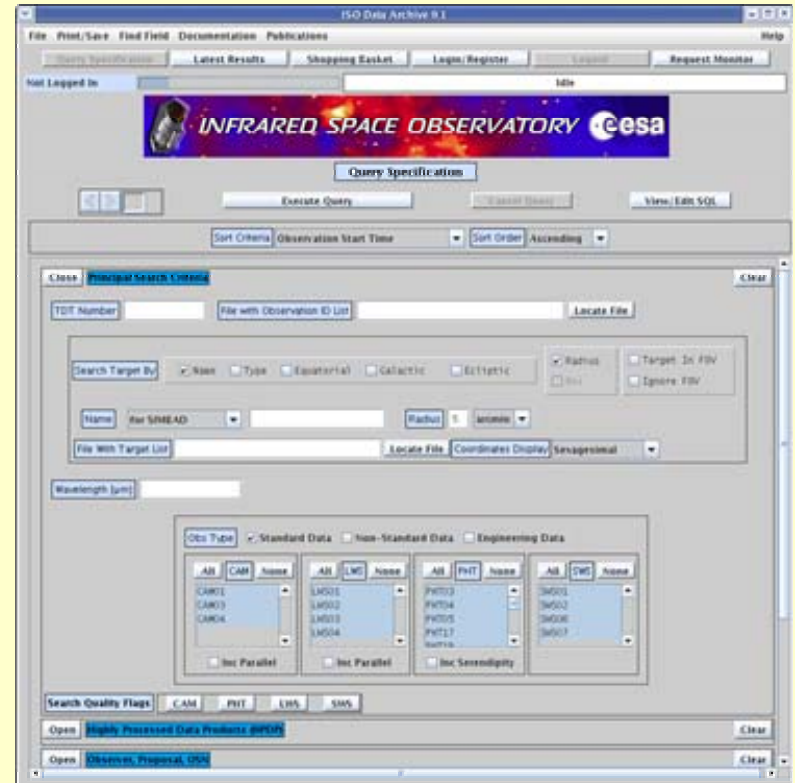
❑ What's new with ISO?

- Highlights of Active Archive Phase (2002 - 2006)



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)

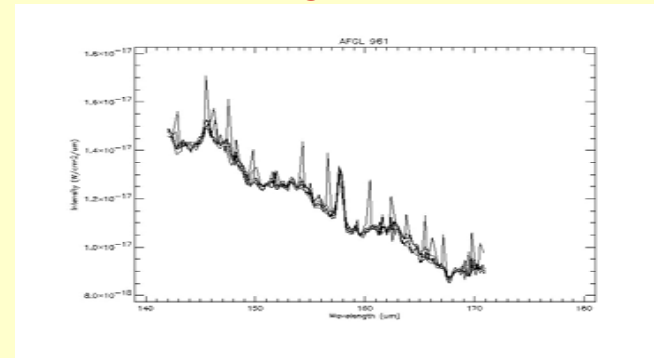
- ❑ Facility for continuous ingestion of systematic processing of selected observing modes or class of objects
- ❑ Products improved systematically 'by-hand'
 - via Interactive Analysis or improved algorithms, to correct for residual instrumental artefacts still present in the pipeline data.
- ❑ Data,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



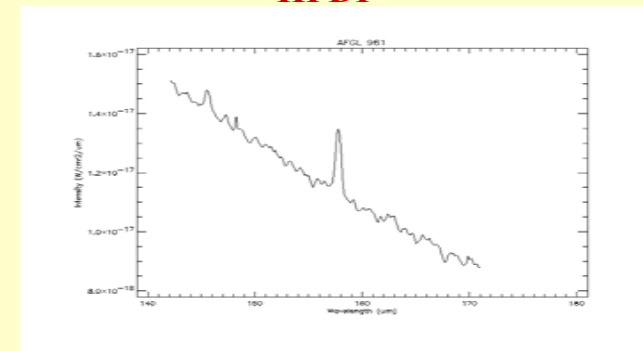
Uniformly processed LWS01 spectra

- ✓ 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



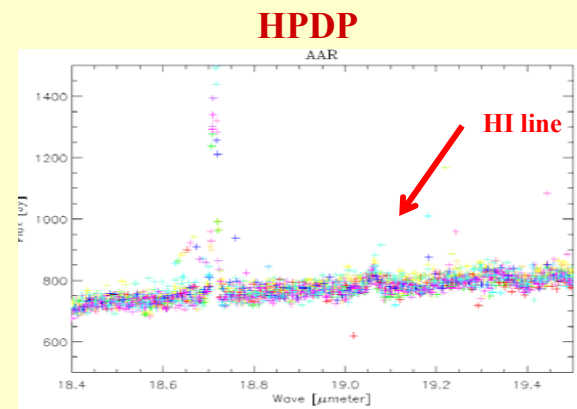
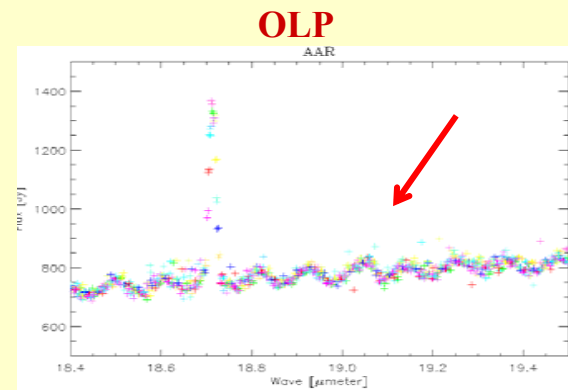
HPDP





High resolution processed and defringed SWS01

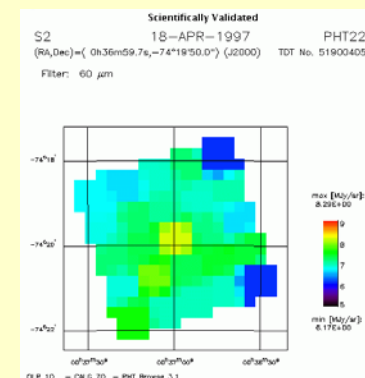
- ✓ Applicable to ~ 300 AOT1s-full grating scan at reduced resolution
- ✓ Processing brings spectra back to instrument resolution
- ✓ Defringed
- ✓ Provide the opportunity to extract bulk spectral and noise information from data-products





FIR 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/sr]	Detection [signal]	Object size	Quality
[GB98] S02	Star	S2	51900405	01	0.61658333	-74.33052777	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	7.4	2.3	P	R1
IRAS 04407-7000	Star	PSC04407-7000	56702037	01	4.674555556	-69.920277778	C1	60	5-JUN-1997	56702037	01	0.064	0.013	7.8	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	R9
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	R6R13
SV* 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	-66.258583333	C1	60	7-AUG-1997	63003745	01	0.142	0.015	7.8	7.3	P	R10
IRAS 05402-6956	Star	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 07496-7753	Mira	07496-7753	73501601	01	7.775833334	-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	8.785694444	-79.503888889	C2	200	20-NOV-1997	73501809	01	0.377	0.075	12.7	0.0	P	R6
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	17.729083334	-29.262250000	C1	60	3-APR-1997	50401333	01	12.346	3.586	1745.9	2.1	P	R6R10
OH359.513+0.174	Mira	OH359.513+0.174	49800630	01	17.729611111	-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
OH0.019+0.345	Mira	OH0.019+0.345	49402145	01	17.738638889	-28.733611111	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	-29.020527778	C1	60	28-MAR-1997	49801418	01	-0.08	3.26	1426.4	0.2	P	R6R10
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	17.745805556	-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	-29.325416667	C1	60	7-APR-1997	50800648	01	6.925	3.583	1779.6	1.2	P	R9
OH0.096+0.427	OH/IR	OH0.096+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
OH0.495+0.211	OH/IR	OH0.495+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
OH0.523+0.206	Mira	OH0.523+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



HPDPs now in the ISO Data Archive

CAM photometry of faint 6.7 μ m 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 μ 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

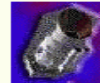
An Atlas of PHT 2.5-12 micron spectra of Normal Galaxies



□ Data Quality Report:

Innovate mechanism
for characterization
of observations.

