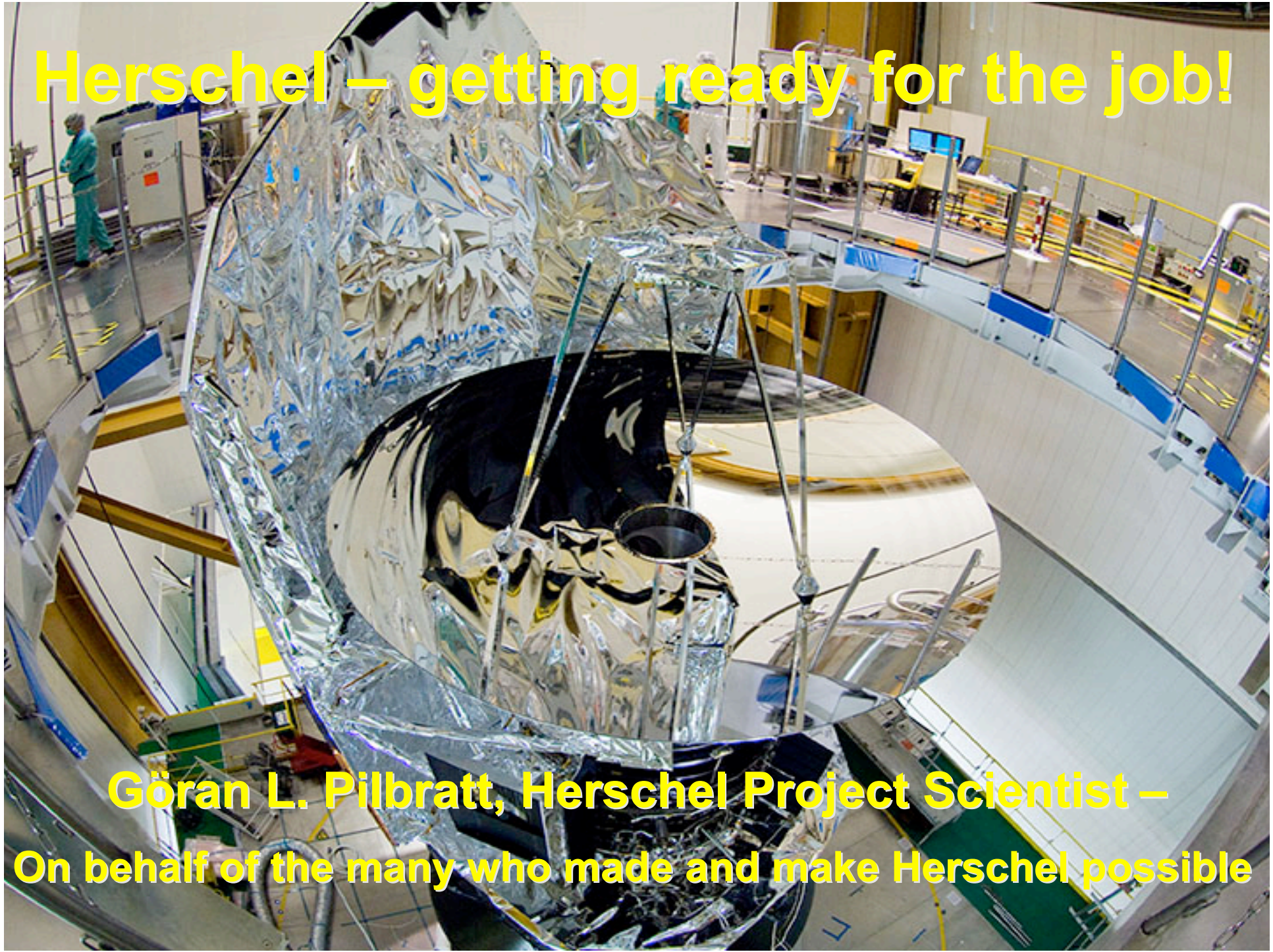


Herschel – getting ready for the job!



**Göran L. Pilbratt, Herschel Project Scientist –
On behalf of the many who made and make Herschel possible**

Fairing integration on 10 May 2009



V188 rollout on 13 May 2009



V188 launch on 14 May 2009





So where are my data?

HERSCHEL SPACE OBSERVATORY

Herschel status in a nutshell



- Herschel was launched 176 days ago this afternoon
- Operational thermally and in orbit around L2
- Spacecraft in good health with no major anomalies
- With exception of HIFI, the instruments are operational, but not all observing modes available yet
- Cryostat and instrument coolers are working well
- The ground segment is working well
- Three web-releases illustrating observing results
- First science data have been provided to observers
- Currently executing a mix of PVP, SDP, and RSP observations – HIFI restart earliest late November

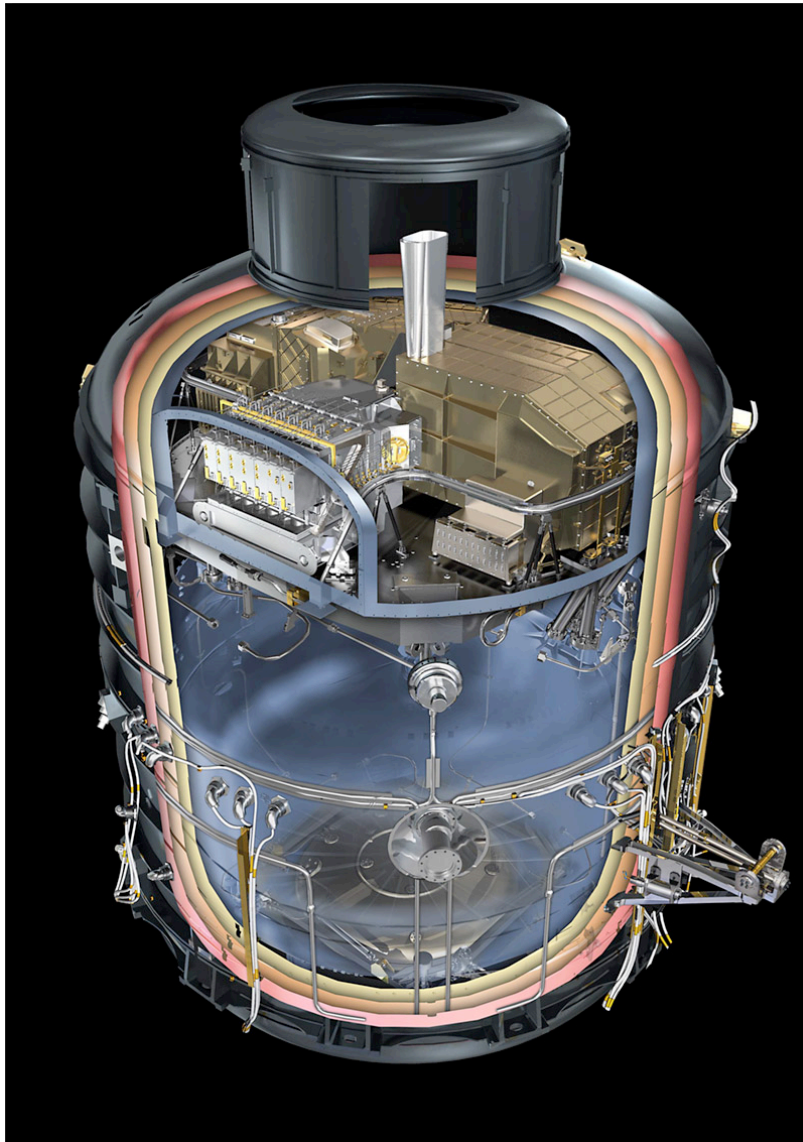
HERSCHEL SPACE OBSERVATORY



So where are my data?

