

Herschel – mission status and future



Göran 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



V188 launch on 14 May 2009



Diagnostic
provisoire
de la mission
lanceur

ARIANE VOL 188 HERSCHEL/ PLANCK ORBITE A L'INJECTION

Mise à feu (H0) le **14/05/09 à 13 h 12 min 00 s (UT)**
soit le **14/05/09 à 10 h 12 min 00 s (Kourou)**

ORBITE	ESTIMATION PROVISOIRE	MIN	VISEE	MAX
Perigee (km)	270.0	265.5	270.0	274.5
Apogee (km)	1 197 080.	1 041 822. (-151806)	1 193 622.	1 345 422. +151906
Inclinaison (deg)	5.99	5.94	6.00	6.06

Le Chef de Mission

Ph. Rouaud

Le Responsable Charge Utile Ariane

L. CHICCHINO

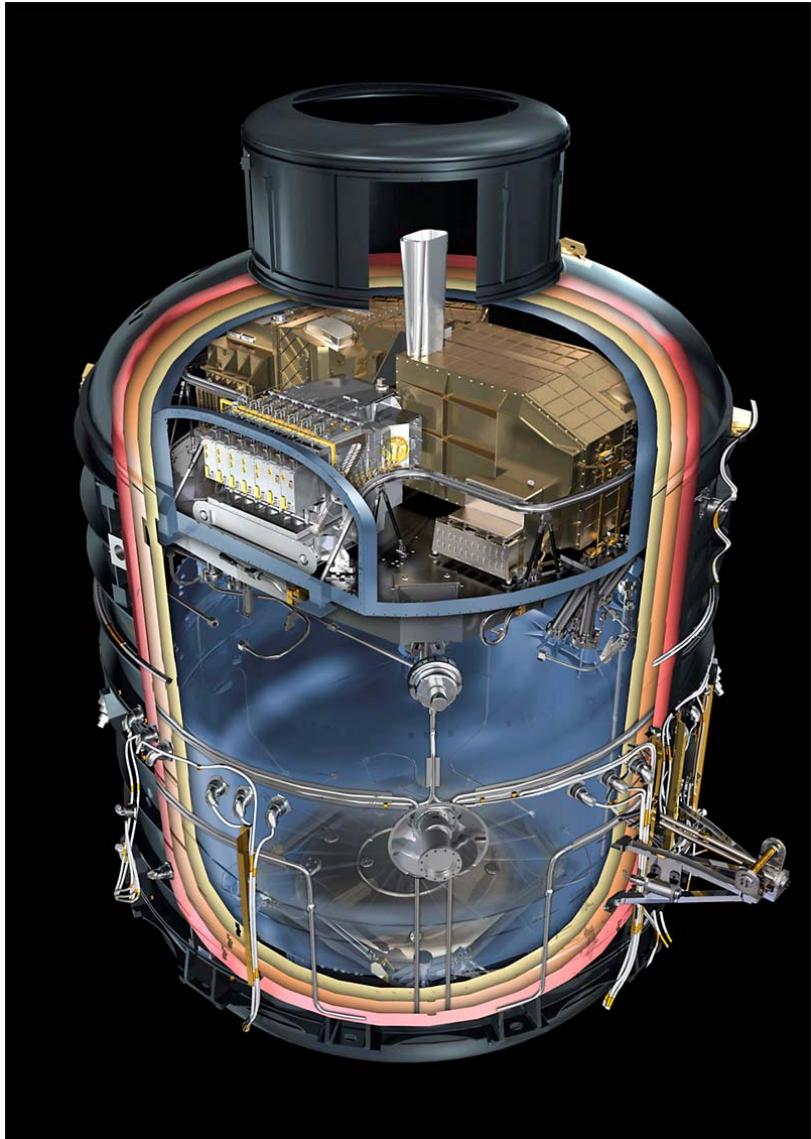
EVRY-FAX 01 60 87 62 17



Early mission phases – the Plan

- **14 May: Herschel launched (together with Planck)**
 - Herschel launched warm outside and cold inside cryostat
- **Commissioning Phase (COP) ~2 months**
 - Functional testing
 - Cryocover opening after ~1 month
 - Thermal stabilisation after ~2 months
- **Performance Verification Phase (PVP) ~3 months**
 - Verification, optimisation & release of observing modes
 - HIFI malfunction early on (on 2 August)
- **Science Demonstration Phase (SDP) ~1 month**
 - Use released observing modes, optimise & release observing programmes – get initial science as ‘by-product’
- **Routine Science Phase (RSP) ≥36 months**
 - Overall planning and GT awarded based on 3 years RSP
 - By necessity ‘gradual transitions’ between phases