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



INFRARED SPACE OBSERVATORY



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 loses 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.



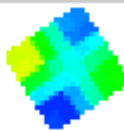
❑ Bring IDA in line with other ESA Archives

- ✓ 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,...)



- ☐ 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			
<input type="checkbox"/> Retrieve Default Dataset		170.00µm		f.o.v. 273"x273"			
Retrieve Other Products	▼	39000533	HHABING	HJHVEGA5	1996-12-10 13:04:30.▶	570 sec	Quality Report





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

ISO Data Archive 10.0

File Print/Save Find Field Documentation Publications Help

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

Not Logged In Idle

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Query Specification

Execute Query Cancel Query View/Edit SQL

Sort Criteria Distance from Nominal Pointings Sort Order Ascending

Close **Principal Search Criteria** Clear

TDT Number File with Observation ID List Locate File

Search Target By ☐ Name ☒ Type ☐ Equatorial ☐ Galactic ☐ Ecliptic

All Select Object Types: None

- * Radio source
 - millimetric Radiosource
 - sub-millimetric source
 - Maser
- * Infra-Red source
- * X-ray source
- * gamma-ray source
 - gamma-ray Burst
- * Multiple object
 - Region defined in the sky
 - Supercluster of Galaxies
 - Cluster of Galaxies
 - Group of Galaxies
 - Compact Group of Galaxies