HERSCHEL SPACE OBSERVATORY

Spacecraft

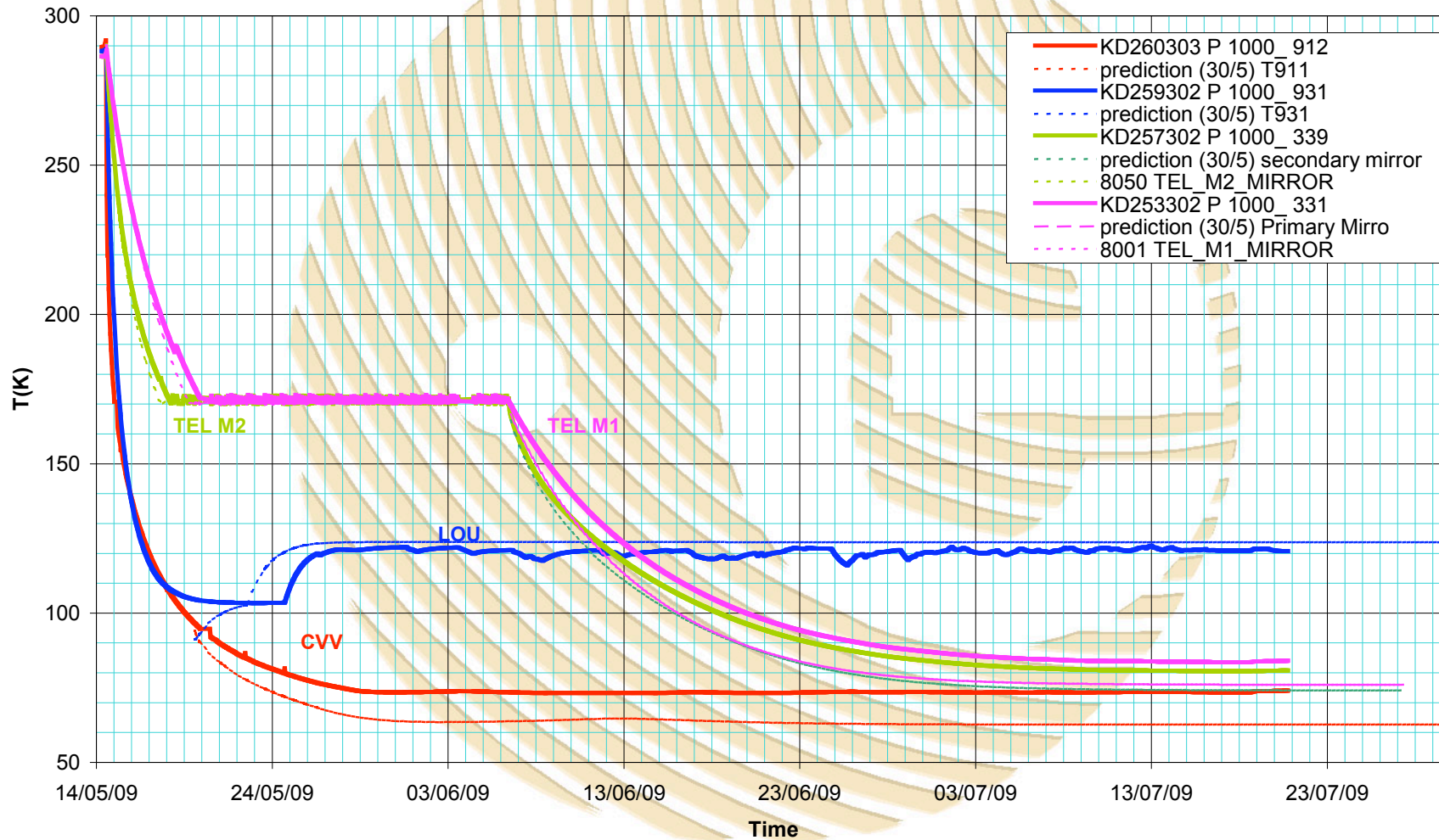


HERSCHEL SPACE OBSERVATORY

Cooldown – telescope, LOU, & CVV



Herschel Post Launch transient - CVV - LOU-Telescope



HERSCHEL SPACE OBSERVATORY

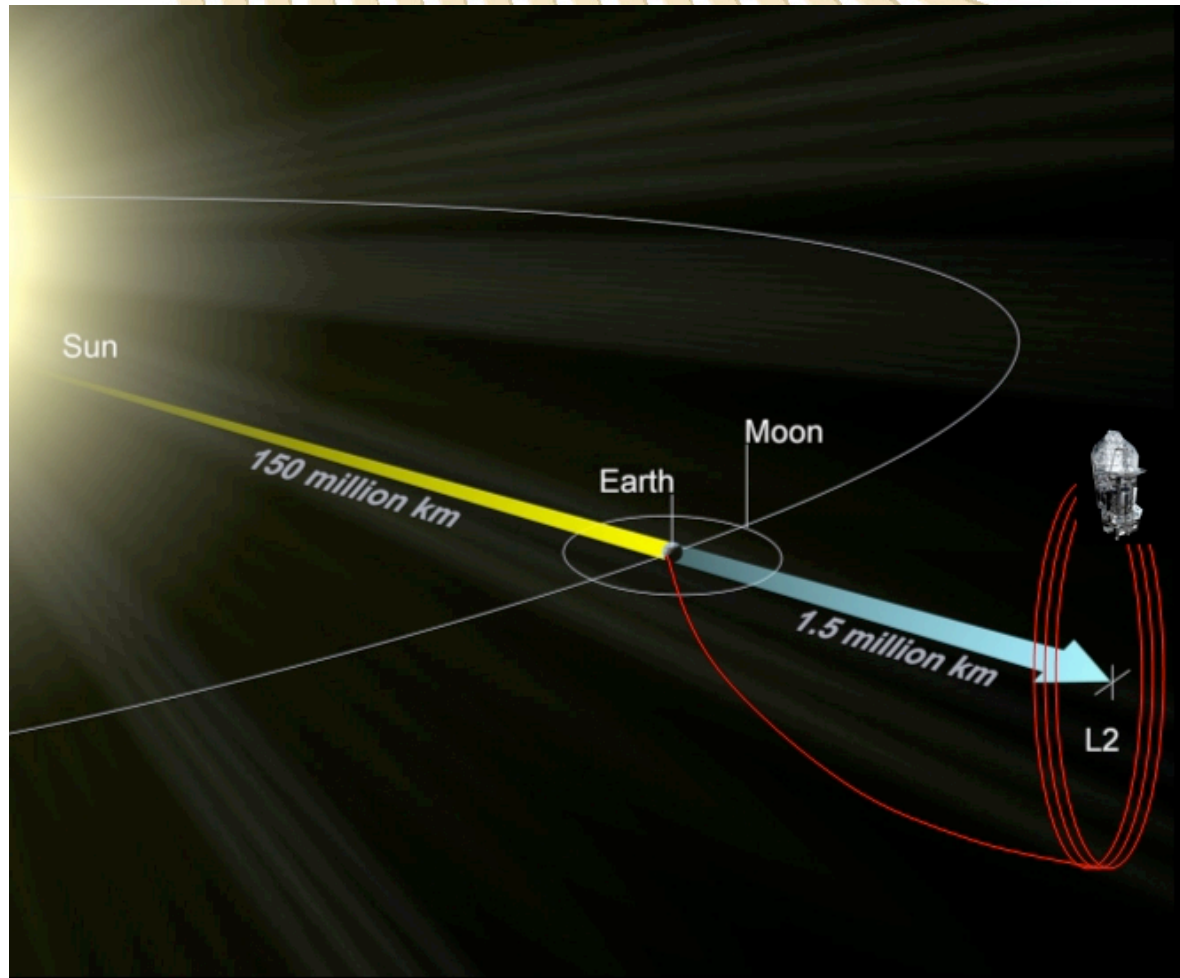
Flight Data from MUST server , Prediction from M.Linder (30/5/09)



L2 operational orbit – not a driver



- Sun, Earth, and Moon in the ‘same direction’ in the sky
 - Thermally favourable and stable environment
 - Good access to the sky for observations
 - Avoid Earth’s radiation belts