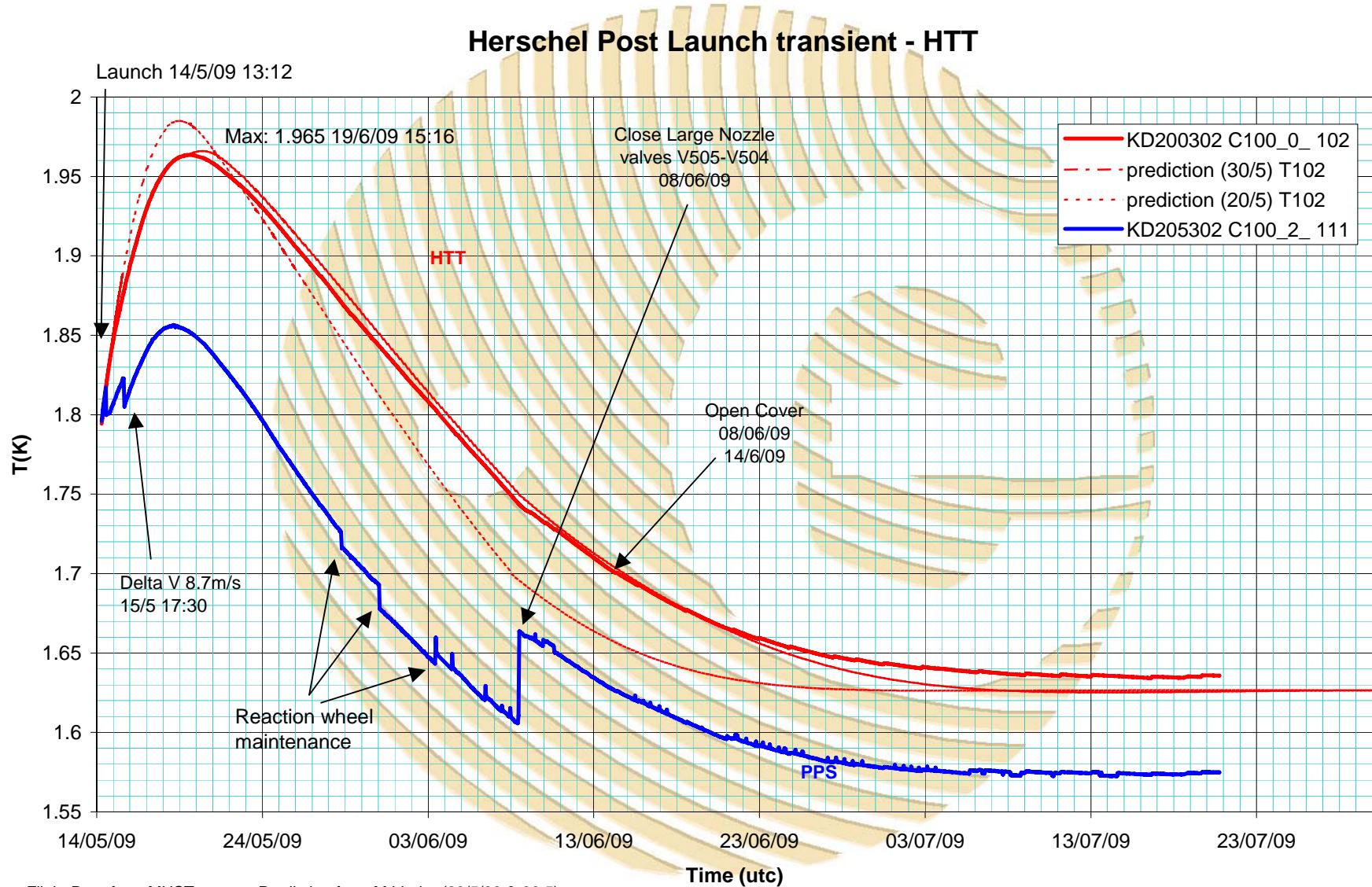
Spacecraft



HERSCHEL SPACE OBSERVATORY



Cooldown – HTT

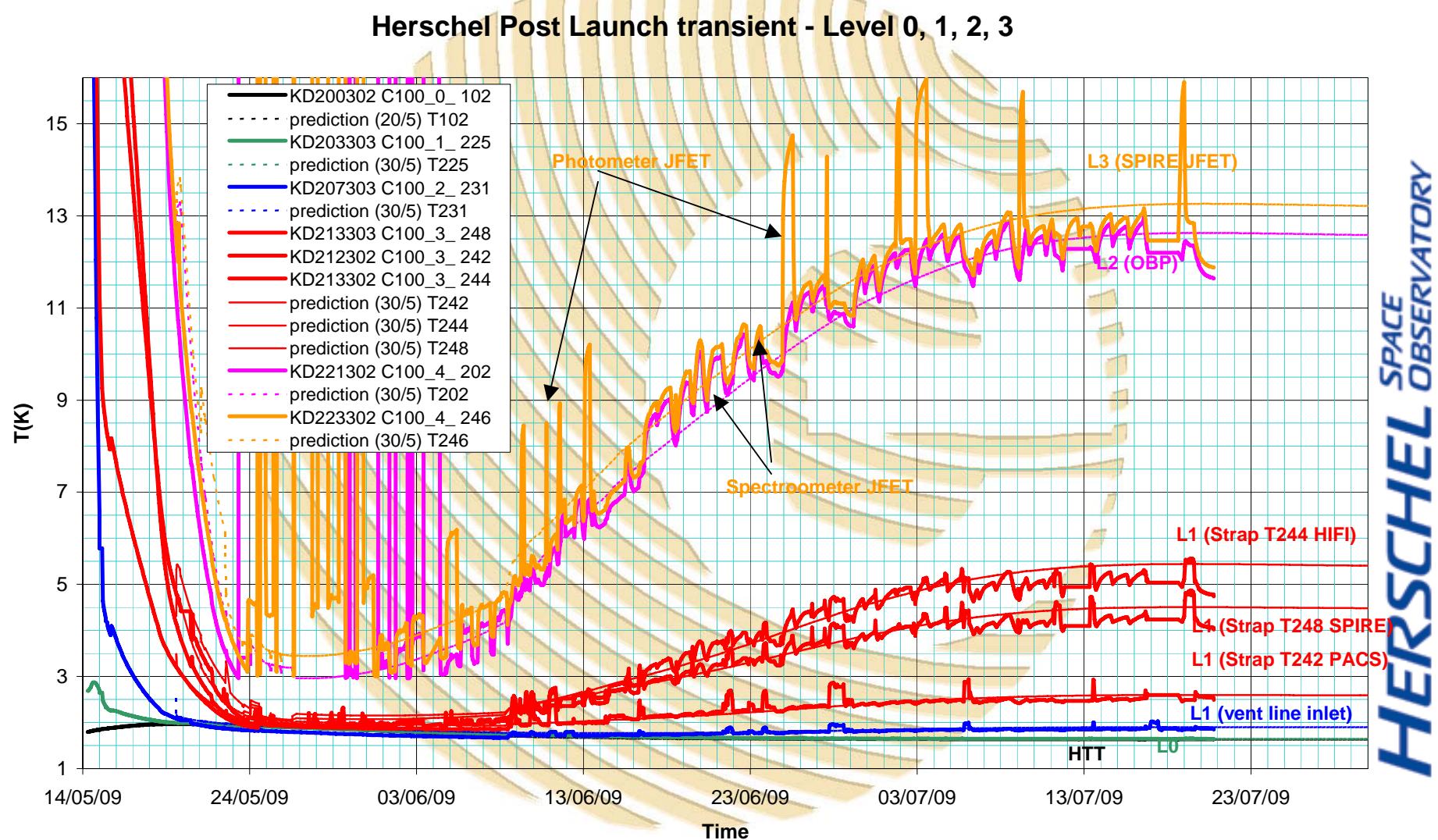


Flight Data from MUST server , Prediction from M.Linder (20/5/09 & 30.5)





Cooldown – levels 0, 1, 2, & 3

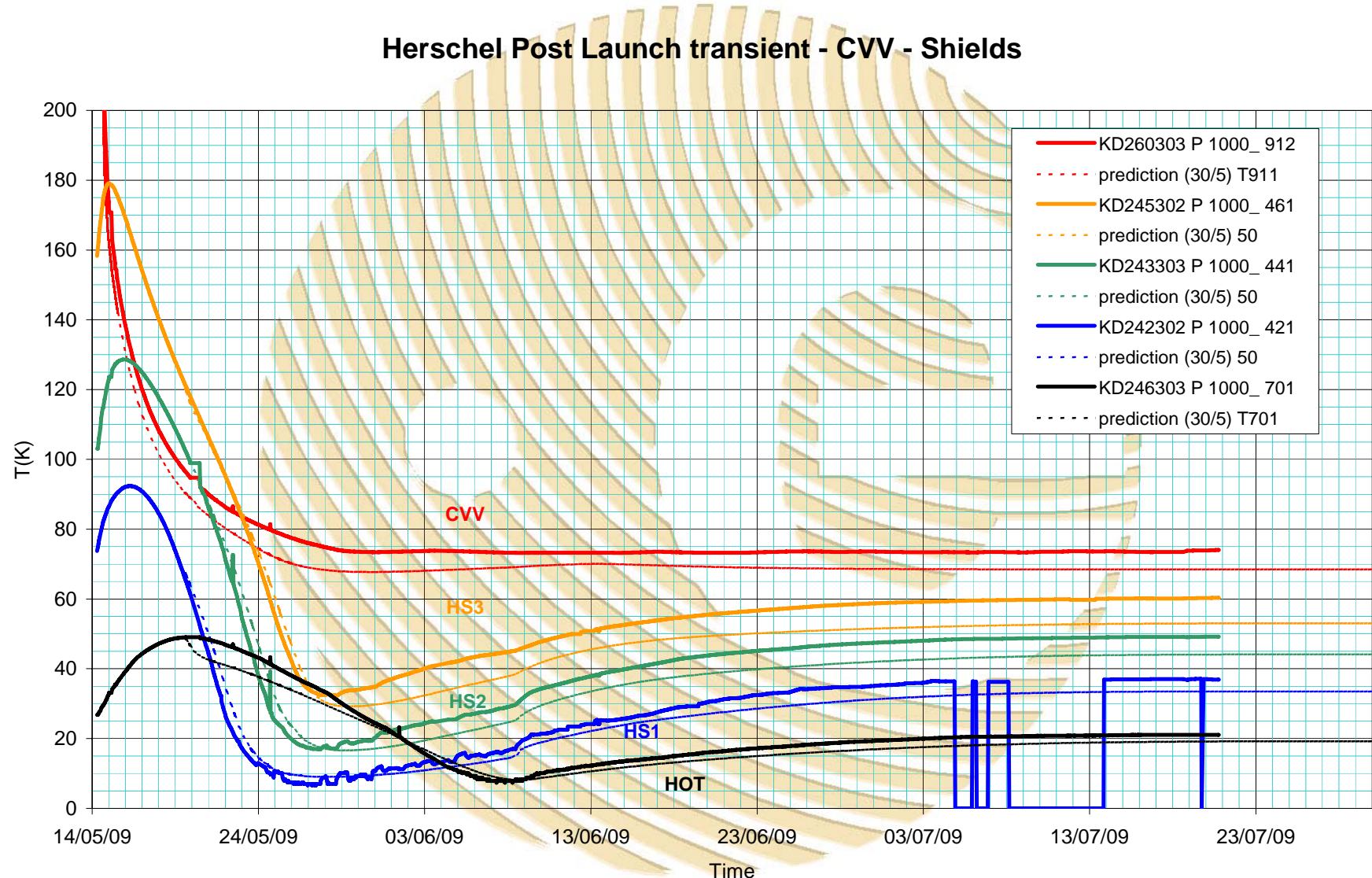


Flight Data from MUST server , Prediction from M.Linder (30/5/09)





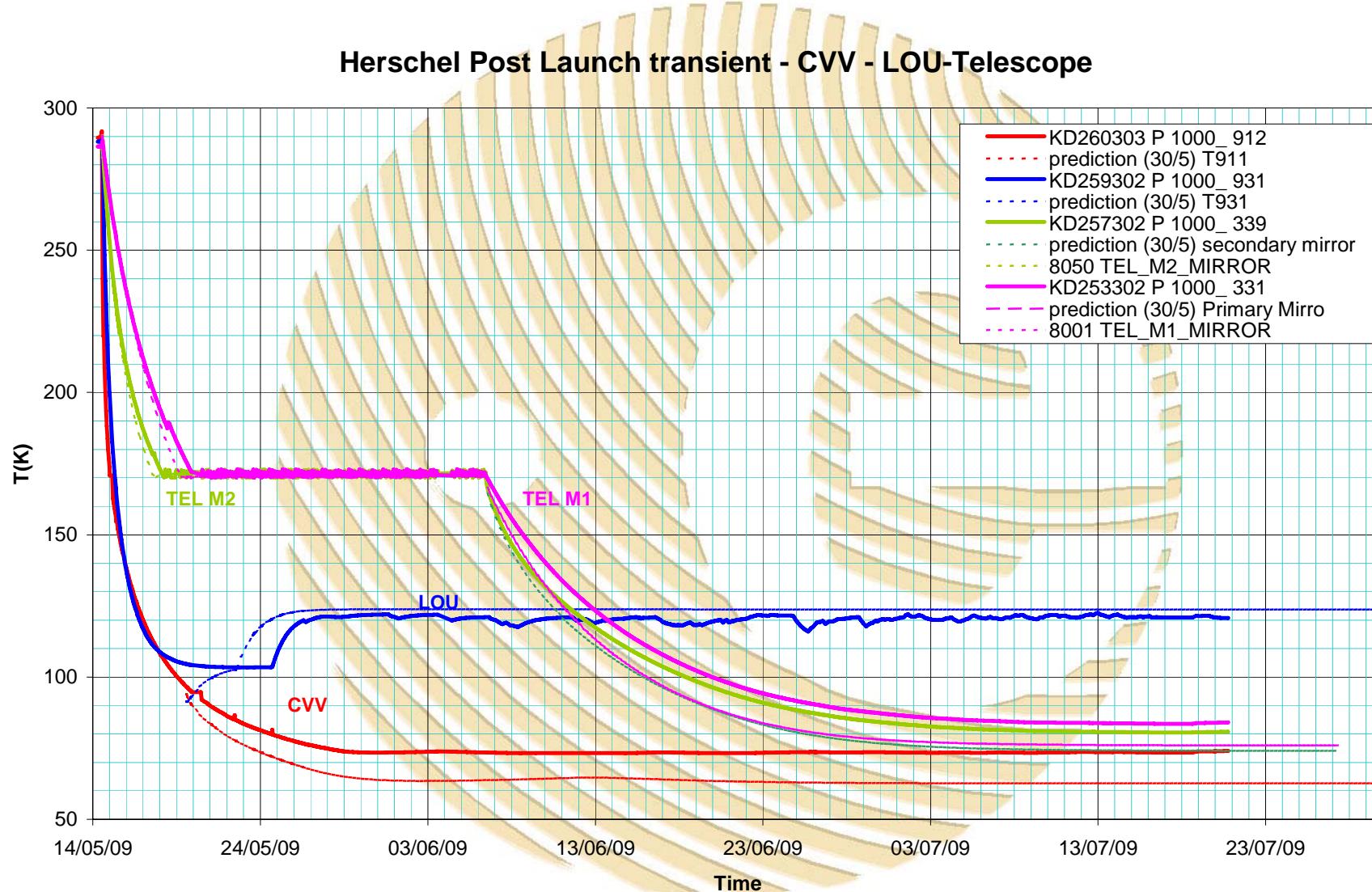
Cooldown – CVV & shields



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



Cooldown – telescope, LOU, & CVV



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





Herschel lifetime - 1

- **At In-Orbit Commissioning Review (IOCR)**

- Mid-July – just reached stationary conditions
- Amount of He at launch known at 333.5 kg
- Transient phase use modelled/estimated
- Stationary conditions
 - CVV average stationary outside temperatures measured
 - Stationary average dissipation
⇒ Average He mass-flow modelled at 2.668 mg/s
- ⇒ Mission lifetime estimated at 3.78 years