- 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



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+

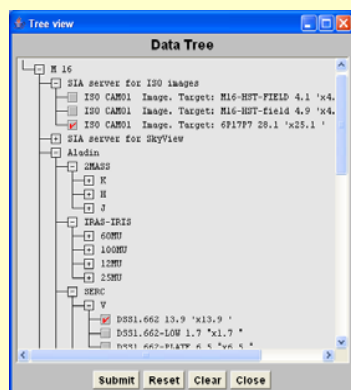
❑ Active link with the ESAC VO Team

- ISO Archive Scientist \longleftrightarrow VO Archive Scientist



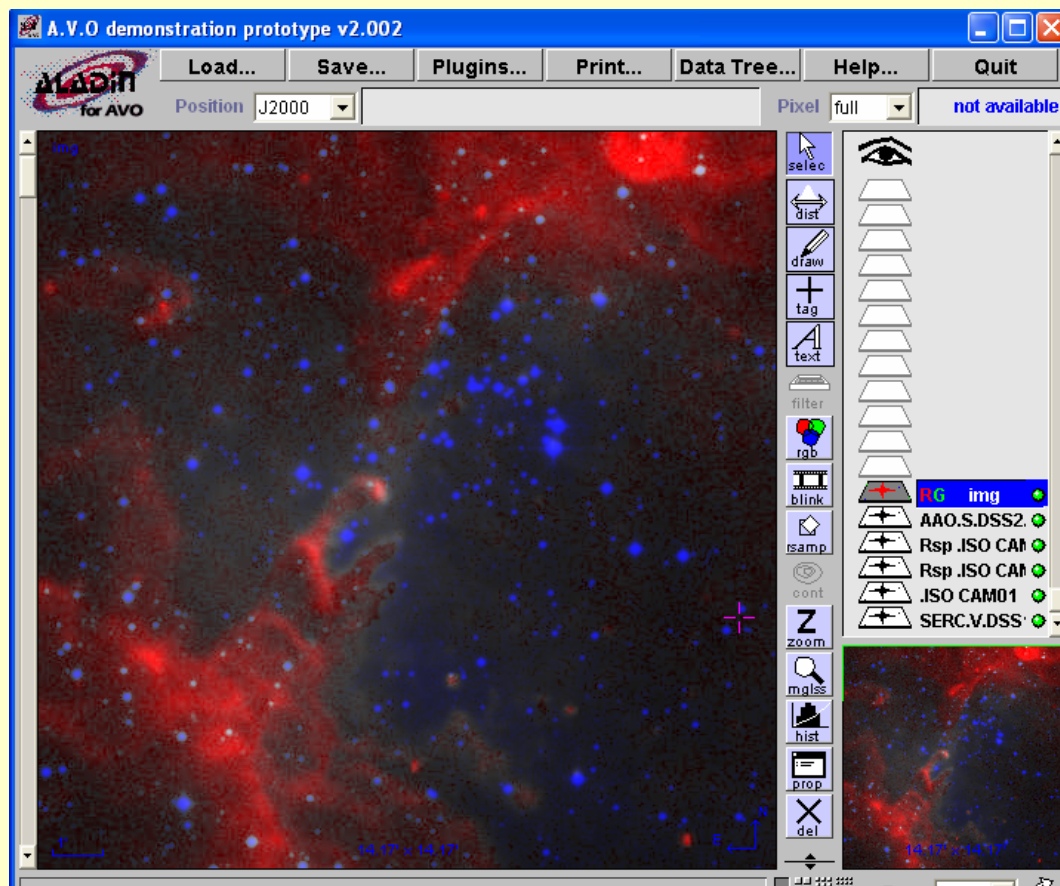
ISO images access

- 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

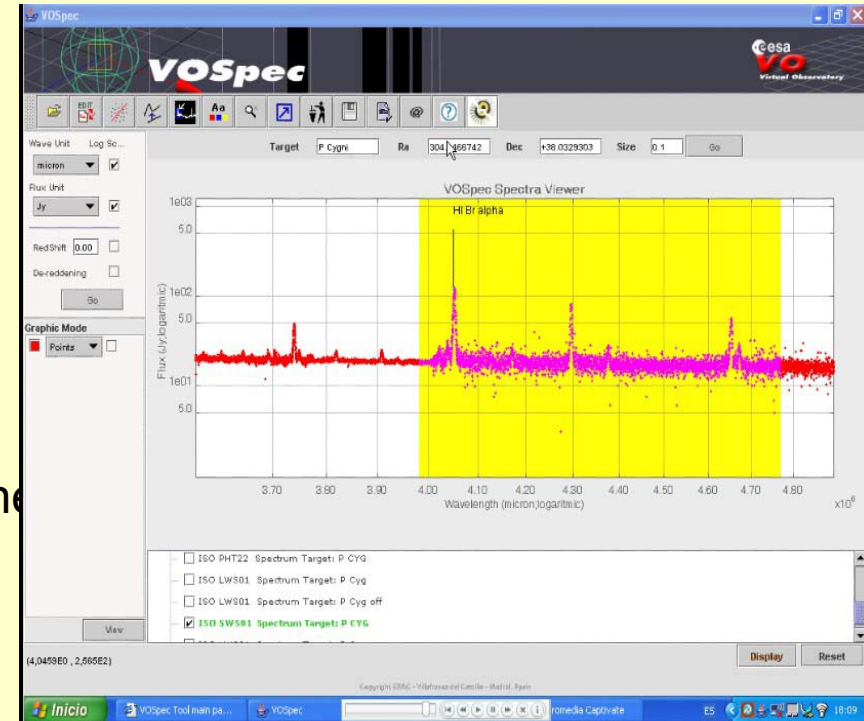




ISO Spectra access

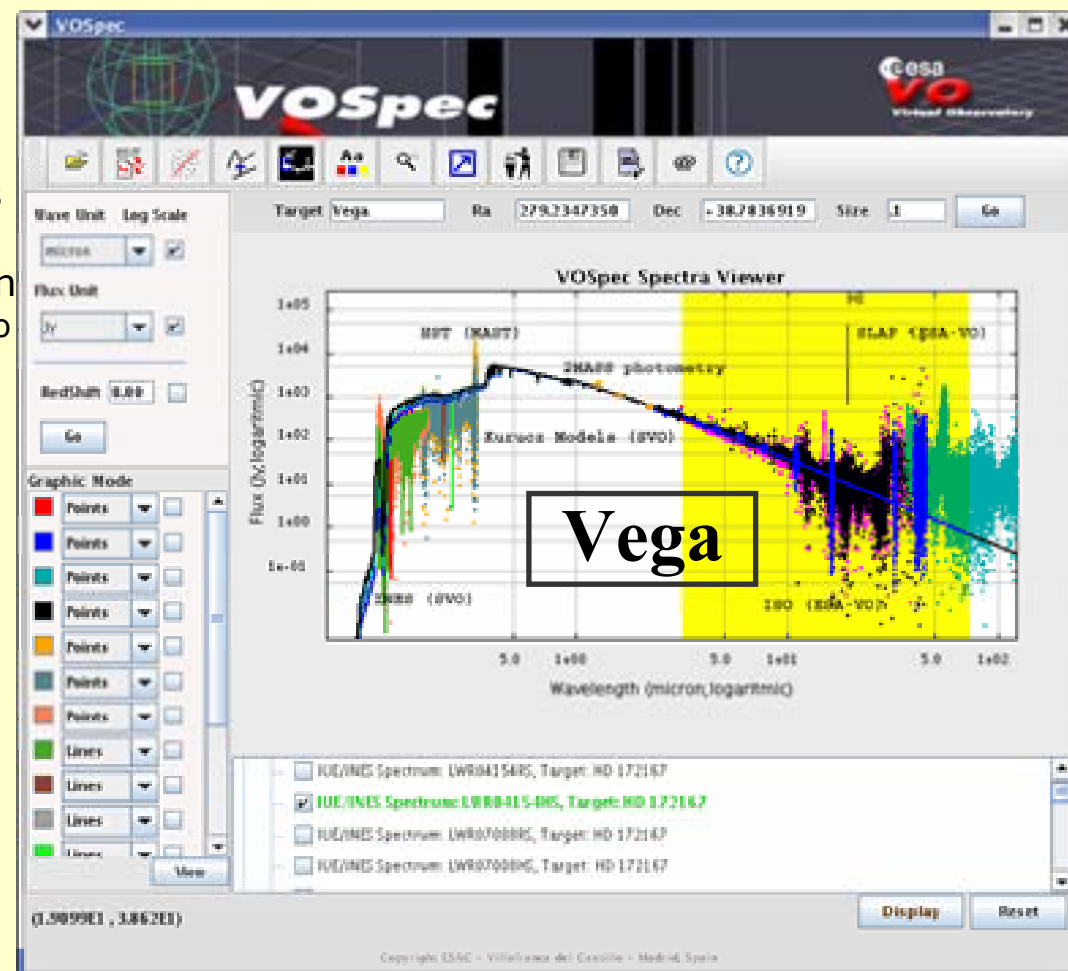
□ ISO spectra provided via the IVOA Simple Spectrum Access Protocol (SSAP)

- 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 Energy Distribution (SED) VO builder developed by ESA-VO

- On-the-fly generation of SED from VO spectra and photometric servers
- Fitting capabilities
- Plot enhancement and export in various formats
- Automatic units handling and conversion via dimensional analysis (Osuna & Salgado 2005)
- Overlap and renormalization of theoretical models available as VO servers
 - Stellar synthesis model
 - Starburst99
 - Kurucz
 - SED@
- Redshift correction
- De-reddening