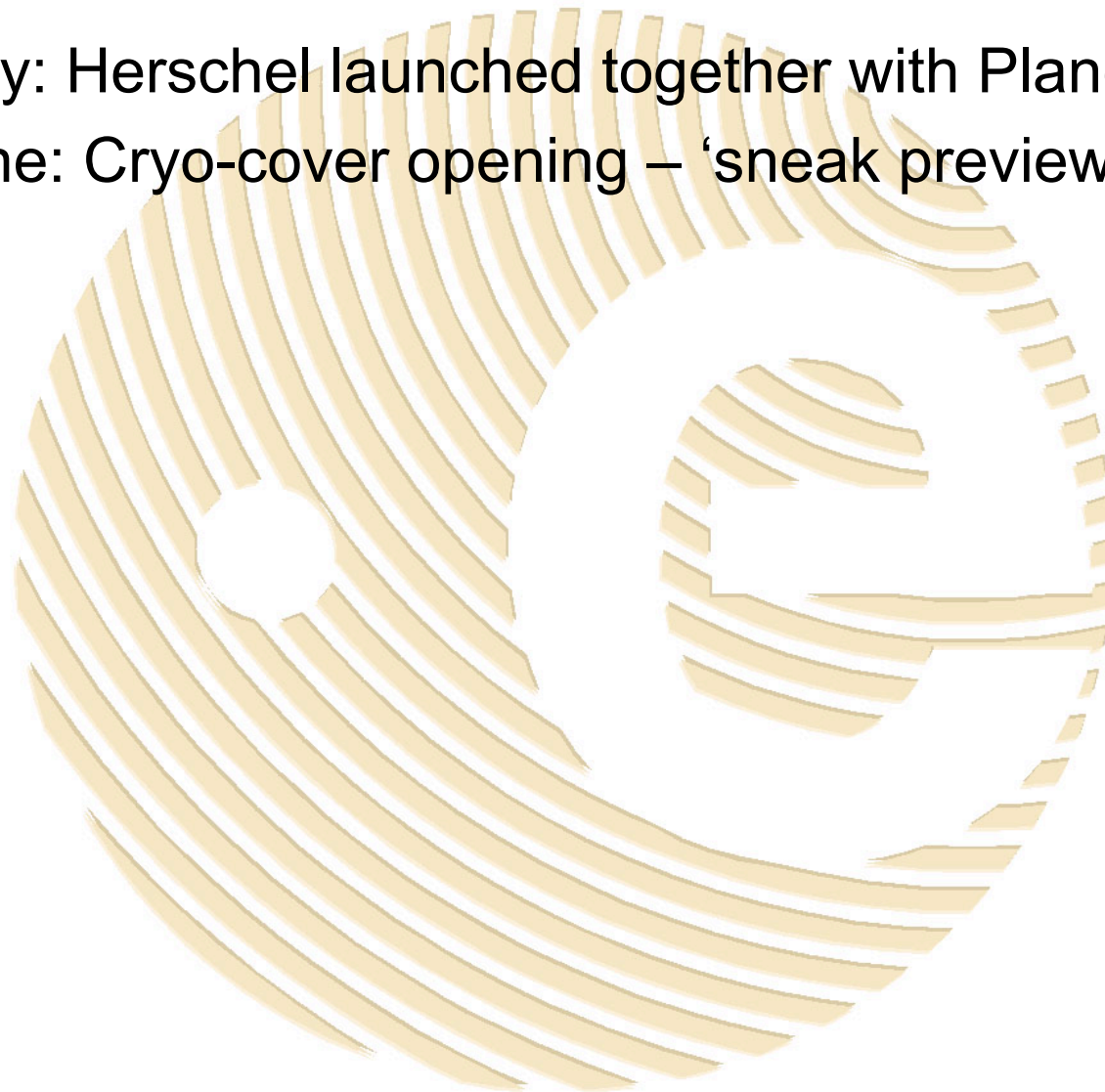


HERSCHEL SPACE OBSERVATORY

Important dates



- 14 May: Herschel launched together with Planck
- 14 June: Cryo-cover opening – ‘sneak preview’



HERSCHEL SPACE OBSERVATORY

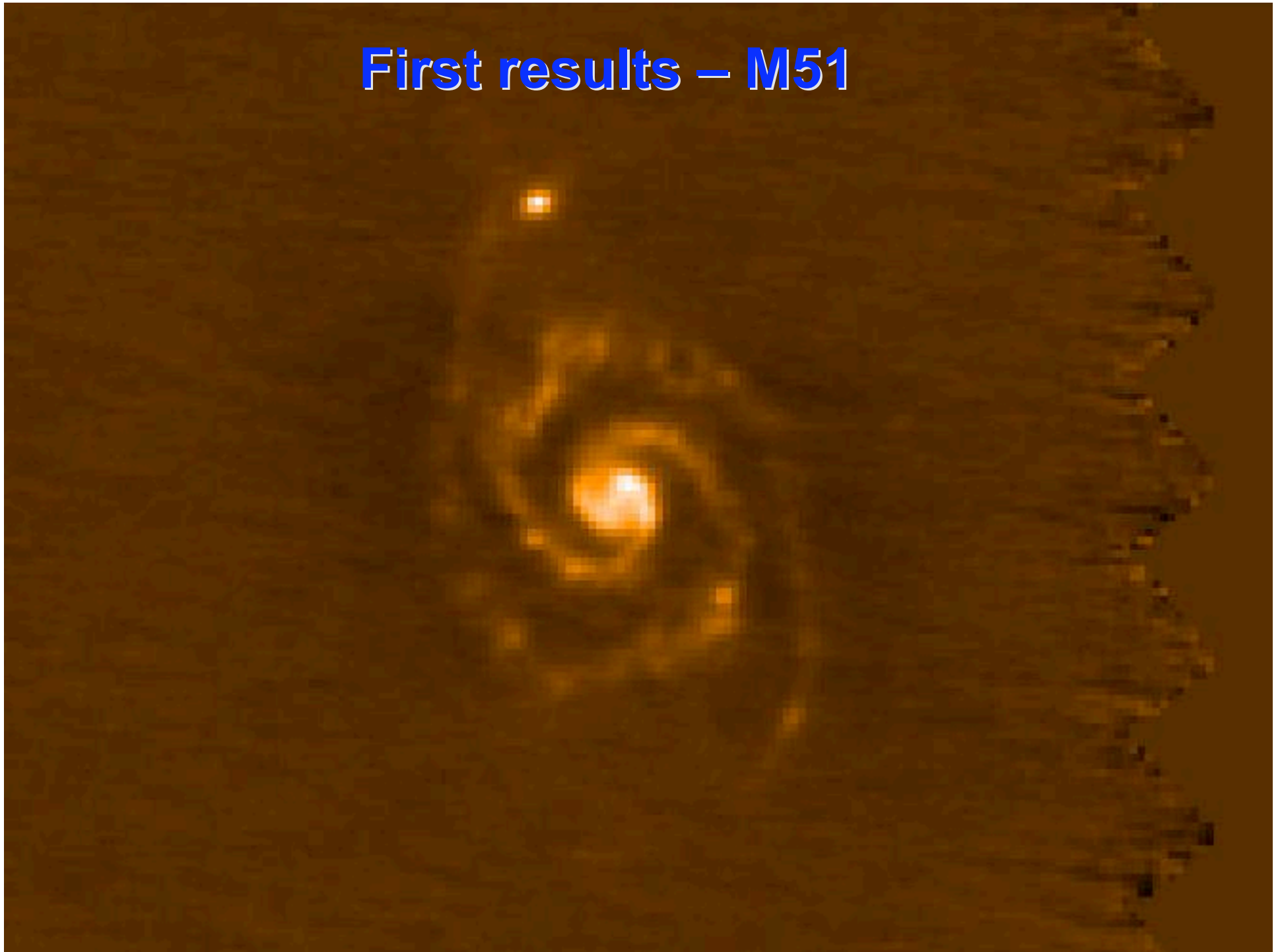
'Sneak preview' – OD#32



- **Used OD initially assigned to 'thermal stabilisation'**
 - Immediately following DTCP when cryocover was opened
 - Considered premature – best effort agreed
- **Observing parameters unknown**
 - Optical performance – telescope/instrument level tests and predictions & alignment wrt instrument focal plane units
 - Optical background – telescope temperature, mirror emissivity, straylight predictions notoriously difficult
 - 'Pointing' – instrument FOV wrt STR pointing (SIAM) knowledge
- **Observing preparations**
 - Selecting PACS photometer – want 'nice image'
 - A number of telecons involving PACS and HSC experts
 - Calculating ranges of optical backgrounds – repeat observations with different instrument bias settings
 - Map large enough area to include 'worst case' – 50x50 arcmin

