

Herschel – mission status and future

Göran Pilbratt, Herschel Project Scientist

- on behalf of the many who made and make Herschel possible

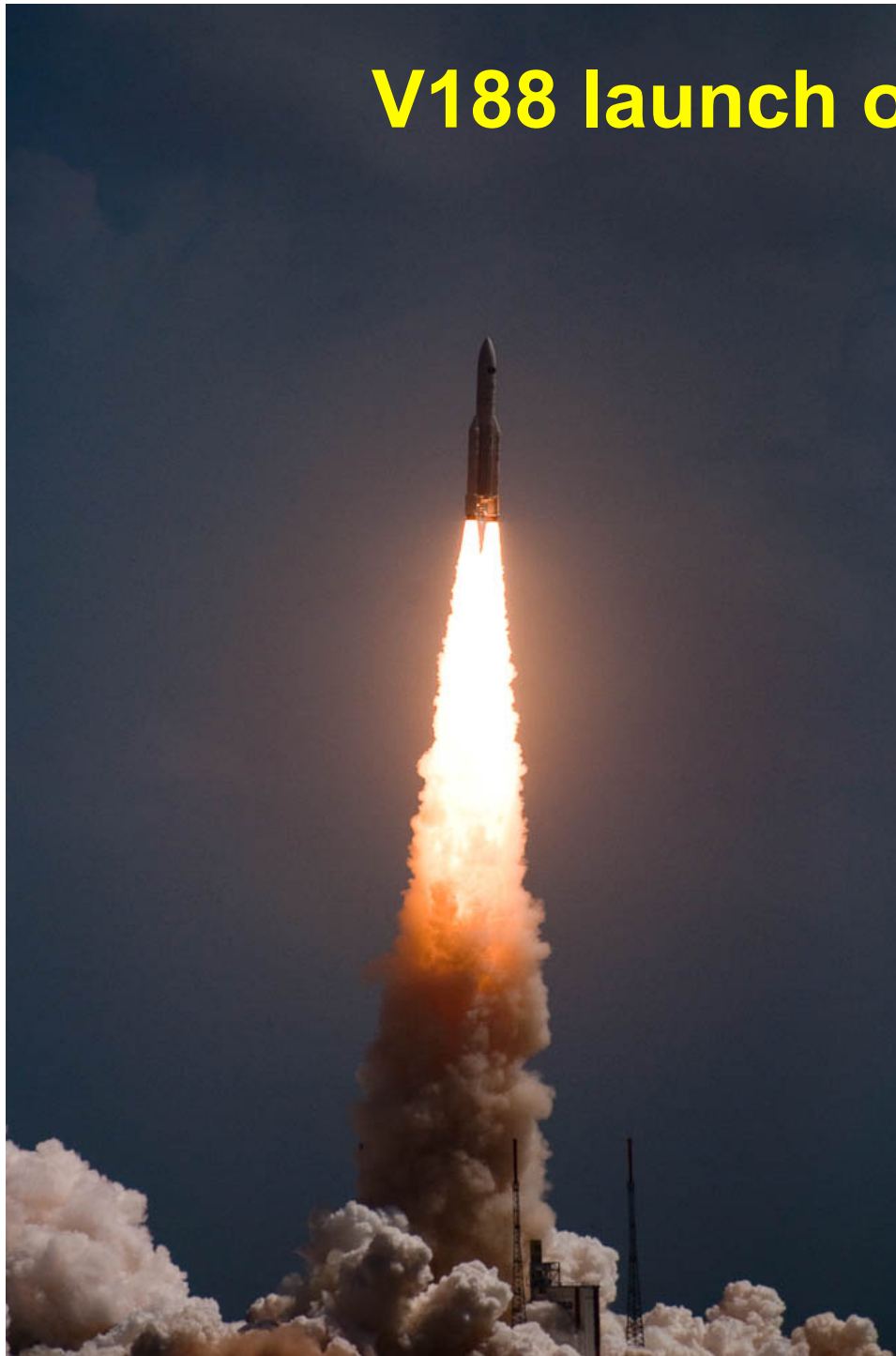
Fairing Integration on 10 May 2009



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	VISEE		
		MIN		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. +151800
Inclinaison (deg)	5.99	5.94	6.00	6.06