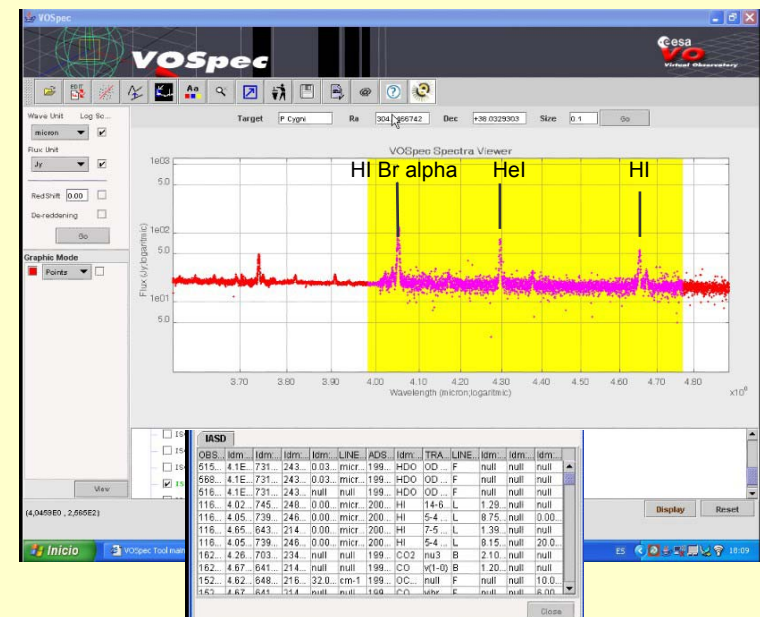


Spectral Line Database Access

□ 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

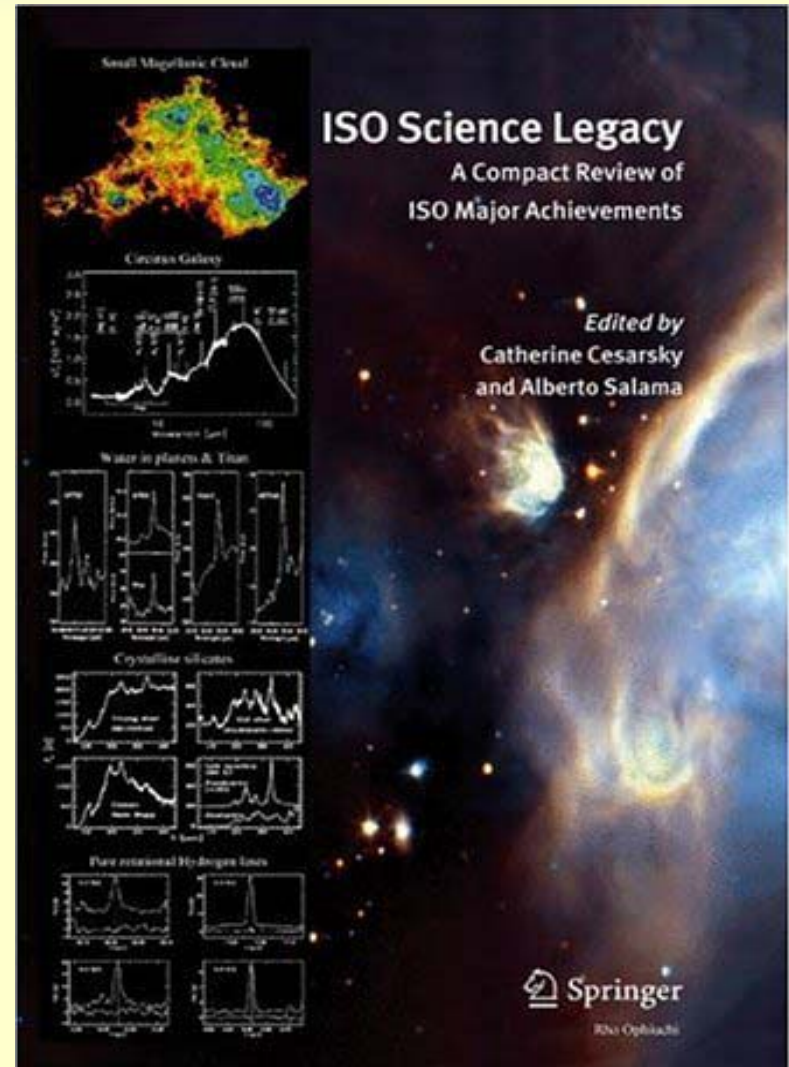




ISO Science Legacy Review

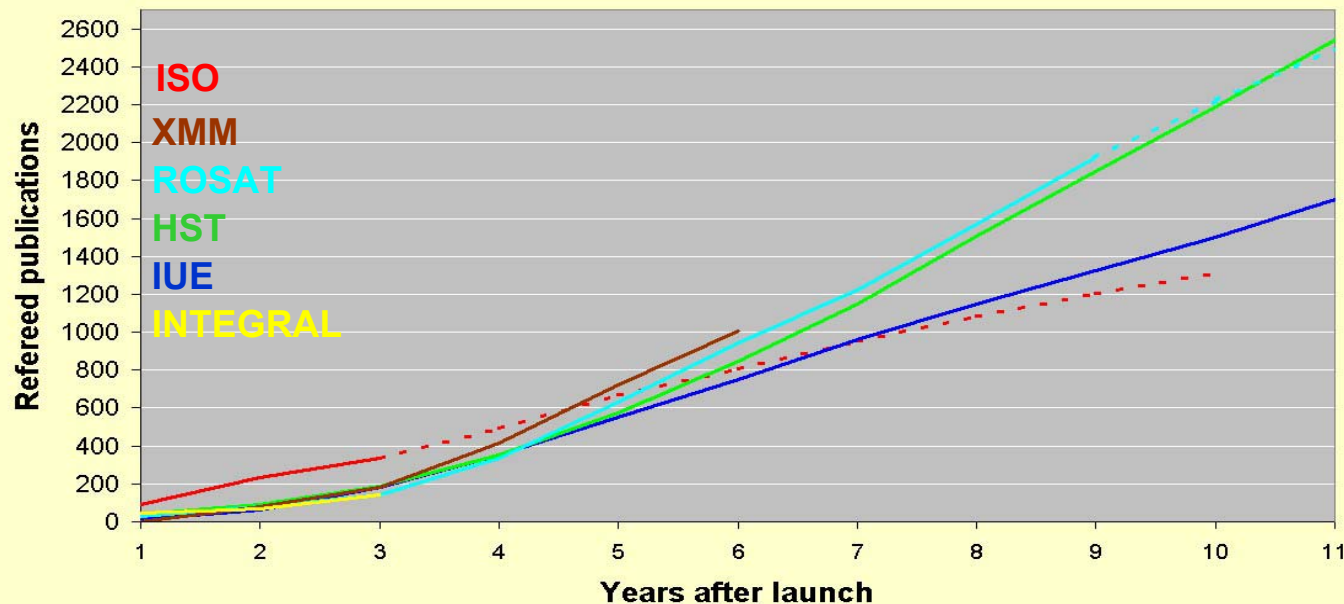
Space Science Reviews Springer, 2005

- Based on 1200 ref. papers
- 450 pages
- 17 chapters
- Also available at <http://iso.esac.esa.int/>