- **First DLCM on OD#195**

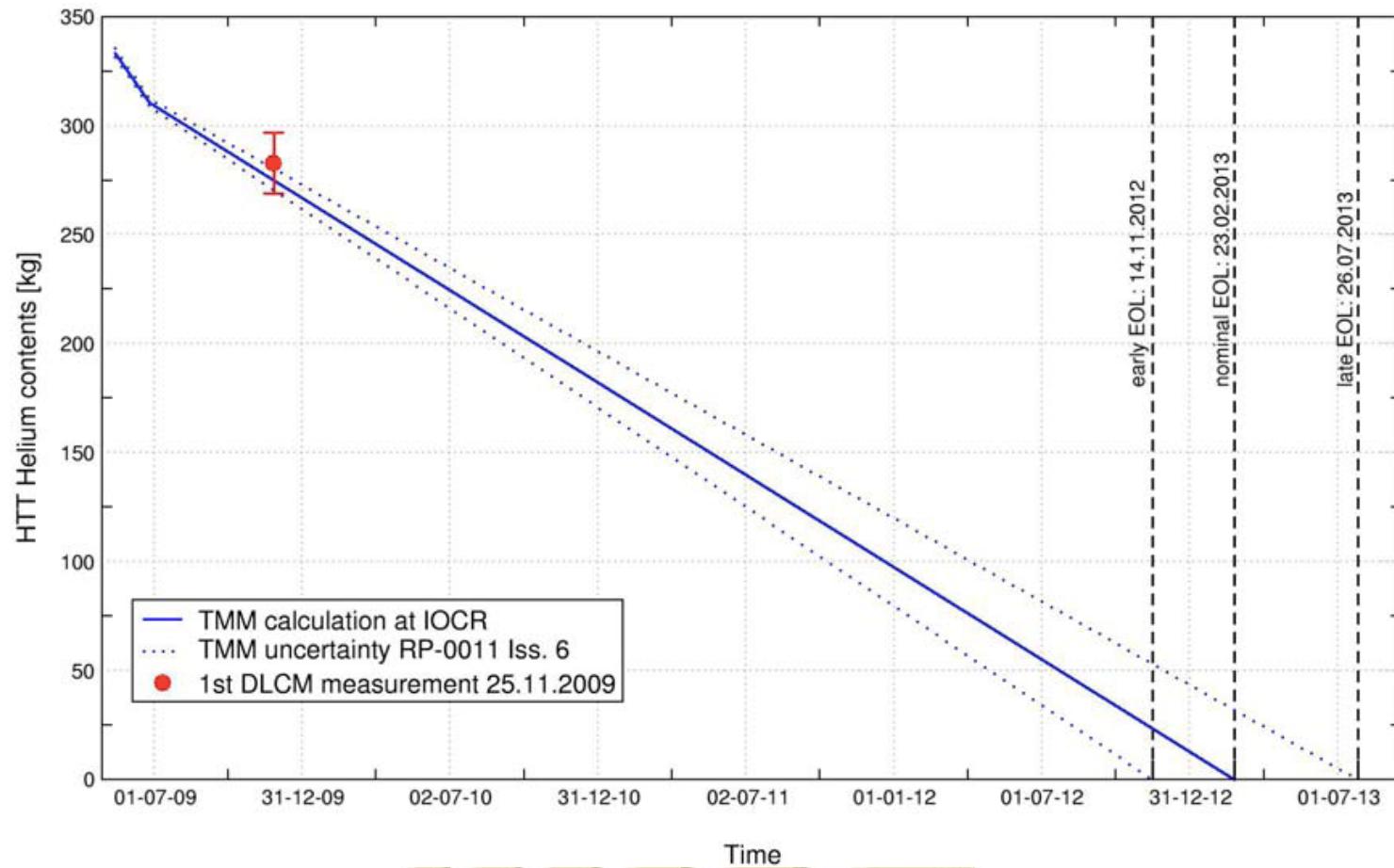
- Remaining amount He measured at 283 ± 14 kg (269-297 kg)
- Use 2.668 mg/s => 1228 ± 50 days (1168-1288 days)
- Compute total mission lifetime => 3.65-3.98 years
- Estimated amount of He was 275 kg (consistent)
⇒ Mission lifetime given as 3.8 years (end ~March 2013)

HERSCHEL SPACE OBSERVATORY



Herschel lifetime - 2

- There are (still) large uncertainties ...



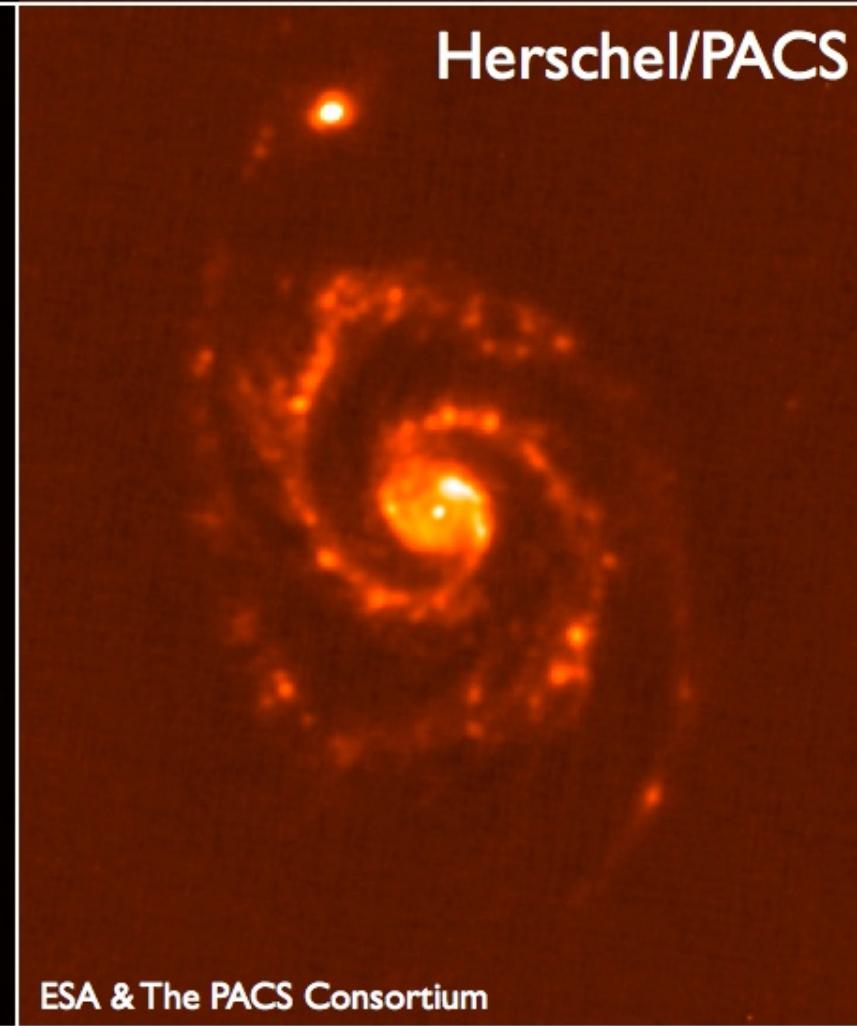
- ... but confidence of 3.5 year mission strengthened

HERSCHEL SPACE OBSERVATORY

Spitzer/MIPS 24 um & Herschel/PACS 100 um



NASA/JPL-Caltech / SINGS



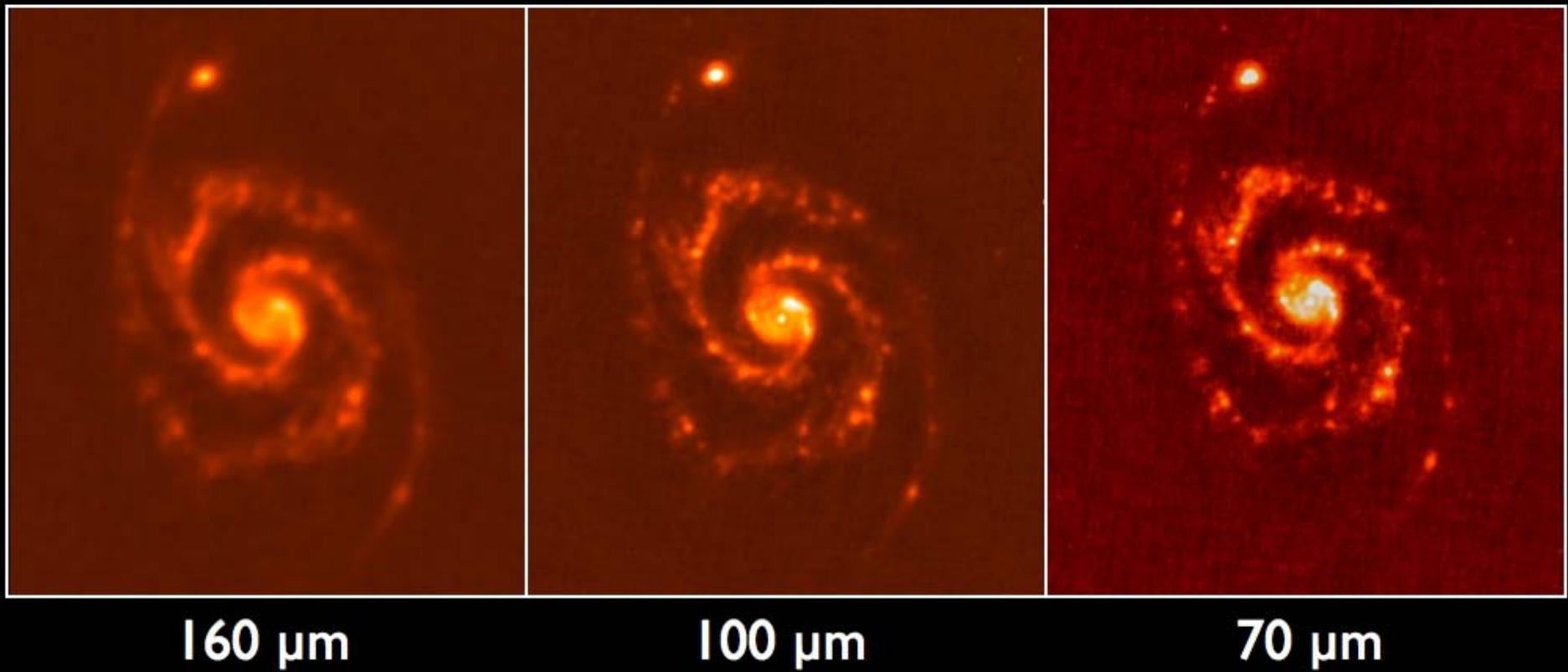
ESA & The PACS Consortium

Spiral Galaxy M51 ("Whirlpool Galaxy") at 24 μ m (MIPS) and 100 μ m (PACS)