HERSCHEL SPACE OBSERVATORY

First results – M51





Spitzer/MIPS & Herschel/PACS at 160 μm



Spitzer/MIPS

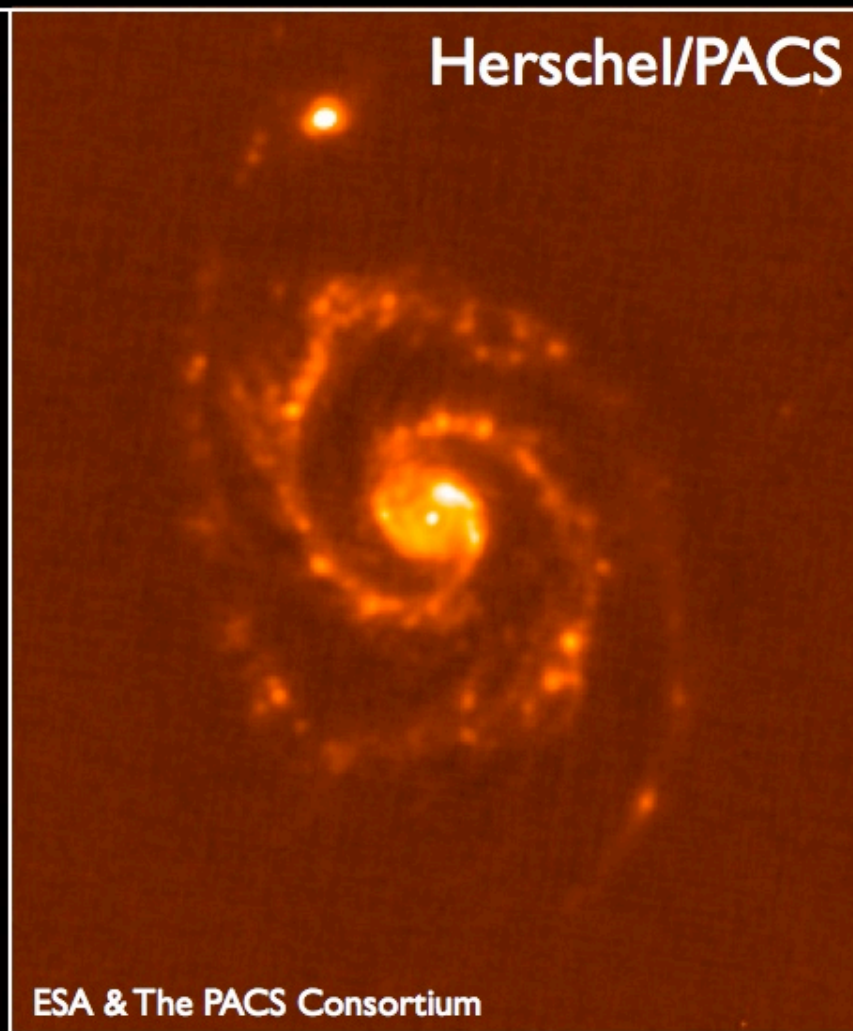
Herschel/PACS

NASA/JPL-Caltech / SINGS

ESA & The PACS Consortium

Spiral Galaxy M51 (“Whirlpool Galaxy”) in the Far Infrared (160 μm)

Spitzer/MIPS 24 μm & Herschel/PACS 100 μm

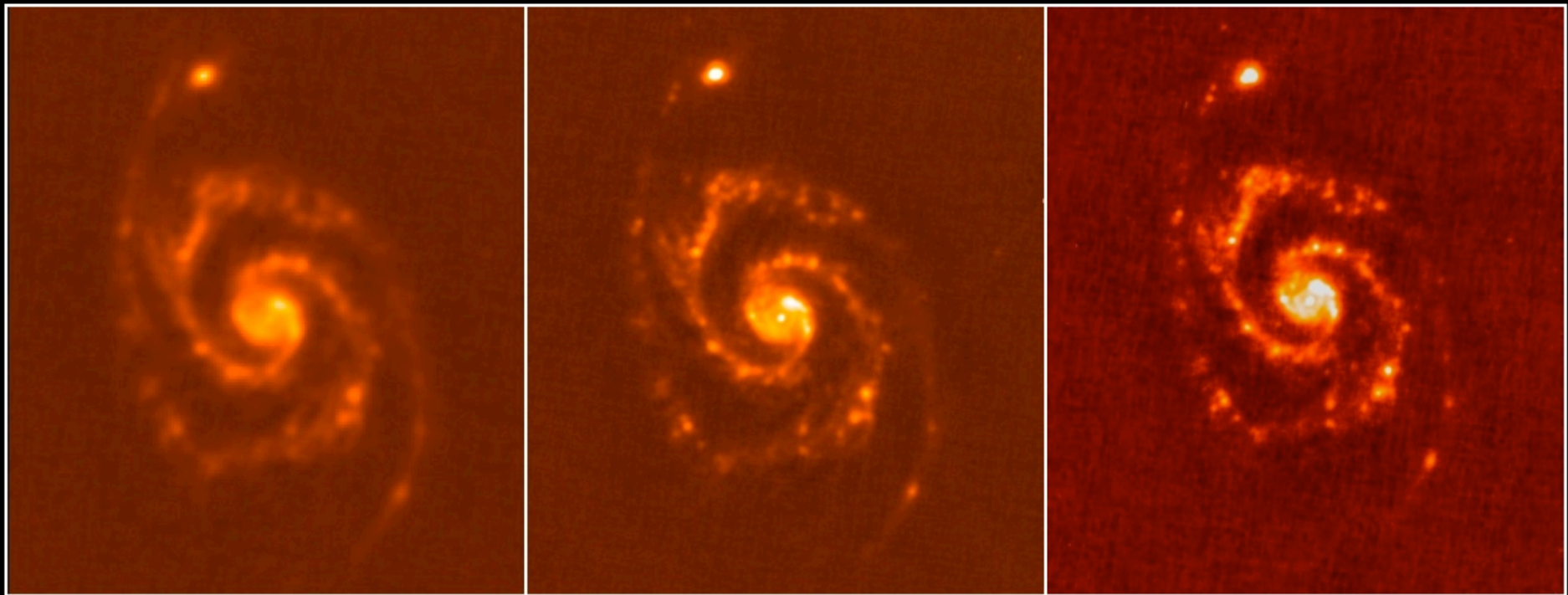


Spiral Galaxy M51 (“Whirlpool Galaxy”) at 24 μm (MIPS) and 100 μm (PACS)

Herschel/PACS 160/100/70 μm



Herschel/PACS Images of M51 (“Whirlpool Galaxy”)



160 μm

100 μm

70 μm

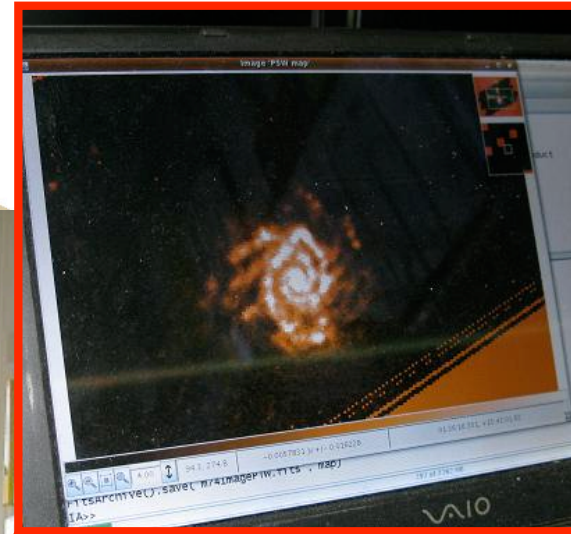
'First light' – OD#39-42



- **'Sneak preview' OD#32 PACS photometry only**
 - Greater success than anyone dared hope for – it worked!
 - Herschel (at least close to) diffraction limited even at 70 um
 - Telescope optical background on 'low side' of predictions
 - Uplink & in particular downlink software worked – DP pipelines produced results within hours of data reception
 - All very promising for the future!
- **SPIRE photometry OD#42**
 - 'PACS repeat' – two nearby galaxies
- **HIFI spectroscopy OD#39**
 - High resolution spectroscopy in different lines in star forming regions
- **PACS imaging spectroscopy OD#41**
 - Planetary nebula