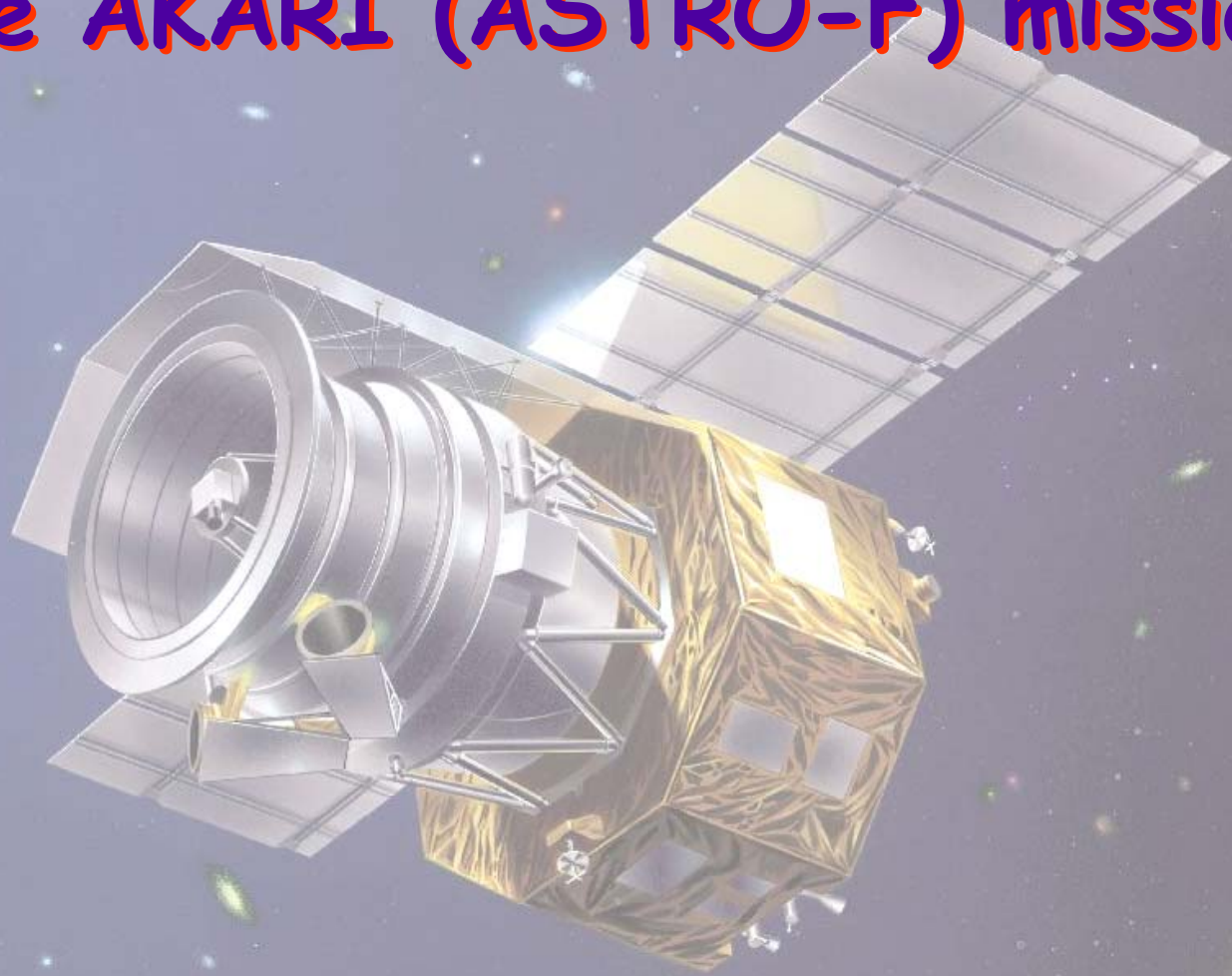


Publications after launch



- **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)

The AKARI (ASTRO-F) mission



Introduction

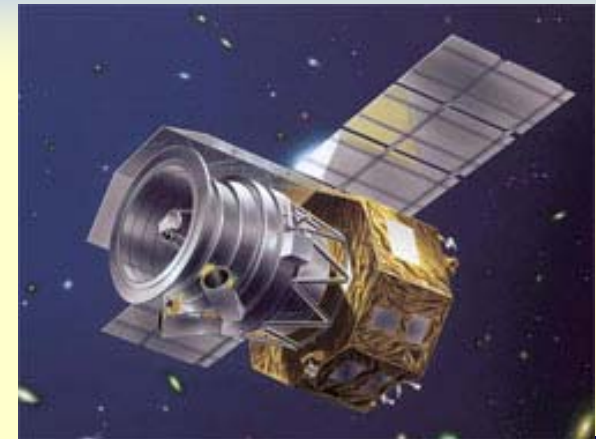


❑ Mission:

- JAXA-led project,
- Sky survey at IR wavelengths
 - plus pointed observations.

❑ Status:

- Launched: Feb 2006.
- All-sky survey dedicated phase end Nov 2006, now mix pointed obs + survey
- LHe depletion expected for Aug 2007.
- ESA contribution funded to 2008.
- ESA provides ground station support and pointing reconstruction for survey to advance production of catalogues in return for 10% of pointed observations



❑ ESAC:

- Community support
- Pointing reconstruction.

❑ ESOC:

- Tracking support (Kiruna).



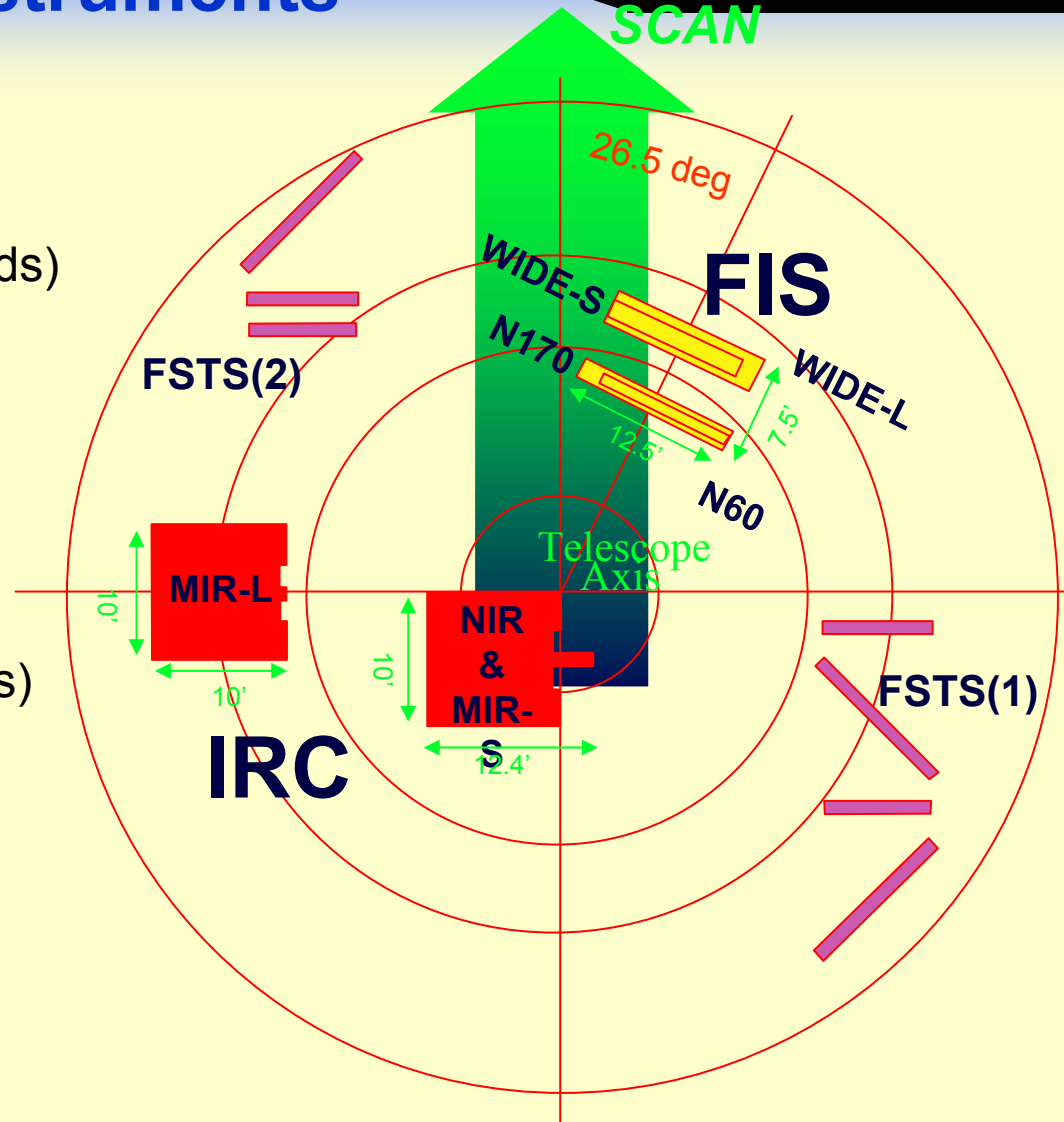
AKARI Focal plane instruments

FIS (Far-Infrared Surveyor)