Herschel/PACS 160/100/70 um



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

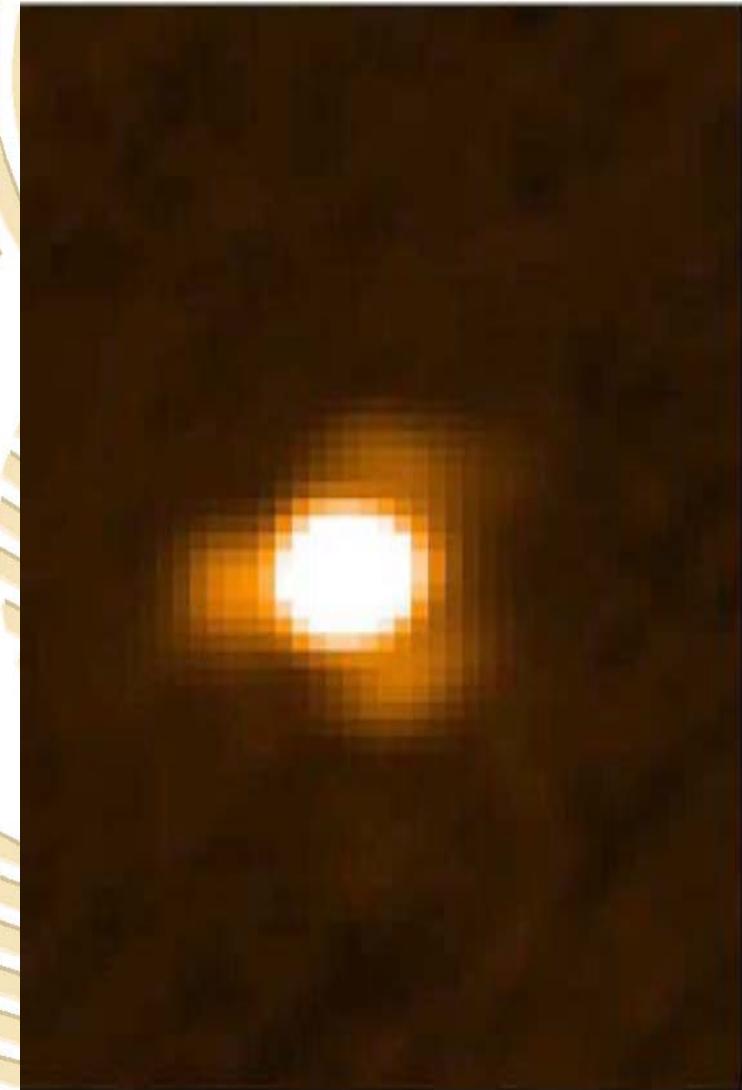


© ESA & The PACS Consortium

Herschel optical performance - 1



- **Good optical performance!**
 - Diffraction limited down to shortest wavelengths
⇒ good focus
 - Good PSFs
 - low level features can be seen at 70 um
- **Low optical background**
 - Slightly higher temperature than predicted
 - But lower emissivity than assumed more than compensates

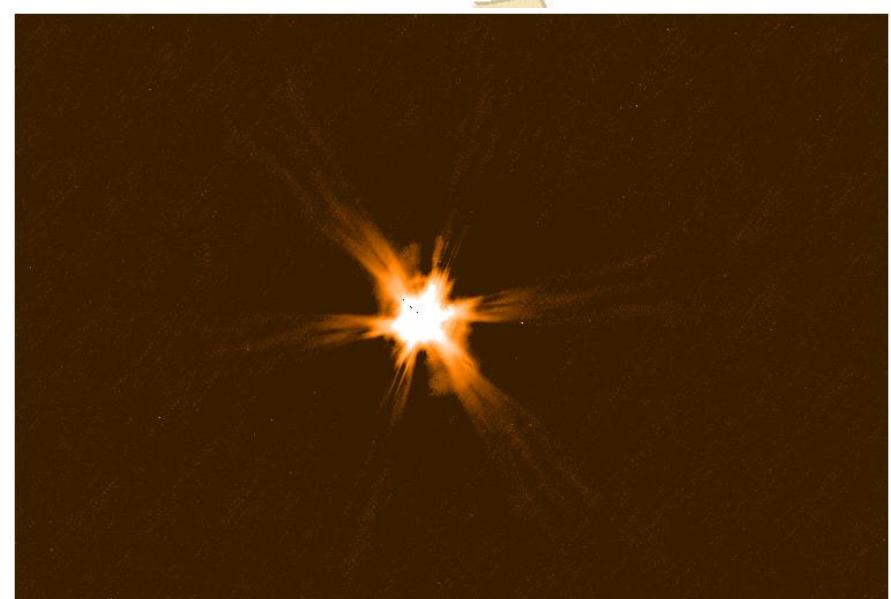
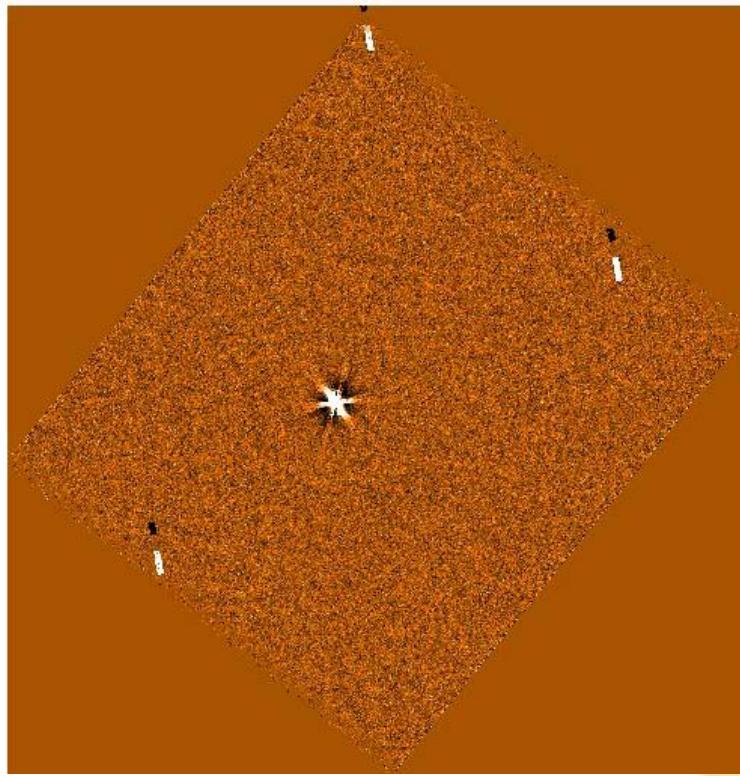


HERSCHEL SPACE OBSERVATORY



Herschel optical performance - 2

- **Straylight near-field**
 - Mars with PACS, can see hexapod structure but no near-field straylight