Le Chef de Mission

Ph. Rouaud

Le Responsable Charge Utile Ariane

L. CHIECCCHIO

EVRY-FAX 01 60 87 62 17

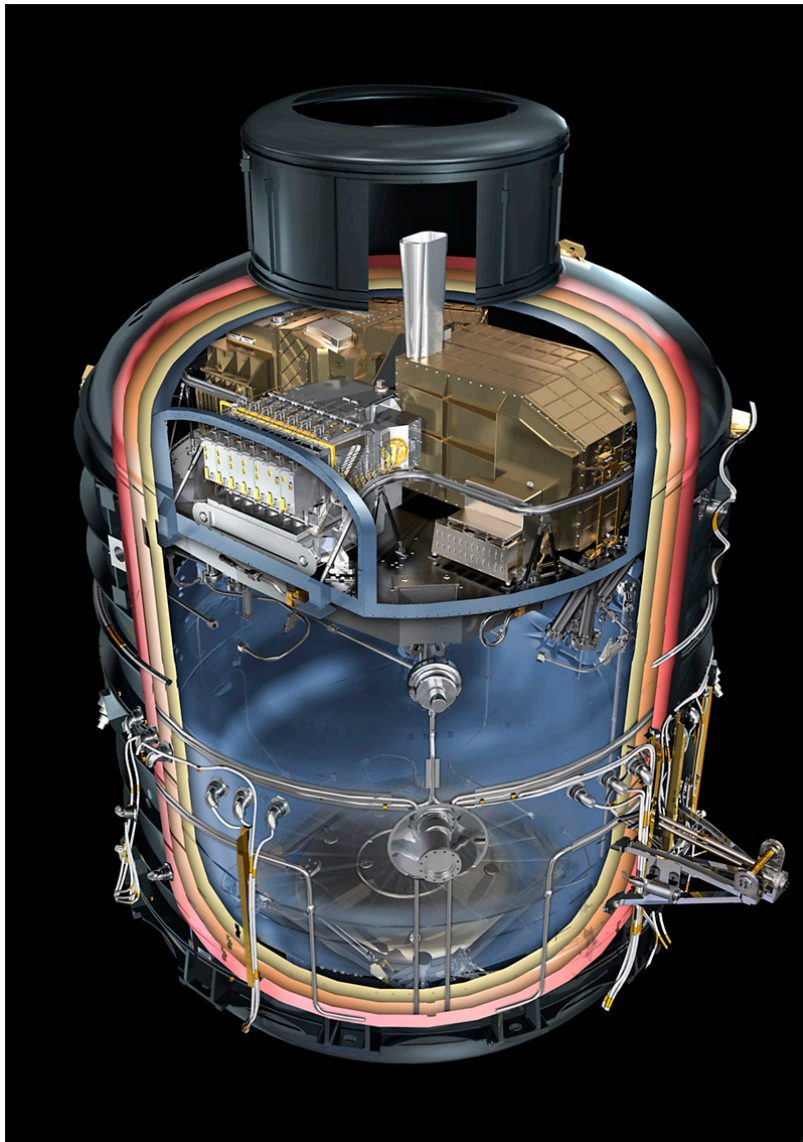
Early mission phases – the Plan



- **14 May: Herschel launched (together with Planck)**
- **Commissioning Phase (COP) ~2 months**
 - Functional testing
 - Cryocover opening after ~1 month
- **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**