- ❑ 50 – 180 μm (4 photometric bands)
- ❑ All-Sky Survey (4 bands)
 - 65, 90, 140, 160 μm
- ❑ Deep imaging and spectroscopy

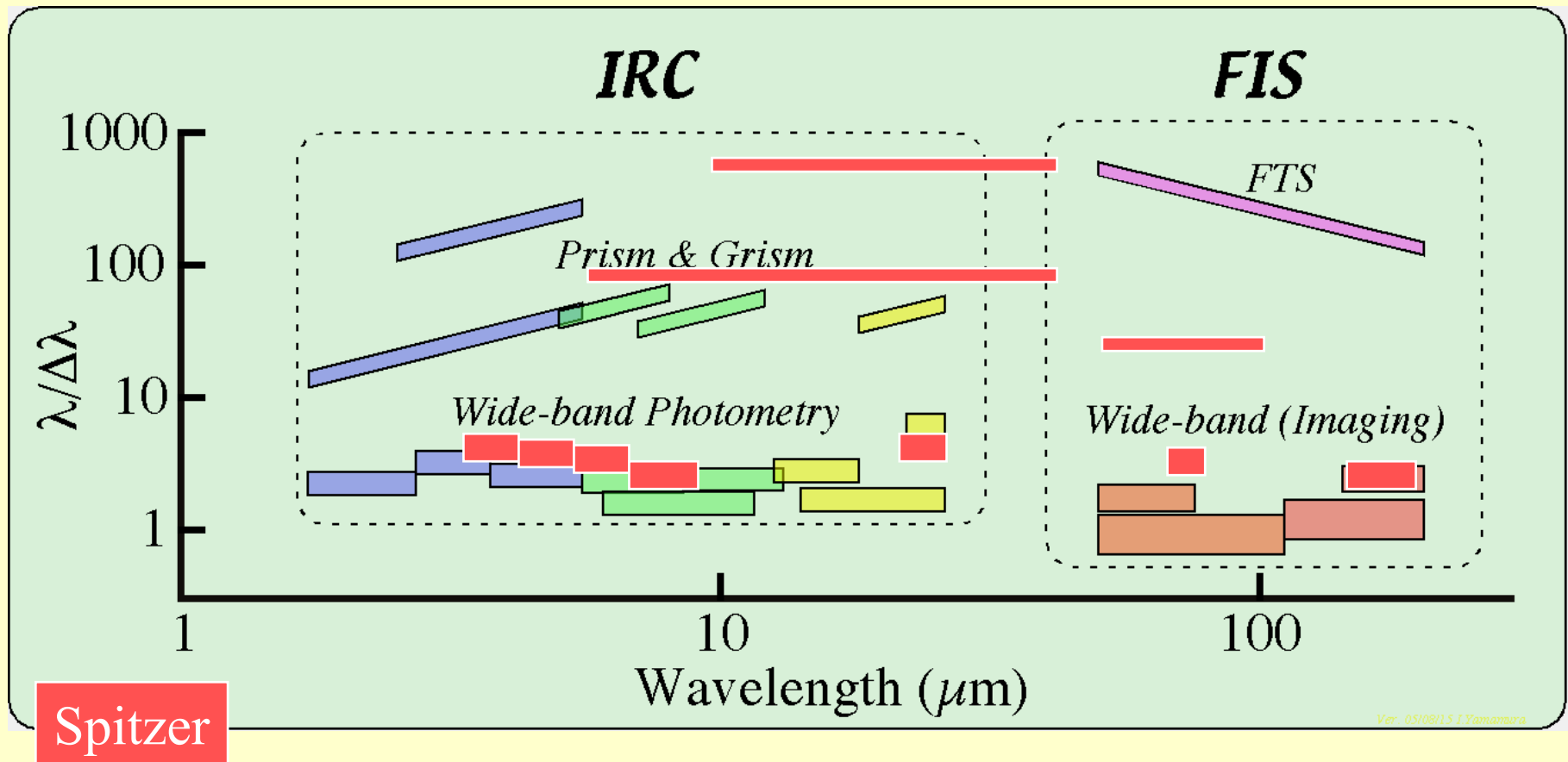
IRC (Infrared Camera)

- ❑ 1.7 – 26 μm (9 bands, 3 cameras)
- ❑ All-Sky Survey in 2 bands
 - 9, 18 μm
- ❑ Imaging and spectroscopy





Photometric & Spectroscopic Capabilities



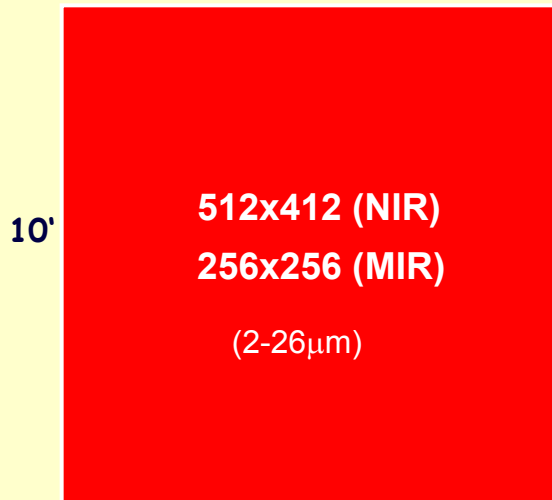


Large Field of View

AKARI

IRC

10'



FIS

(65-160 μ m) (2-26 μ m)



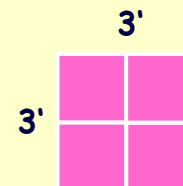
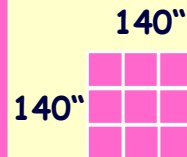
ISO

ISOCAM

3'



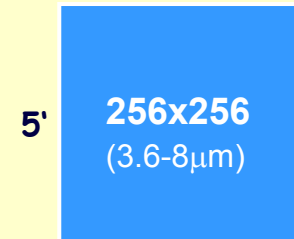
ISOPHOT



SPITZER

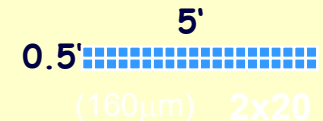
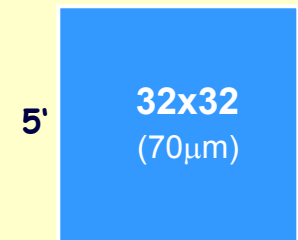
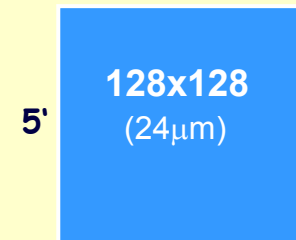
IRAC

5'



MIPS

5'