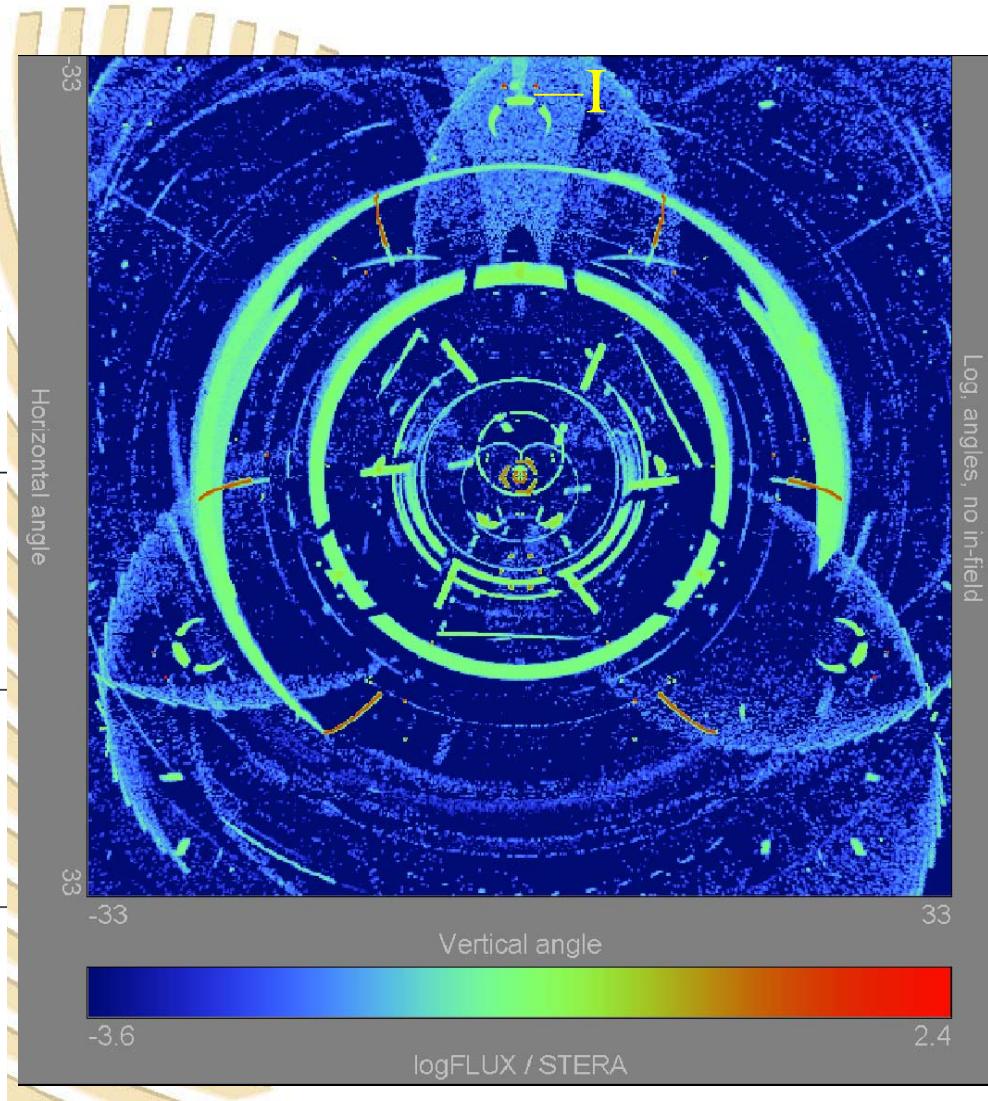
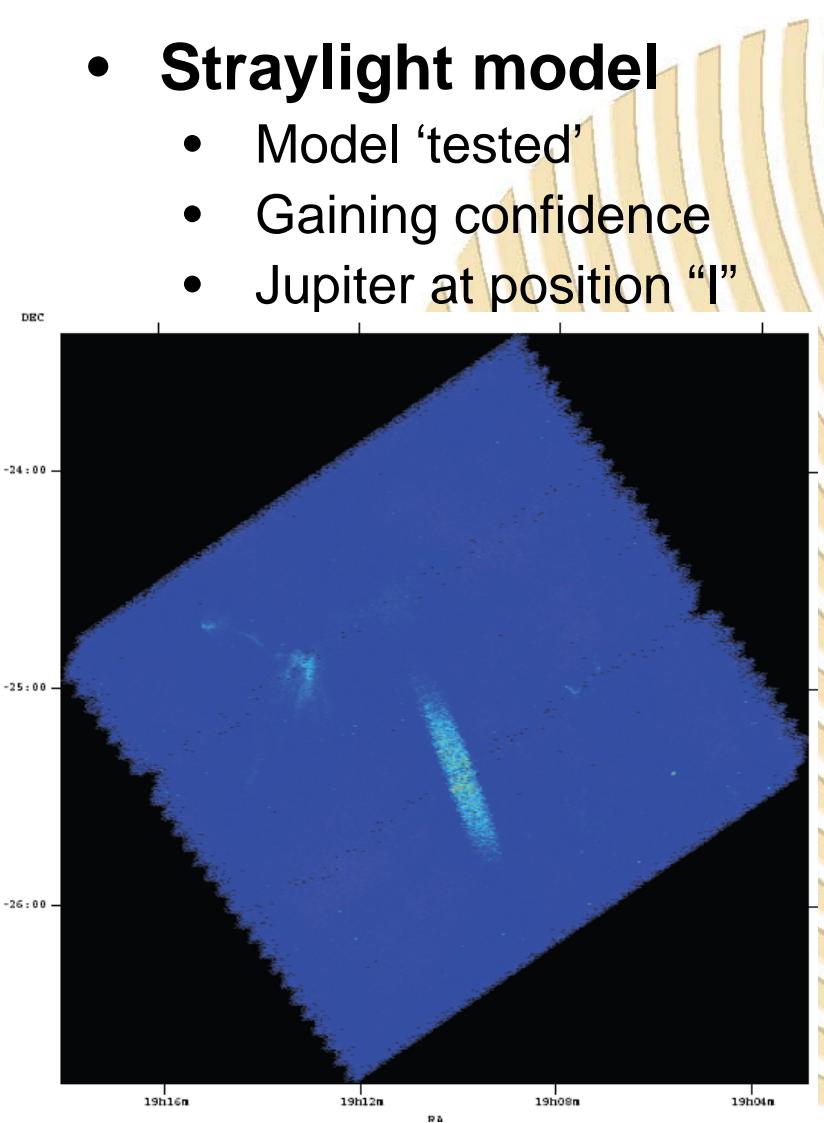




Herschel optical performance - 3

- **Straylight model**

- Model ‘tested’
- Gaining confidence
- Jupiter at position “I”



HERSCHEL SPACE OBSERVATORY

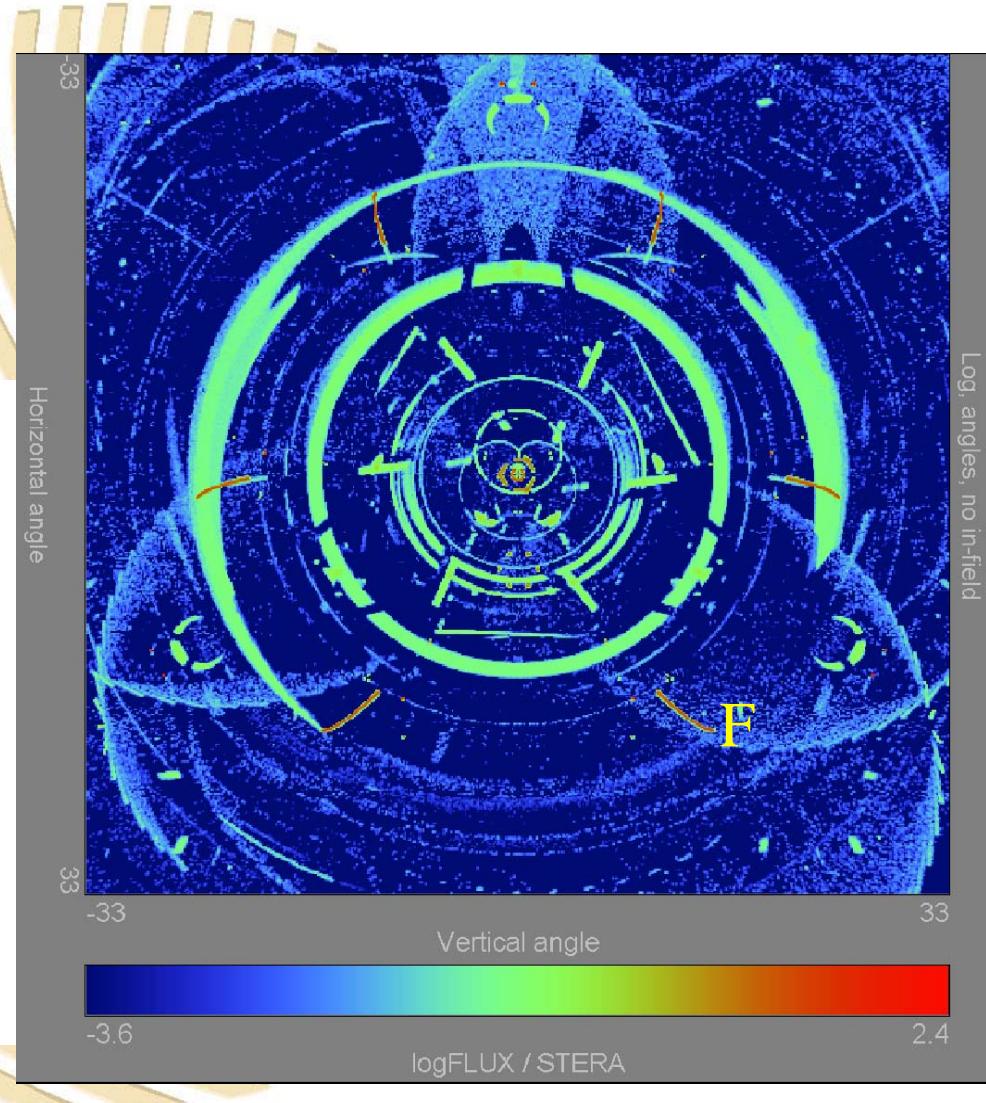
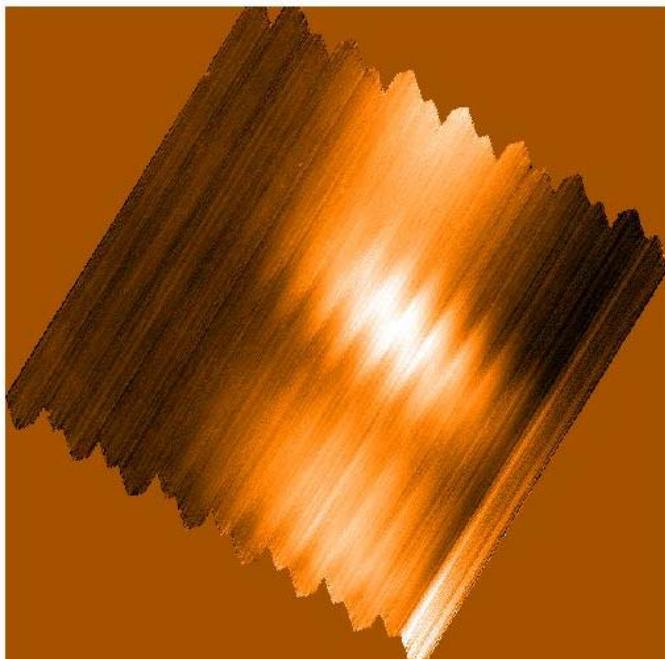




Herschel optical performance - 4

- **Straylight model**

- Model ‘tested’
- Gaining confidence
- Moon at position “F”