HERSCHEL SPACE OBSERVATORY

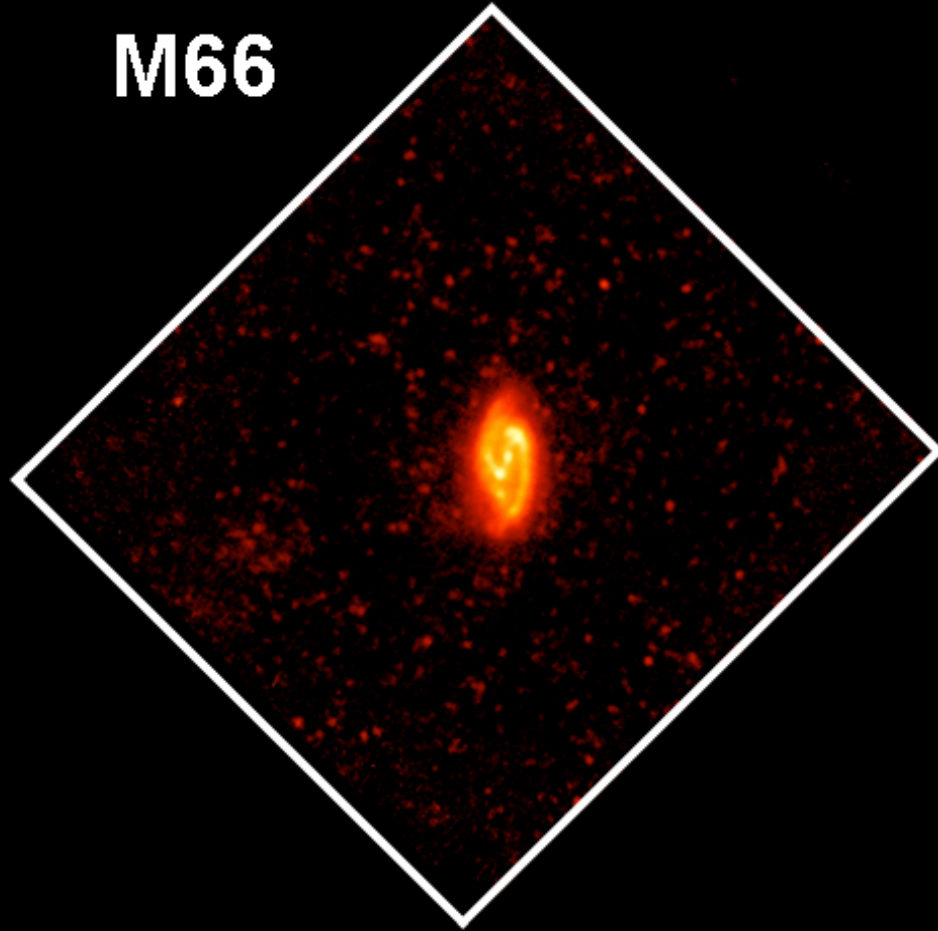
SPIRE 'First light'