Impact and Legacy of AKARI Survey

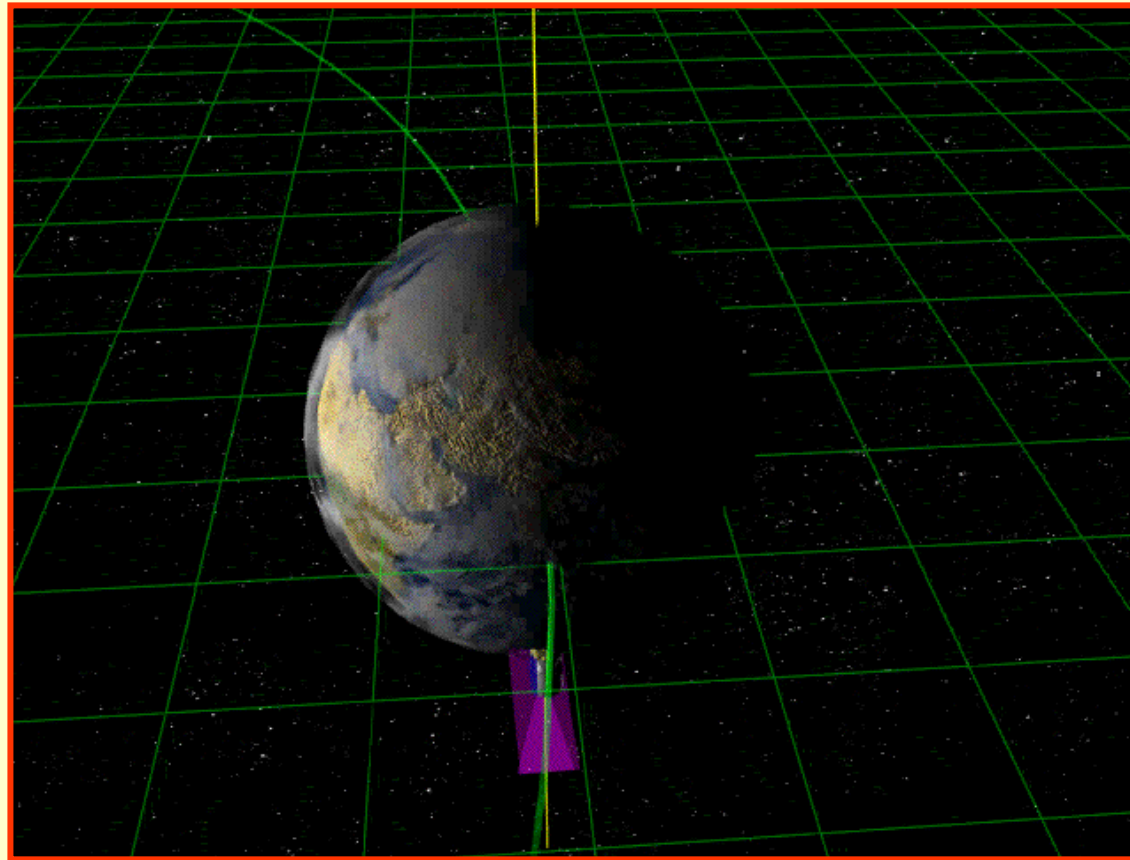
AKARI is a surveyor not an observatory

AKARI is complementary to Spitzer

Virtues of AKARI are:

- ❑ Enormous area coverage
- ❑ Large volumes
- ❑ Suitable moderate depths
- ❑ Cross correlation potential

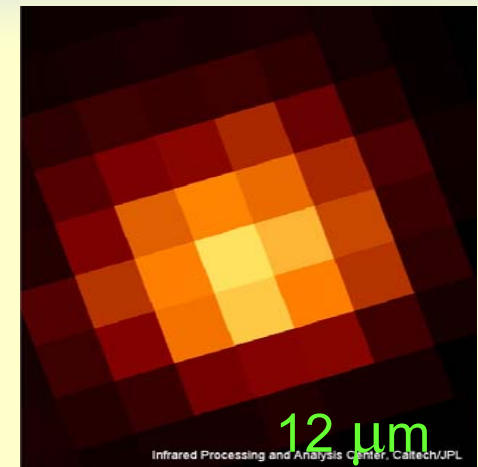
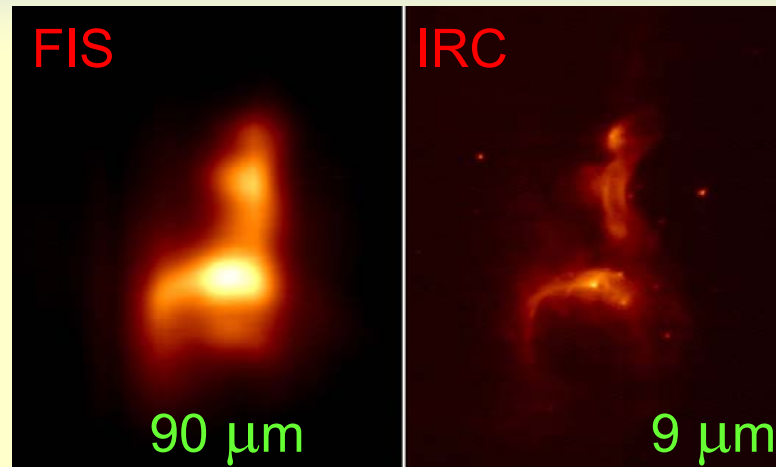
Aim to produce a high quality,
reliable catalogues that will
match future surveys