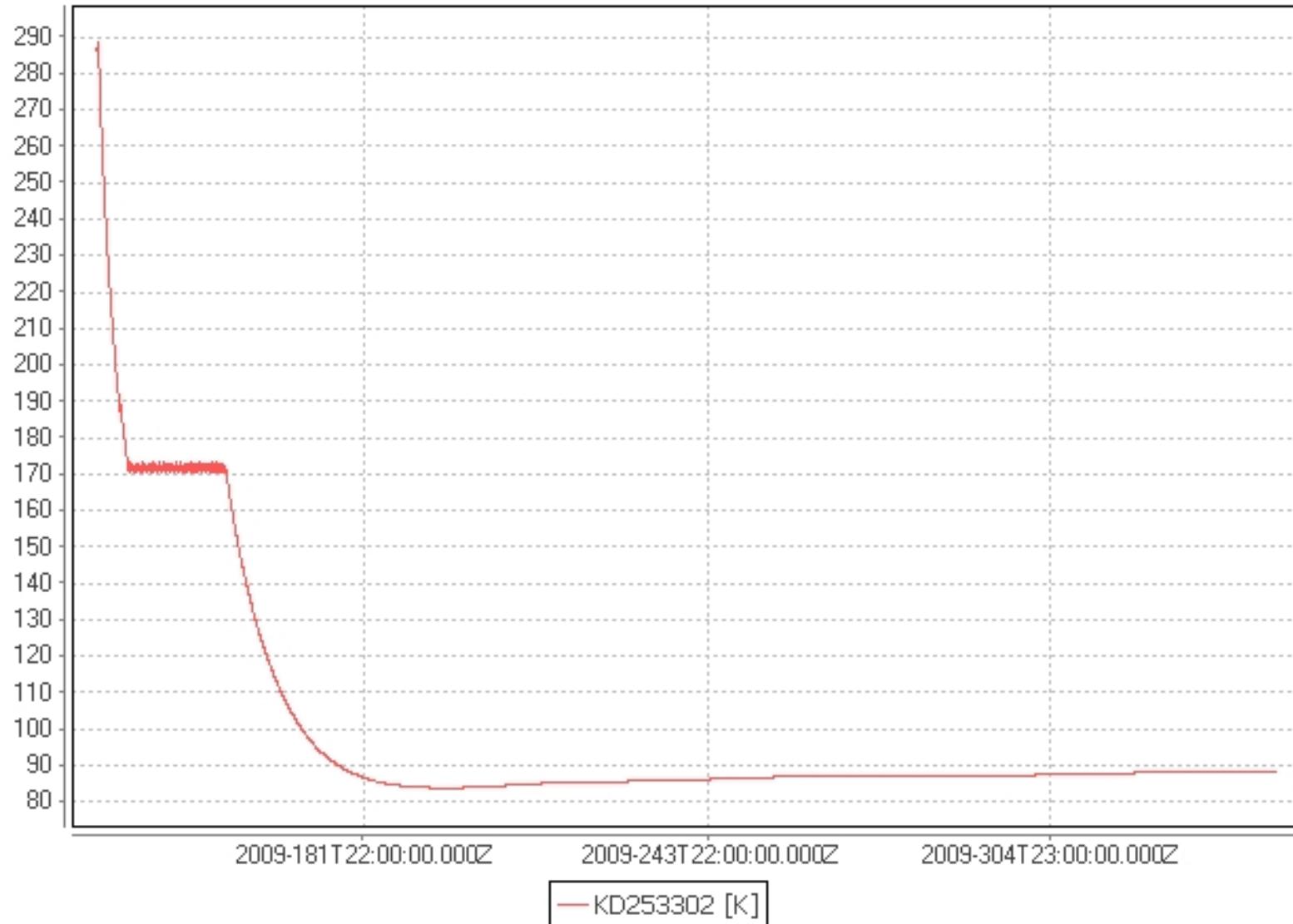


HERSCHEL SPACE OBSERVATORY



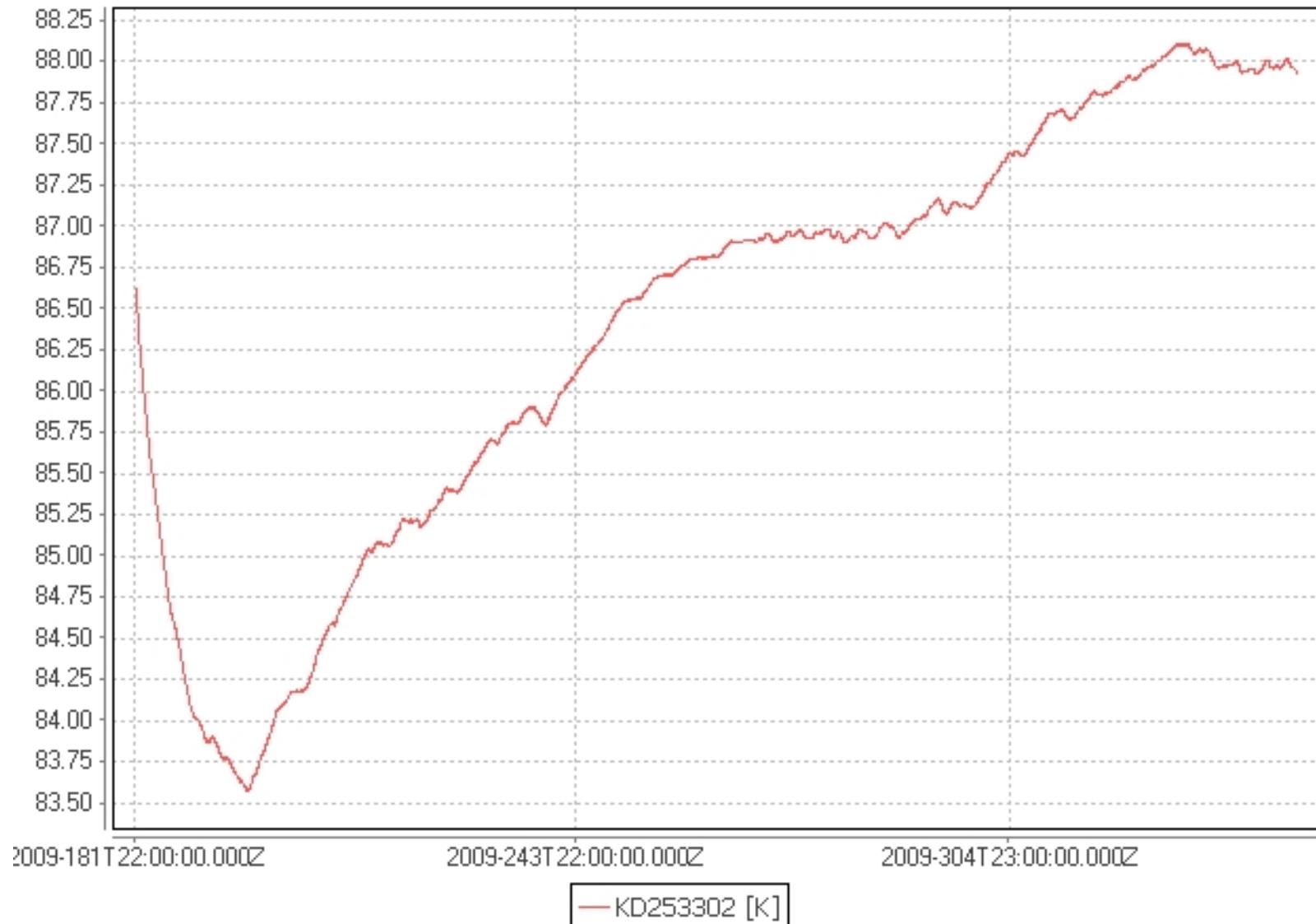
Cooldown and to date – telescope

HERSCHEL SPACE OBSERVATORY

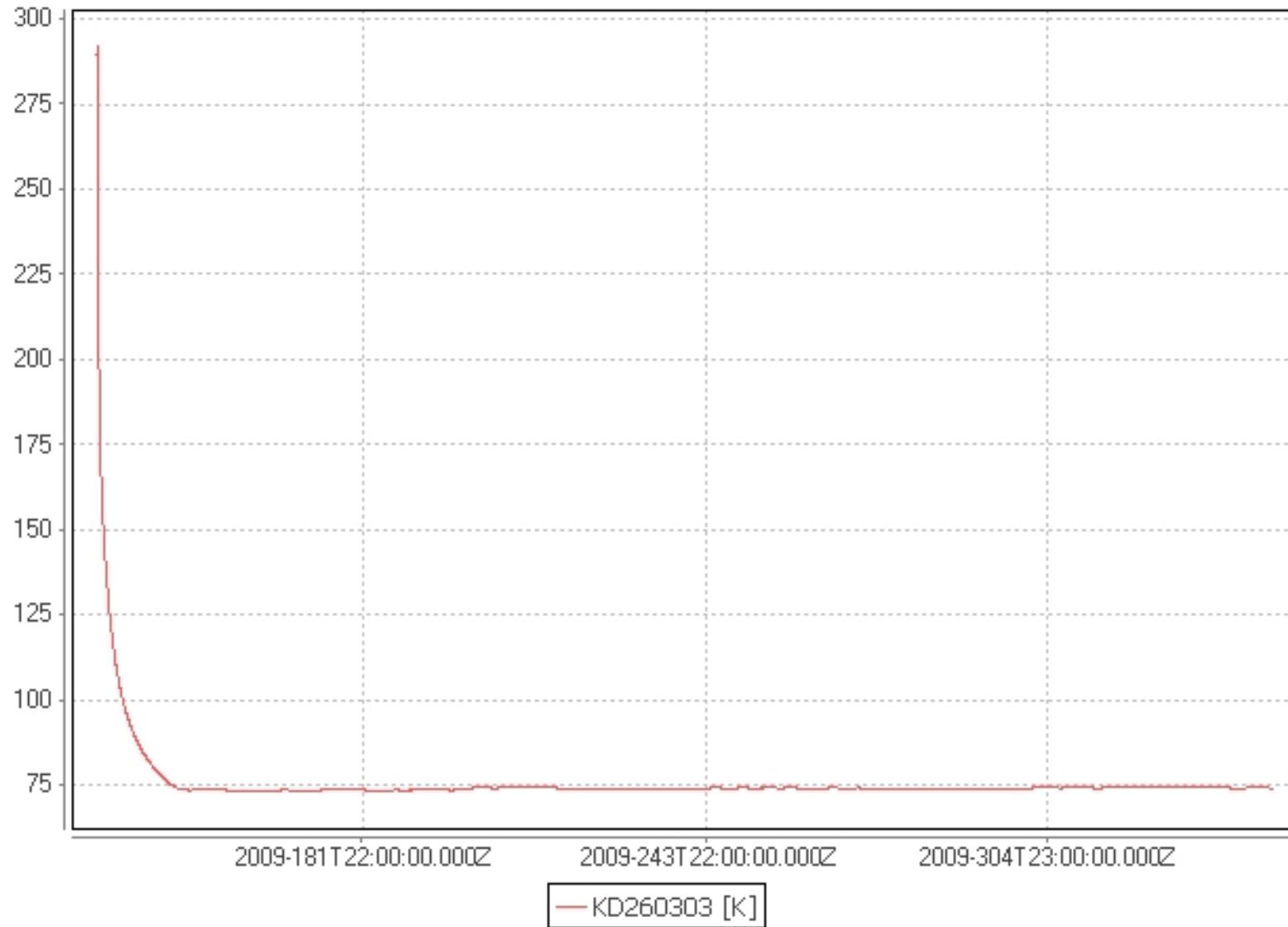




1 July-12 December – telescope



Cooldown and to date – CVV

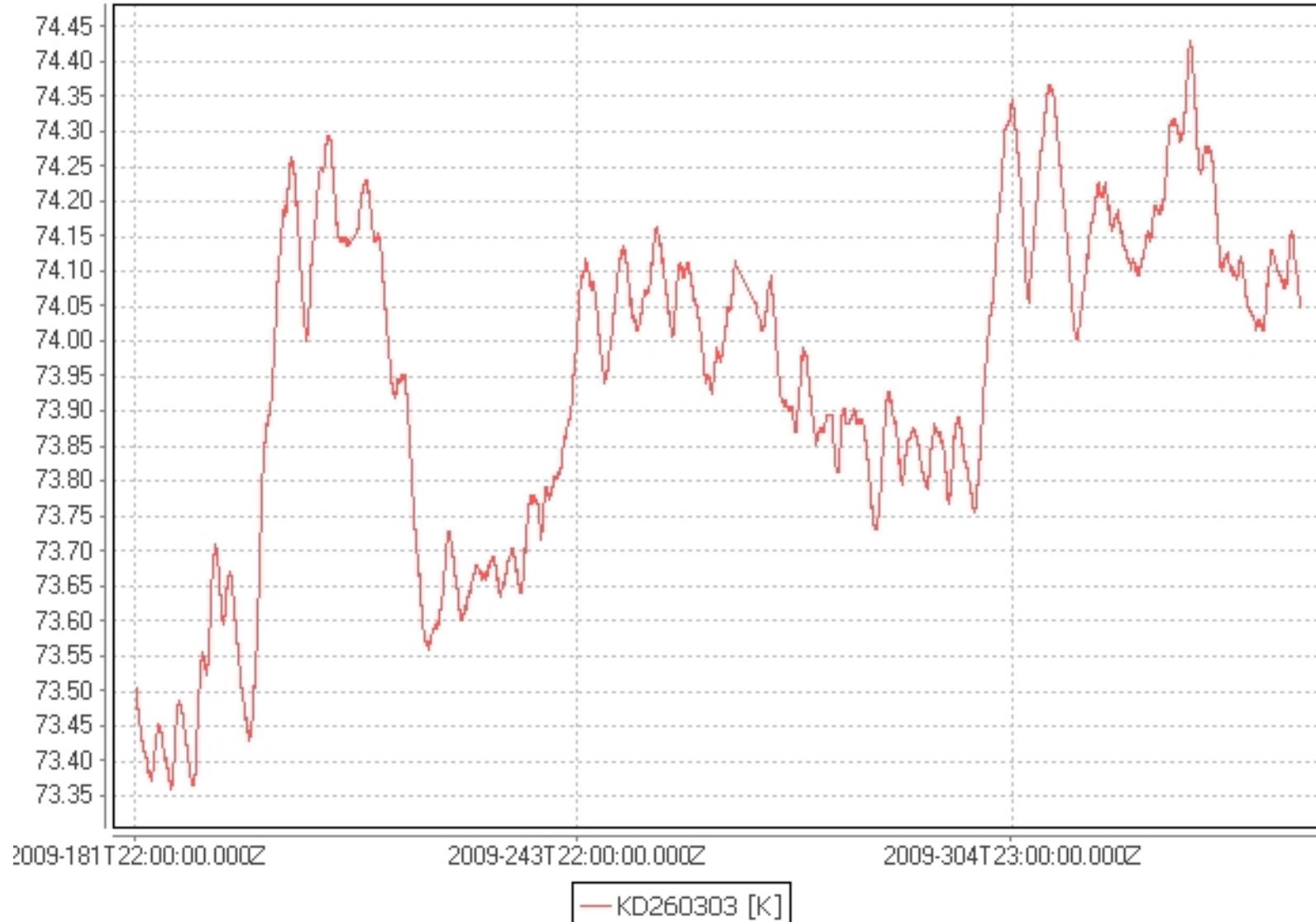


HERSCHEL SPACE OBSERVATORY

1 July-12 December – CVV



HERSCHEL SPACE OBSERVATORY





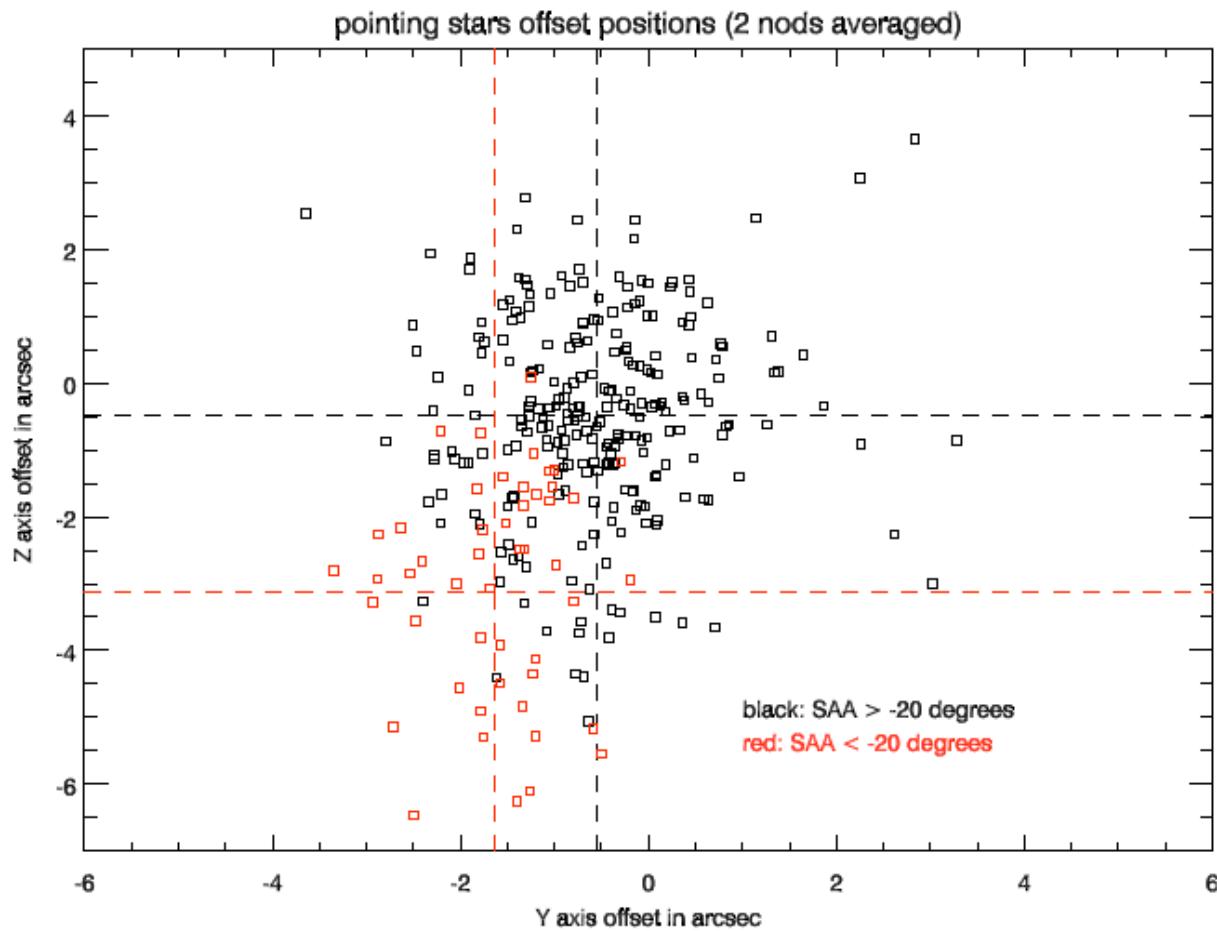
'Seasonal' temperature evolution

- Pre-launch modelling 'cold' and 'hot' cases
 - Takes into account a number of factors including
 - Solar 'constant'