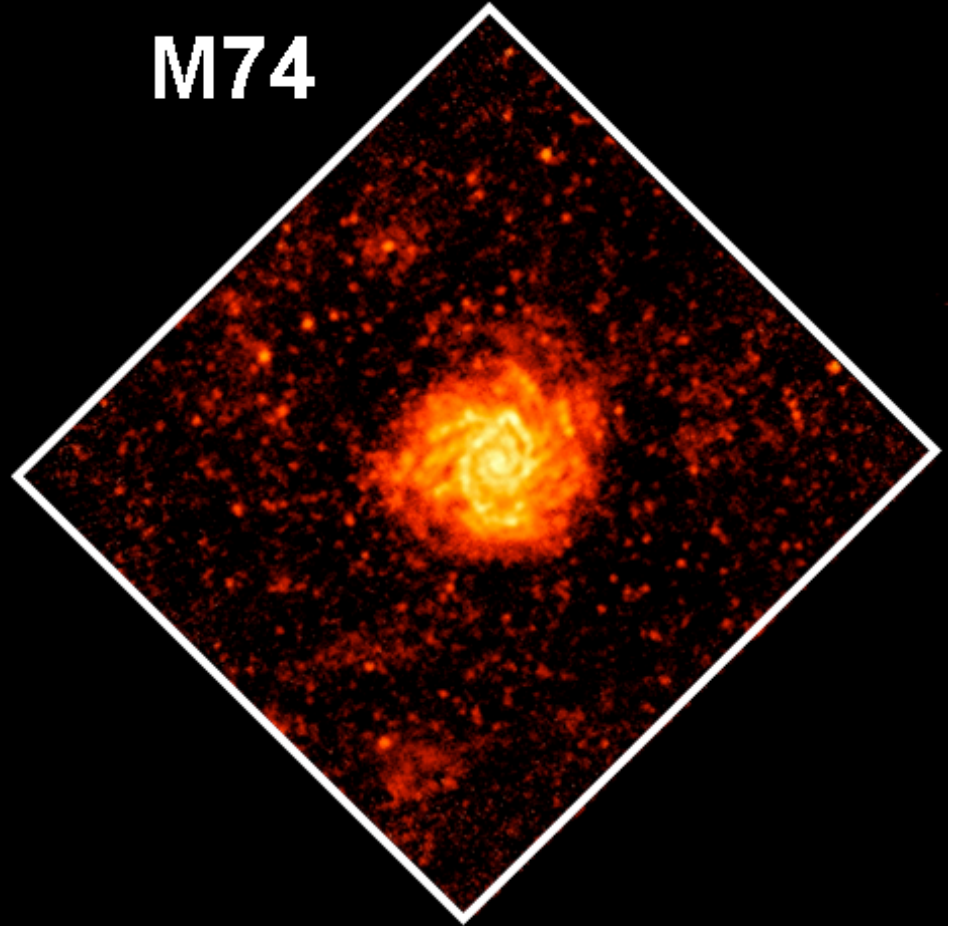
HERSCHEL SPACE OBSERVATORY

Herschel/SPIRE 250 μm Images

M66



M74

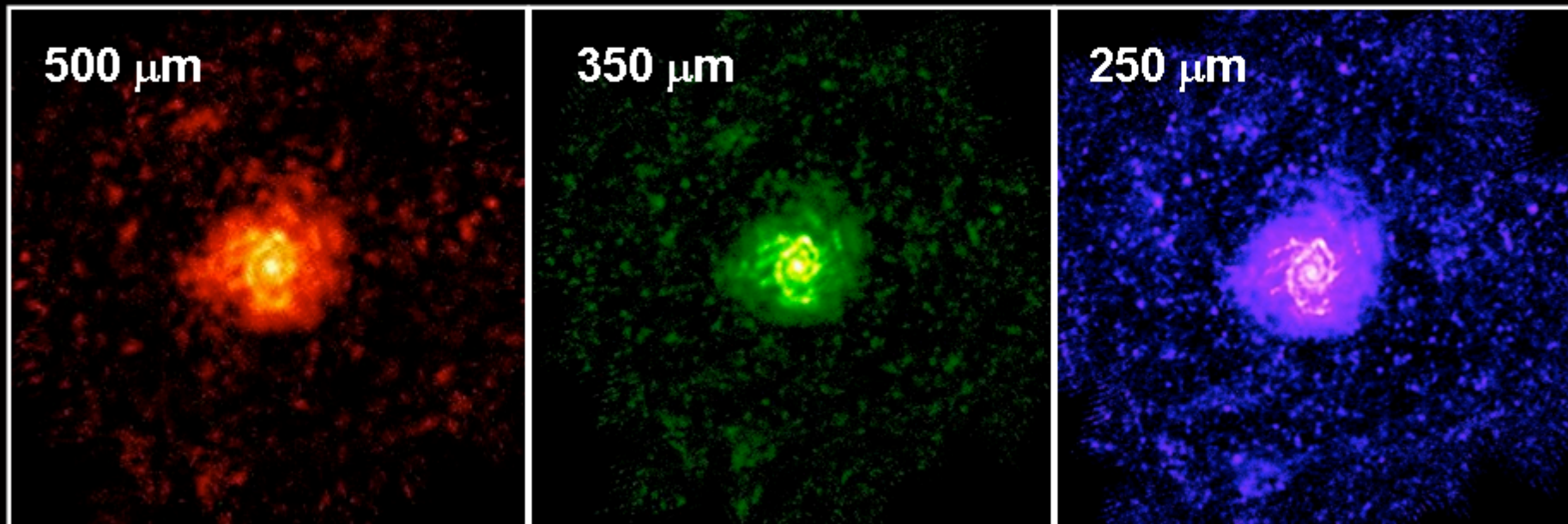


© ESA and the SPIRE Consortium

Herschel/SPIRE at 500/350/250 μm



SPIRE Images of M74

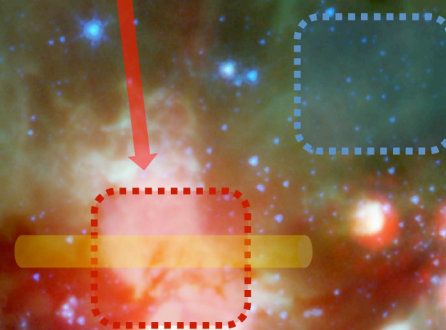
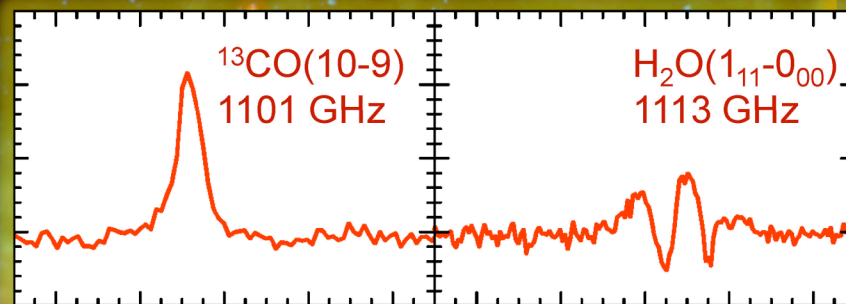
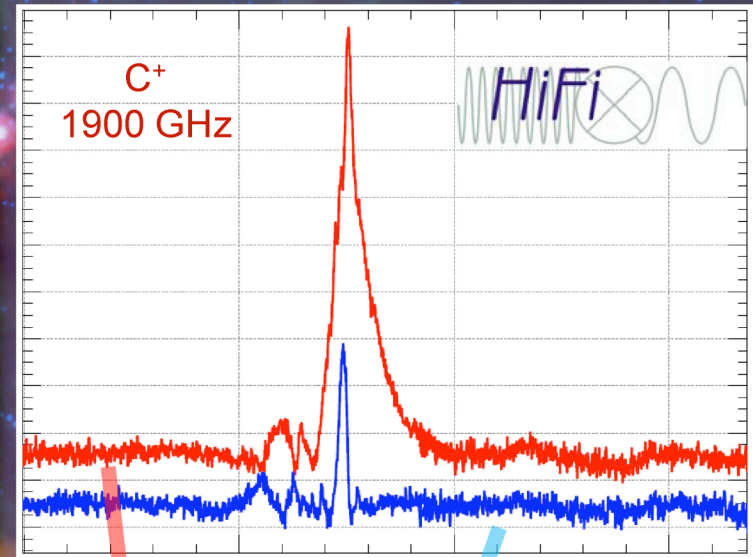


© ESA and the SPIRE Consortium

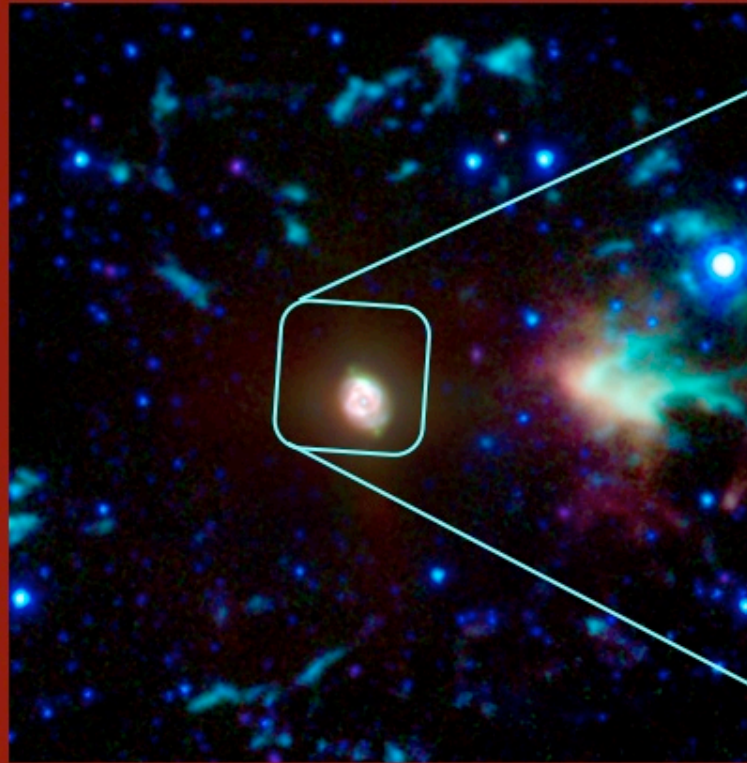
HIFI 'First light'



Herschel/HIFI THz spectroscopy

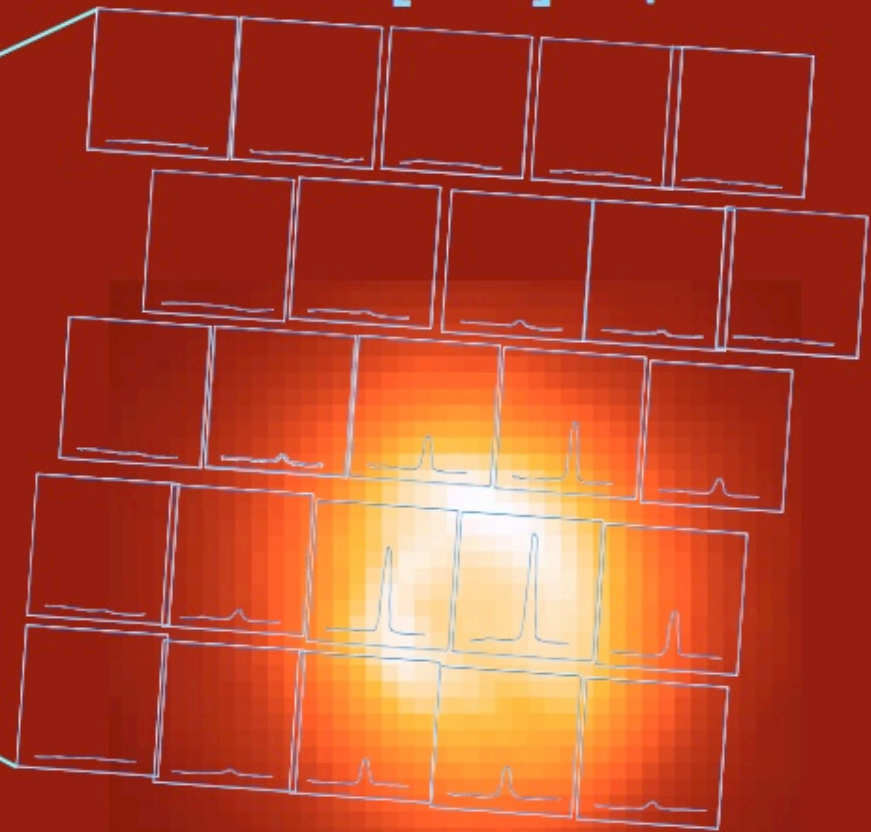


Planetary Nebula NGC 6543 (“Cat’s Eye”)



Spitzer/IRAC (4/6/8μm)
NASA/JPL-Caltech/J. Hora (Harvard-Smithsonian CfA)

PACS [N III] 57μm



PACS 70μm continuum

Important dates



- 14 May: Herschel launched together with Planck
- 14 June: Cryo-cover opening – ‘sneak preview’
- 18 July: **Commissioning Phase (COP)** completed
- 19 July: **Performance Verification Phase (PVP)** started
- 21 July: Successful In-Orbit Commissioning Review and transfer of responsibility from Project Manager to Mission Manager
- 2 August: HIFI malfunction – unavailable since
- 1 September: PACS/SPIRE parallel mode executed for the first time