AKARI outreach images

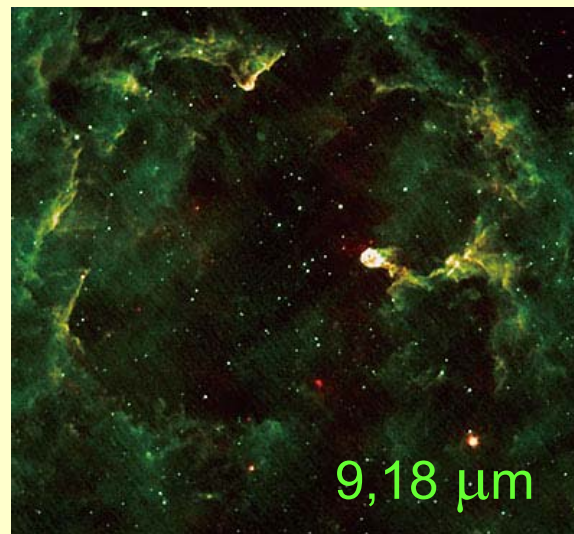


Reflection nebula
IC 4954

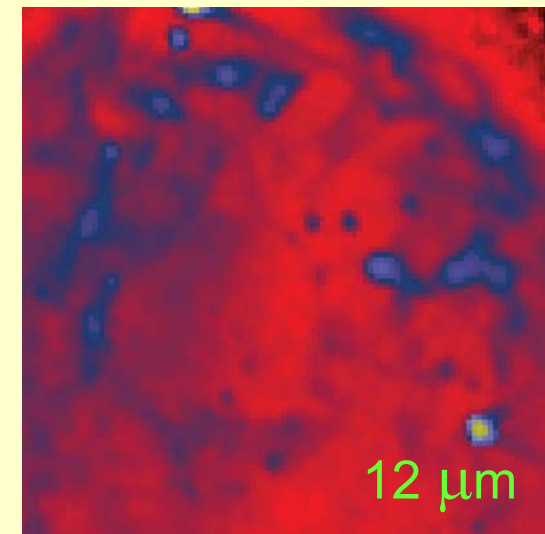


AKARI

Reflection nebula
IC 1396



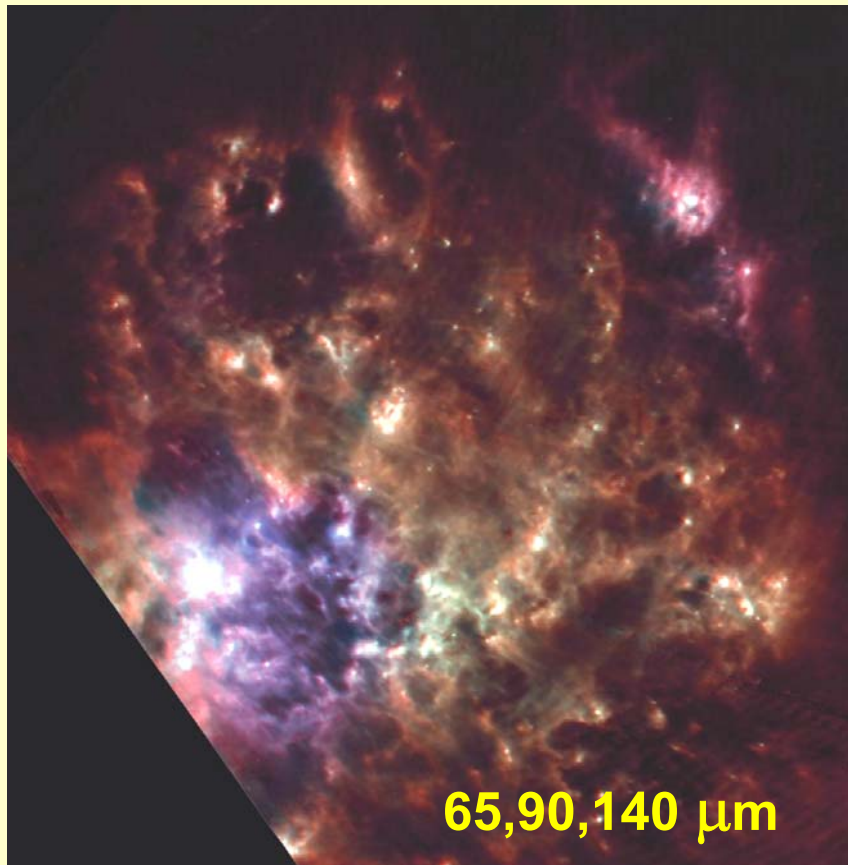
IRAS



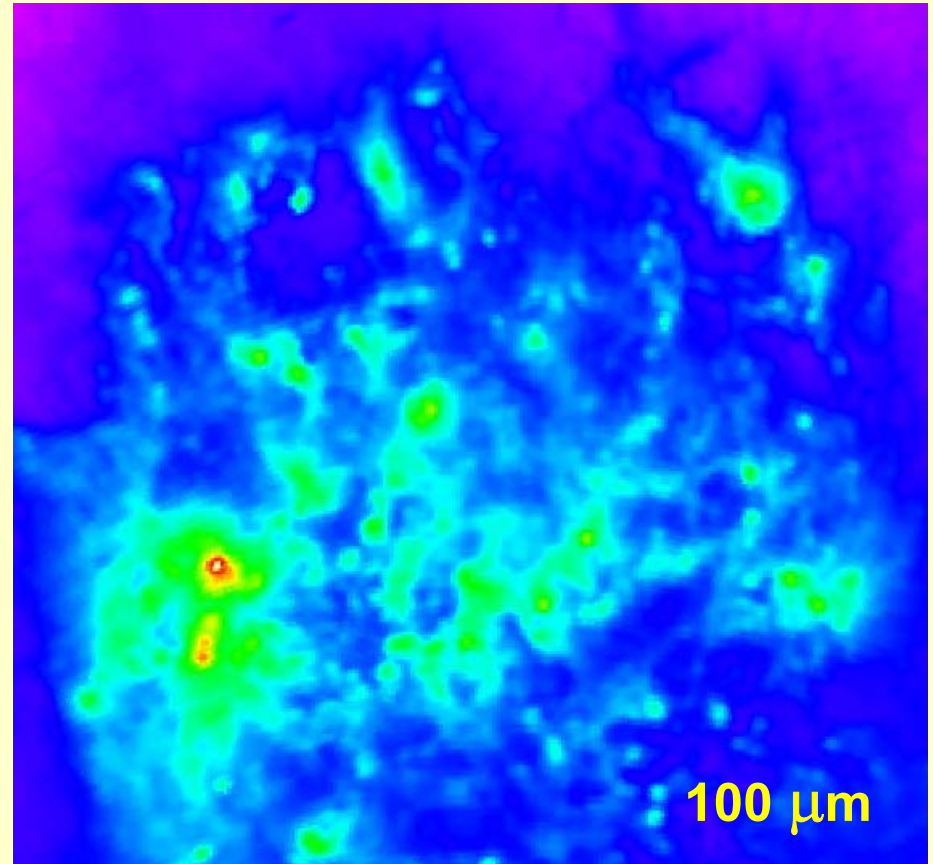


AKARI outreach images

LMC



AKARI



IRAS



AKARI Observation Program

Large Area Surveys

- All-Sky survey in 6 bands (9,18,65,90,140,160 μm)
- NEP Survey
- LMC Survey

Mission Program (Guaranteed Time)

- Coordinated project teams-led programs of specific subjects

Open-time Program

- 30% of pointed observations, distributed via parallel Call for Proposals
 - 20% for Japan, Korea
 - 10% for Europe (ESA member states)

Director's time & Calibration

- 10% of total time



All-Sky Survey catalogues

- ❑ ASTRO-F/FIS Flux of known sources
 - Flux consistency check with the IRAS PSC + additional FIR flux data.
 - Incremental release during the survey period.
 - Team release: incrementally during the survey period

- ❑ The Bright Source Catalogue (BSC).
 - Uniform source extraction (Same detection limit for any area in the sky).
 - Consolidated data generated after the end of survey.
 - Team release: ≤ 1 year after the End of Survey. (→ ~Aug 2008)

- ❑ The Faint Source Catalogue
 - The supplemental catalogue of the fainter sources in the region with higher redundancy.
 - Additional process after BSC.
 - Team release: ≤ 1.5 year after the Bright Source Catalogue (→ ~ Dec 2008)

Public release: 1 year after team release



European Open Time <http://akari.esac.esa.int/>

- ❑ Call for Proposals in September 2005 (parallel ESA – Japan/Korea)
 - ESA Call: 50 Proposals from 42 PI's in 32 institutes from 9 European countries
 - X 7 oversubscription
 - TAC selection: 28 proposals (from Solar System to cosmology)

- ❑ Open Time programme execution
 - Started on 12 September 2006
 - 13% of allocated European programmes performed to date

- ❑ Many new operational constraints
 - Very stringent visibility constraints, strong dependence on (changing) orbit
 - Need intensive interaction with Japanese Teams
 - Helpdesk system with users well in place

- ❑ ISAS (and ESAC mirror) archive will open for AKARI users in Jan 2007
- ❑ Proprietary period for all Open Time observations: 1 year after end-of-He
 - Current implementation based on initial lifetime estimates: 900 pointings