 - Spacecraft attitude
 - Uncertainties in various parameters
- Telescope M1 Δ ('hot'-‘cold’) ~8 K
 - Absolute temp ~5 K higher than predicted – Δ ~accurate
 - Attitude effects ~2 K
 - ⇒ Seasonal effect ~6 K – appears close to observed
- CVV Δ ('hot'-‘cold’) ~2 K
 - Absolute temp ~8 K higher than predicted – Δ ~accurate
 - Attitude effects ~1 K
 - ⇒ Seasonal effect ~1 K - appears close to observed



Herschel pointing performance - 1

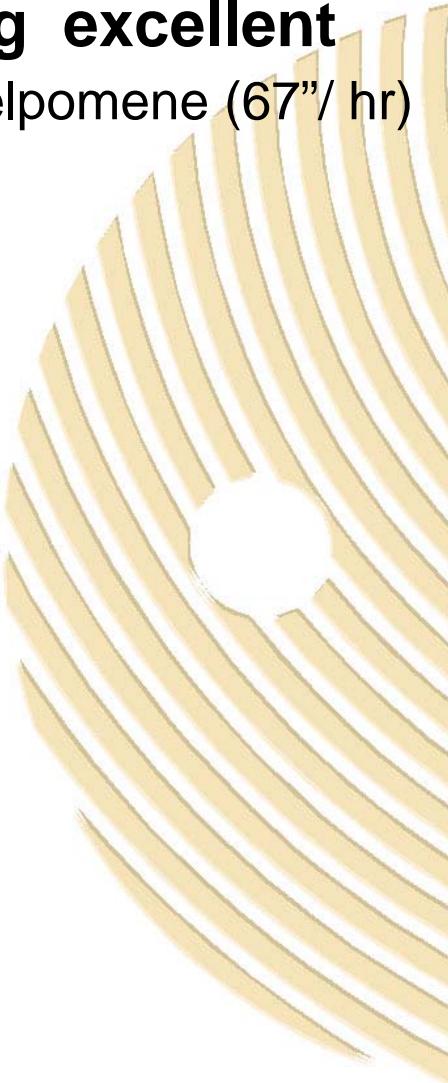
- **Fine pointing**
 - Generally as predicted ~2", measured ~1.8"
 - SAA range 60-110, thermal effects in 110-120 range