HERSCHEL SPACE OBSERVATORY

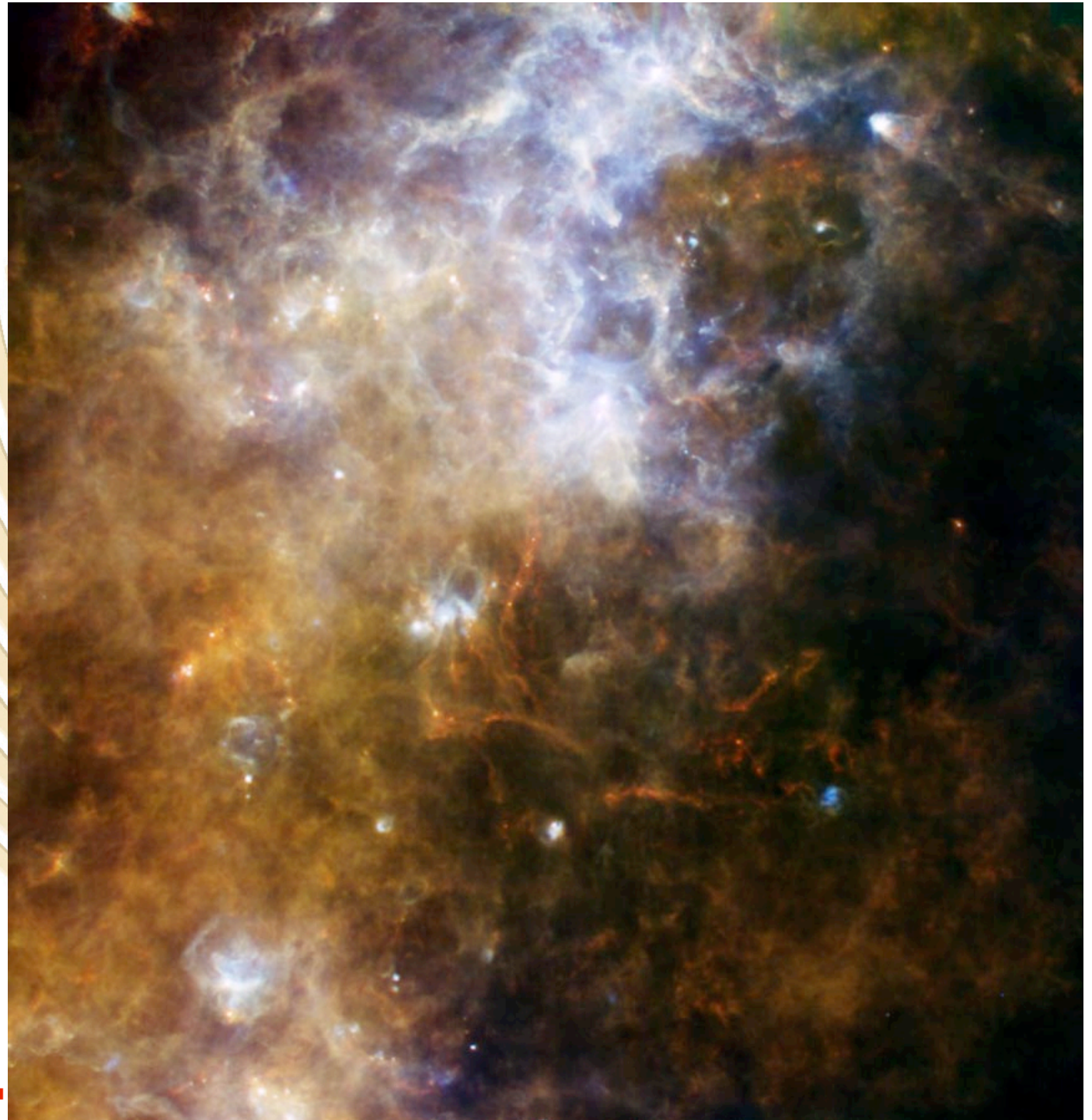
'Parallel mode' OD#111-112



- **First 'SPIRE/PACS parallel mode' observations**
 - PACS 2-colours and SPIRE 3-colours simultaneously
 - Need both instrument coolers recycled
 - FOVs about 18 arcmin apart on the sky
 - Ideal for large area mapping
- **First exercised 1-3 September**
 - Natural to use 'in units of 2 days' – cooler hold times
 - Big success
- **Web-release posted**
 - Widely acclaimed!
 - Astronomy Picture of the Day (APOD) on 16 October 2009

HERSCHEL SPACE OBSERVATORY

**PACS &
SPIRE
combined**



Important dates



- 12 September: First **Science Demonstration Phase (SDP)** observations performed – first data delivered on 28 September
- 18 October: First **Routine Science Phase (RSP)** observations
- *14-16 December: SDP Data Processing workshop in ESAC*
- *17-18 December: SDP Initial Results presentations in ESAC*
- *End April 2010: Open Time AO – announcement*
- *4-7 May 2010: **First Results Symposium** in ESTEC*
- *End June 2010: Open Time AO – proposal deadline*

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So where are my data?

HERSCHEL SPACE
OBSERVATORY

Current status



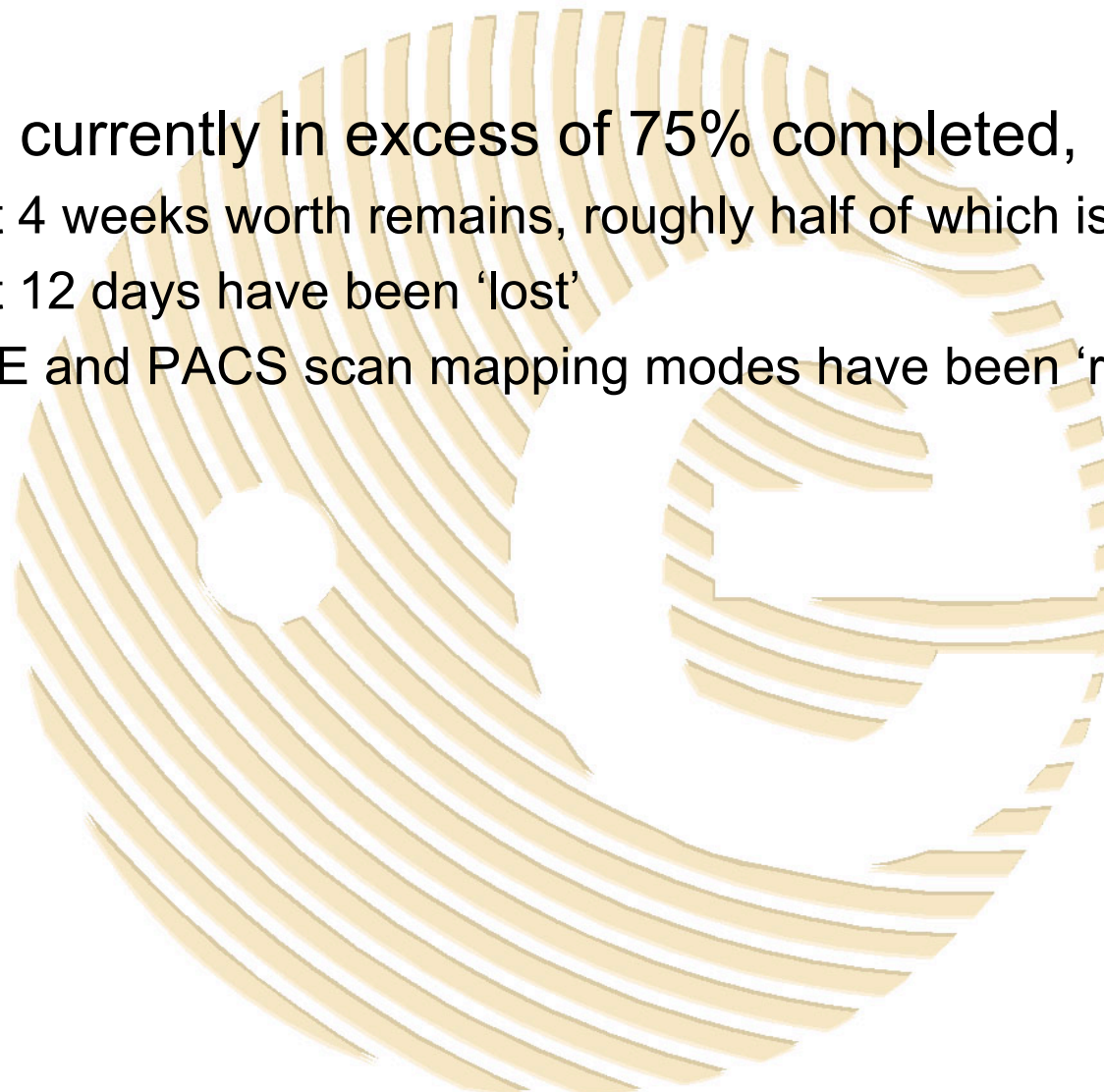
- Spacecraft and Ground Segment operating well (MOC, HSC, ICCs and NHSC) – approaching routine
- Good optical performance and optical background lower than preflight predictions
- Pointing performance in line with with preflight predictions – i.e. generally better than requirements
- For the instrument modes so far commissioned, the detailed scientific performances are still being evaluated, but are generally in line with pre-launch predictions – web-releases have attracted attention!
- Mission (cryostat) lifetime is expected to meet 3.5 year requirement, with higher than predicted CVV temperature taken into account

HERSCHEL SPACE OBSERVATORY

Current status

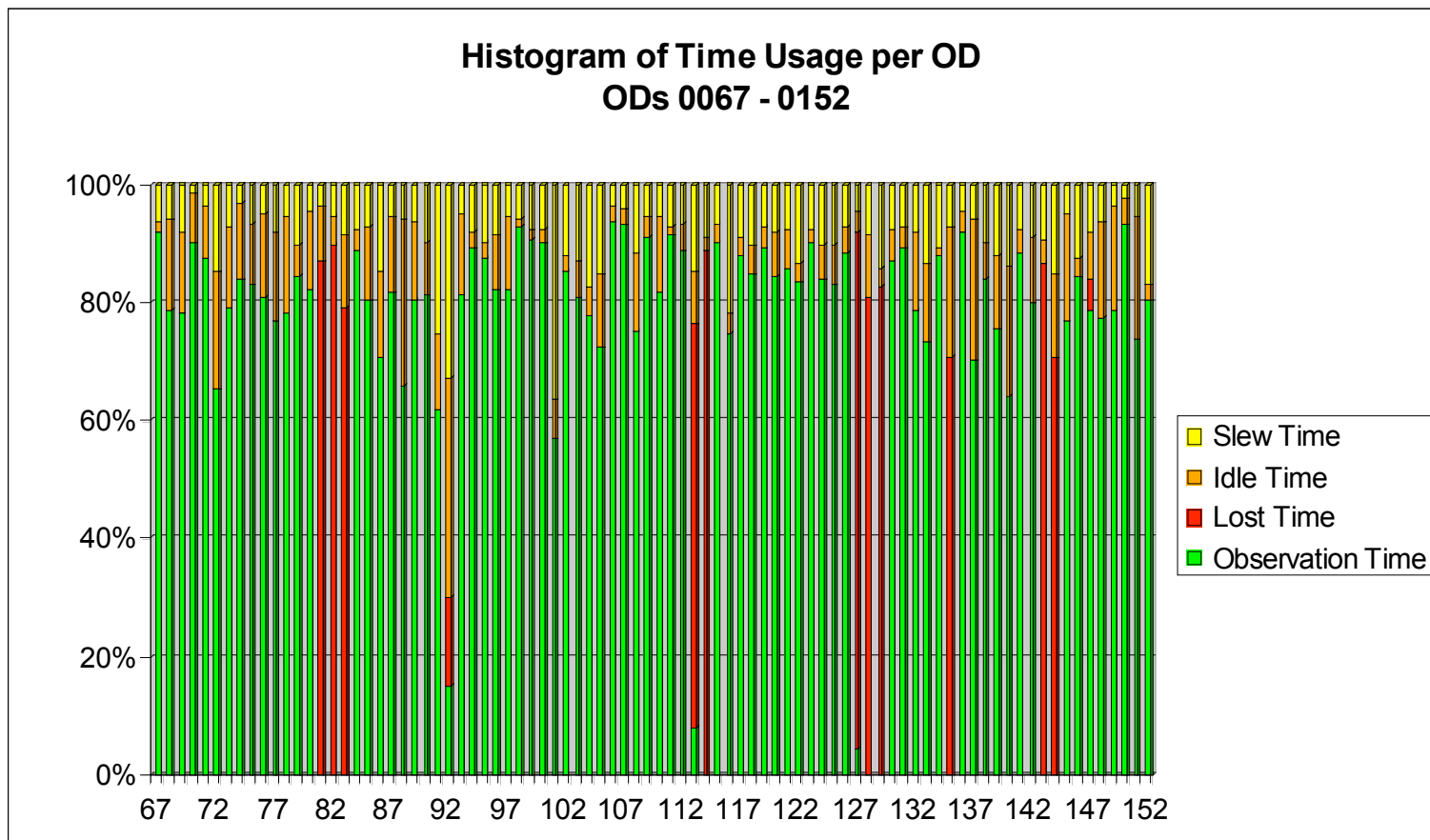


- PVP is currently in excess of 75% completed,
 - about 4 weeks worth remains, roughly half of which is HIFI
 - about 12 days have been ‘lost’
 - SPIRE and PACS scan mapping modes have been ‘released’



HERSCHEL SPACE OBSERVATORY

Time usage



81 HIFI went down
82, 83, 92 STR autonomous switchover impacts
113 Command sequence in early SPIRE spectrometer test
114 Unsuitable PACS epilogue in first parallel mode test
127-129 PACS readout anomaly in very fast readout eng. test (understood & fixed)
135 CDMS upload failure (understood & rescheduled)
143, 144 SPIRE SMEC current OOL

HERSCHEL SPACE OBSERVATORY

Current status



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- Herschel is currently mainly performing PVP and SDP observations, but also some RSP
 - SPIRE and PACS scan-map ahead of schedule
 - SPIRE spectroscopy late
 - HIFI hampered by malfunction – late

HERSCHEL SPACE OBSERVATORY

HIFI anomaly – events



- On 2 August HIFI stopped producing telemetry and went into an undefined mode – detected on 3 August
- On 10 August HIFI was briefly switched on – diagnosed failed DC/DC converter in the LCU
- HIFI & ESA investigation teams, representative set-up and component testing – surviving scenario:
- While HIFI is in nominal operations an SEU forces the LCU microcontroller to re-boot
- The re-boot commands HIFI to stand-by (in full power!)
- A safety relay (against under-voltage...) is activated, which triggers a transient voltage spike killing one or more components (diodes) in a DC/DC converter in the LCU

HERSCHEL SPACE OBSERVATORY

HIFI anomaly – way forward



- Mitigation of transients in general – minimise ‘mode changes’ by introducing operational constraints
- Inhibit operation of the safety relay in particular
- Software updates to HIFI to be implemented and tested, construction of reactivation plan
- Set of particularly important HIFI observations (Priority Science Programme – PSP) defined (~450 hours)
- After go-ahead (at level of D/SRE) conduct reactivation
- Perform COP and limited PVP, then start PSP observations
- Earliest possible time for reactivation: end November

HERSCHEL SPACE OBSERVATORY

Current status



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 - about 4 weeks worth remains, roughly half of which is HIFI
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 - SPIRE and PACS scan mapping modes have been ‘released’
- Herschel is currently mainly performing PVP and SDP observations, but also some RSP
 - SPIRE and PACS scan-map ahead of schedule
 - SPIRE spectroscopy late – software update
 - HIFI hampered by malfunction – late
- A ‘more gradual than initially planned’ transition between the various early mission phases!
 - always priority to use spacecraft time (helium) efficiently

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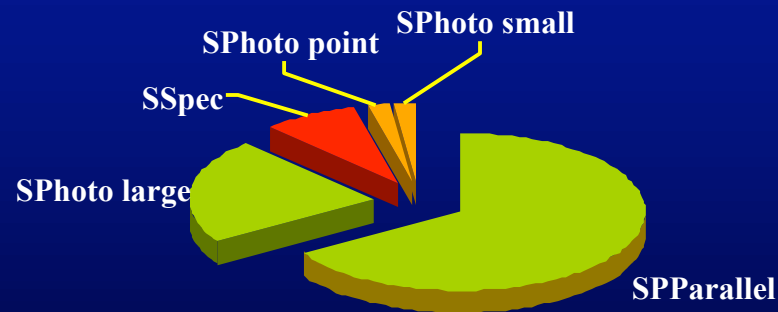
So where are my data?

HERSCHEL SPACE OBSERVATORY

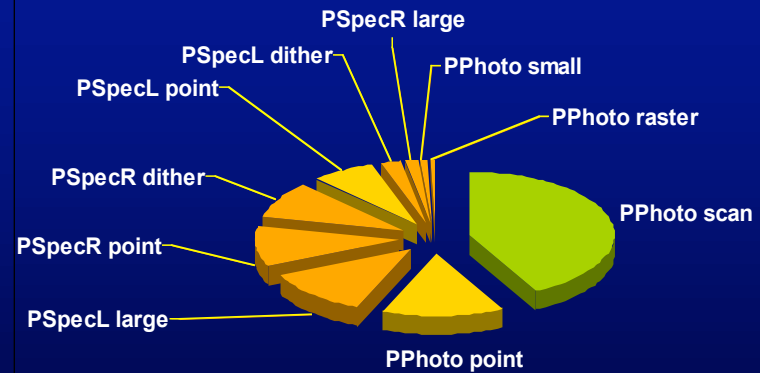
AOT release status



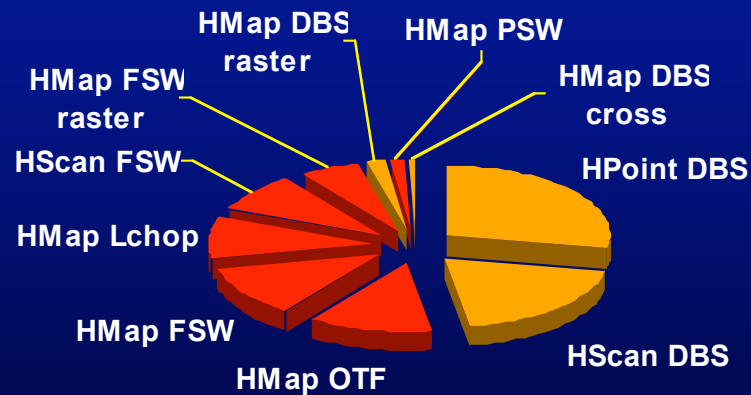
SPIRE AOT uplink release
(as percentage of allocated KP time = 3436.7 hrs)



PACS AOT uplink release
(as percentage of allocated KP time = 5360.1 hrs)



HIFI AOT up/downlink release
(as percentage of allocated KP time = 2403.9 hrs)



HERSCHELL OBSERVATORY



Disk observations



FIRST proposal workshop May 1982



**Some people have waited
longer than you!!**