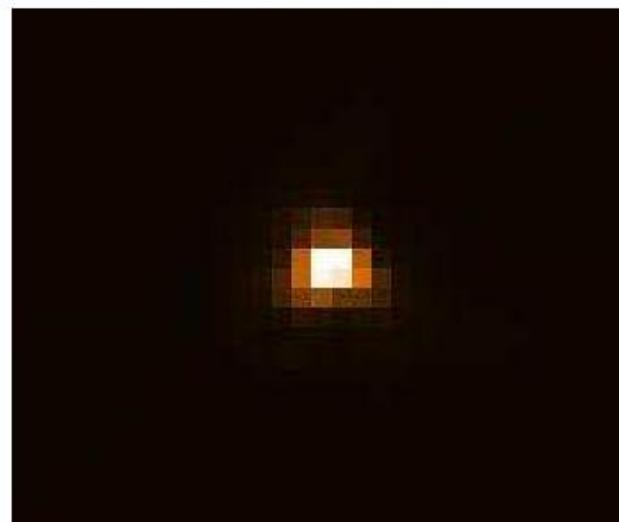
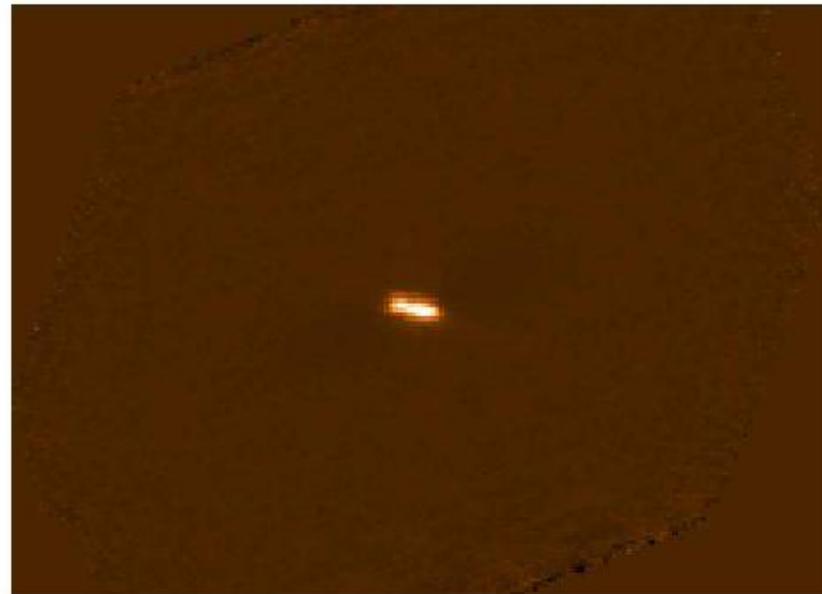


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Herschel pointing performance - 2

- Tracking excellent
 - 18 Melpomene (67"/ hr)
- 



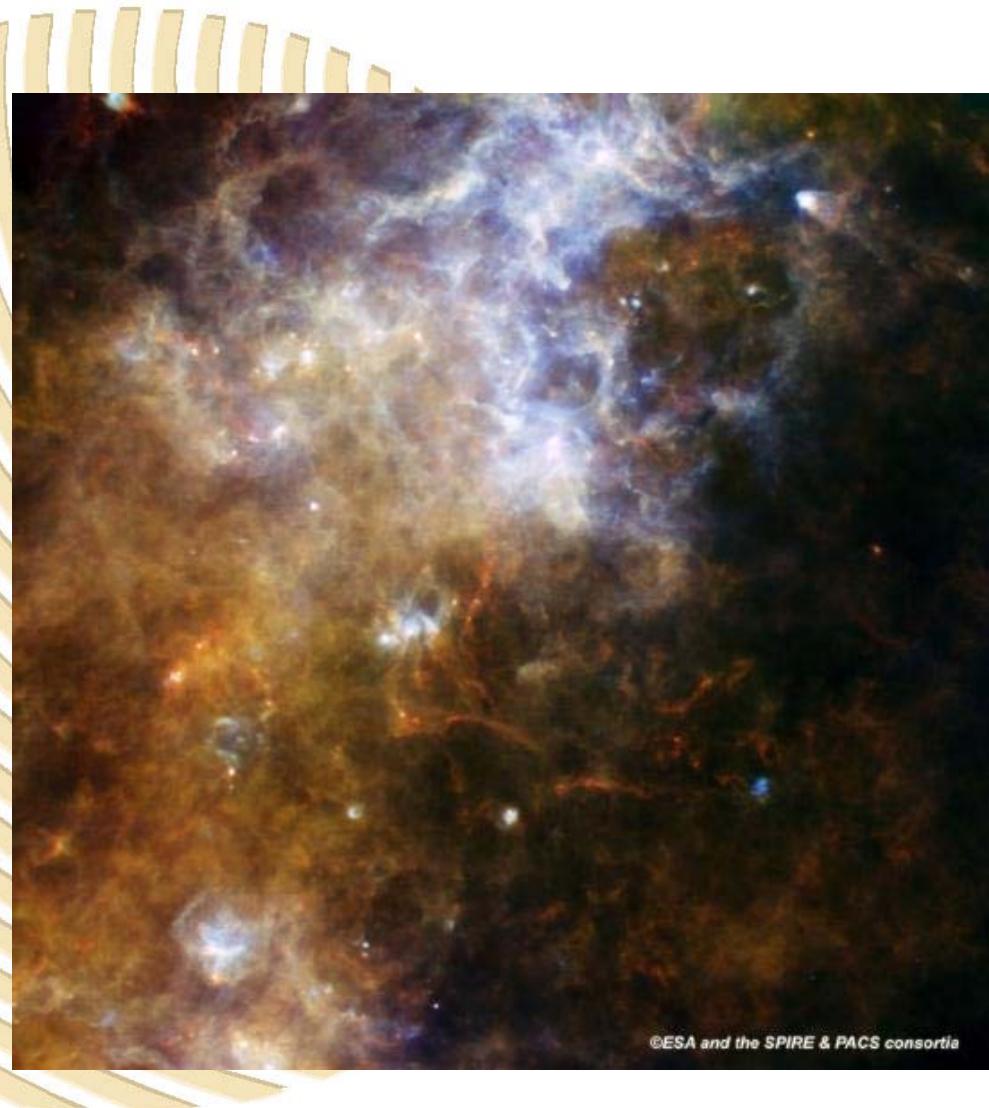
HERSCHEL SPACE OBSERVATORY



Herschel pointing performance - 3

- **Scanning**

- Works well for both PACS and SPIRE
- 'Speedbumps' are a concern
- Turnaround overheads reduced for PACS
- Improvements also for SPIRE currently being addressed



HERSCHEL SPACE OBSERVATORY

Herschel overall status summary - 1



Herschel is presently in ‘mixed phases’

- 14 May: Herschel (and Planck) launched
- 8-9 June: Herschel coolers were activated
- 14 July: **Commissioning Phase (CoP)** ended
- 15 July: **Performance Verification Phase (PVP)** activities started
- 21 July: Successful In-Orbit Commissioning Review (IOCR)
- 2 August: Malfunction of HIFI, it has not been operated since
- 1-3 September: PACS/SPIRE parallel mode executed first time
- 12 September: First **Science Demonstration Phase (SDP)** observations performed (SPIRE scan-map)
- 28 September: Delivery of first (SPIRE) SDP data products to users
- 18 October: First **Routine Science Phase (RSP)** observations conducted (PACS scan-map)
- 14-18 December: **SDP Data Processing and Initial Results workshops**

HERSCHEL SPACE OBSERVATORY

Herschel overall status summary - 2



Phase transitions

- **Commissioning Phase (CoP) to Performance Verification Phase (PVP)**
 - ‘In one go’
 - In-Orbit Commissioning Review (IOCR) and transfer of responsibility from Project Manager to Mission Manager
 - **Performance Verification Phase (PVP) to Science Demonstration Phase (SDP)**
 - AOT (or sub-AOT) one by one underway
 - AOT release *cons
 - Most PACS, SPIRE, and parallel mode released
 - **Science Demonstration Phase (SDP) to Routine Science Phase (RSP)**
 - KP (or part of KP) one by one underway
 - KP (or sub-KP) release telecons underway
 - 22 telecons with 17 different KP Ps for 18 KPs held

HERSCHEL SPACE OBSERVATORY



Herschel overall status summary - 3

- **Herschel observations right now**
 - SDP completion almost 60%
 - Of what's left
 - ~½ is HIFI
 - ~½ is non-released PACS & SPIRE AOTs – mainly spectroscopy
- **Currently we are mainly observing RSP!!**
 - Scheduling underway over Christmas and the New Year – to be completed this week
- **HIFI activities to re-commence in January 2010**
 - HIFI to be allocated ~50% of Herschel time in early 2010
 - HIFI Priority Science Programme (PSP) to be executed in February-April 2010



Future AOs - 1

- **Mission lifetime 3.5-4 years**
 - Routine science phase duration 3-3.5 years
 - About 6600 hours science time per year
- **Key Programmes**
 - Allocated ~11000 hours or ~1.7 years
- **Time available to be allocated**
 - Total RSP – KP allocated = ~1.3-1.8 years
 - Reasonable to have 2 AOs (3 has been suggested, but overkill)
- **Timing for future AOs**
 - Existing KPs cover – ‘in one block’ (unrealistic) – to mid-2011
 - Want many available AORs to ensure efficient scheduling
 - HIFI experience shows you need to robust against instrument temporarily out of action

⇒ want AO-1 AORs by late 2010, issue AO early 2010



Future AOs - 2

- **GT AO process Feb-April 2010**
- **OT AO issue: 20 May 2010**
 - Offer 1 year of observations (~6600 hours)
 - Just after Herschel First Results Symposium
 - The hope is the AKARI FIS and IRC catalogues by then will be publicly available - and incorporated in HSpot (TBC)
- **OT proposal submission deadline: 22 July 2010**
 - 2 months to submit
- **Technical checking: until end September 2010**
- **HOTAC process: early October 2010**
- **Final AOR updating by successful proposers Oct 2010**
- **AO-1 AORs available for scheduling from Nov 2010**
- **AO-2 approximately one year later (dates TBD)**



Future AO's - 3

- **AO documentation**

- Herschel Key Programme Announcement of Opportunity
- Executive Summary
- Policies and Procedures
- Herschel Observers' Manual
- HIFI Observers' Manual
- PACS Observers' Manual
- SPIRE Observers' Manual
- SPIRE/PACS Parallel Mode Observers' Manual

- **AO tools**

- HerschelFORM PDFLaTeX package
- Reserved Observations SearchTool
- HSpot Observing Planning Tool



The logo for the Herschel Space Observatory, featuring the word "HERSCHEL" in large blue capital letters above the words "SPACE OBSERVATORY" in smaller blue capital letters. The "E" in "HERSCHEL" and the "O" in "SPACE" are stylized to look like galaxies or nebulae.

We have come a long way since!