HERSCHEL SPACE OBSERVATORY

Spacecraft

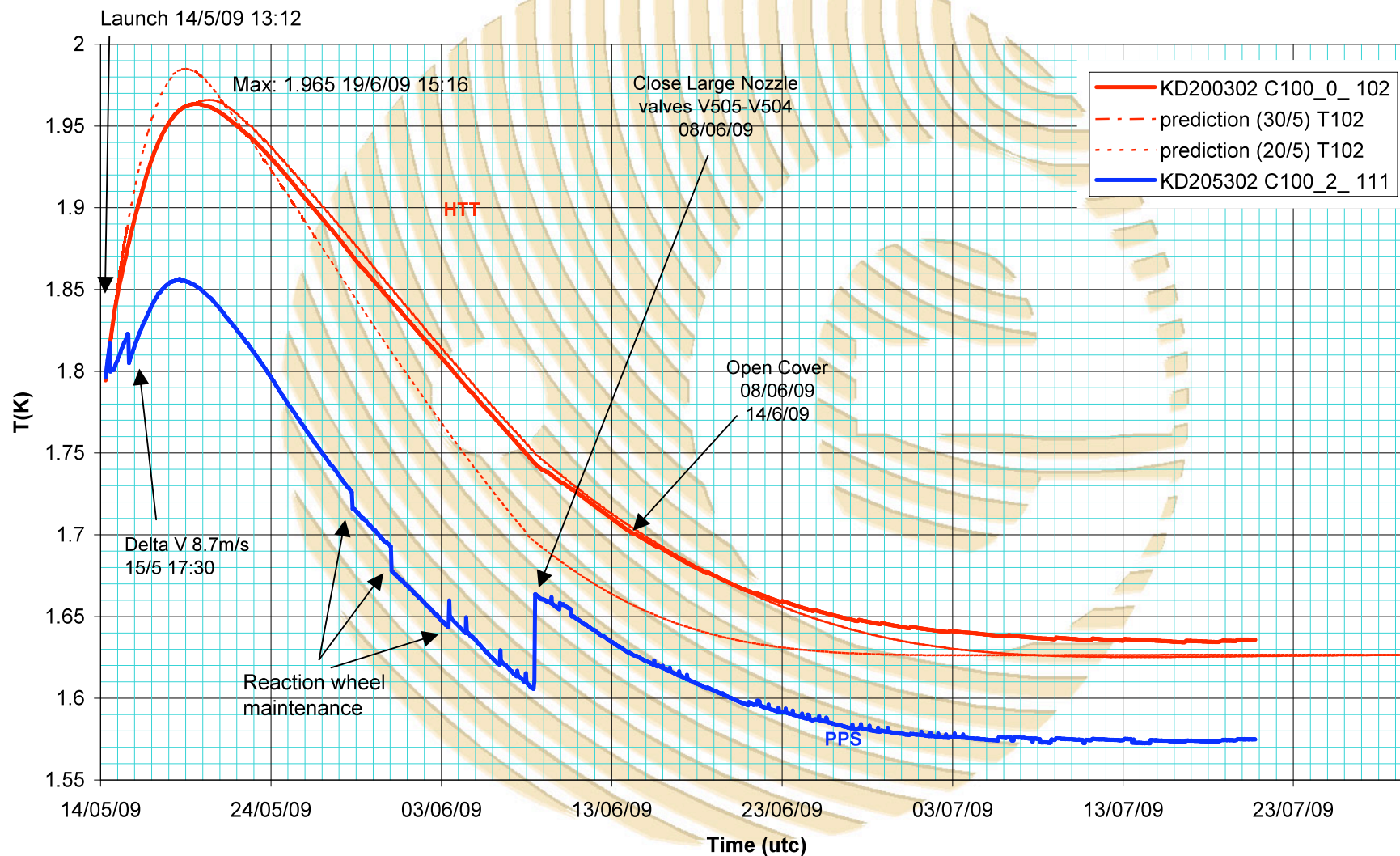


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OBSERVATORY

Cooldown – HTT



Herschel Post Launch transient - HTT



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

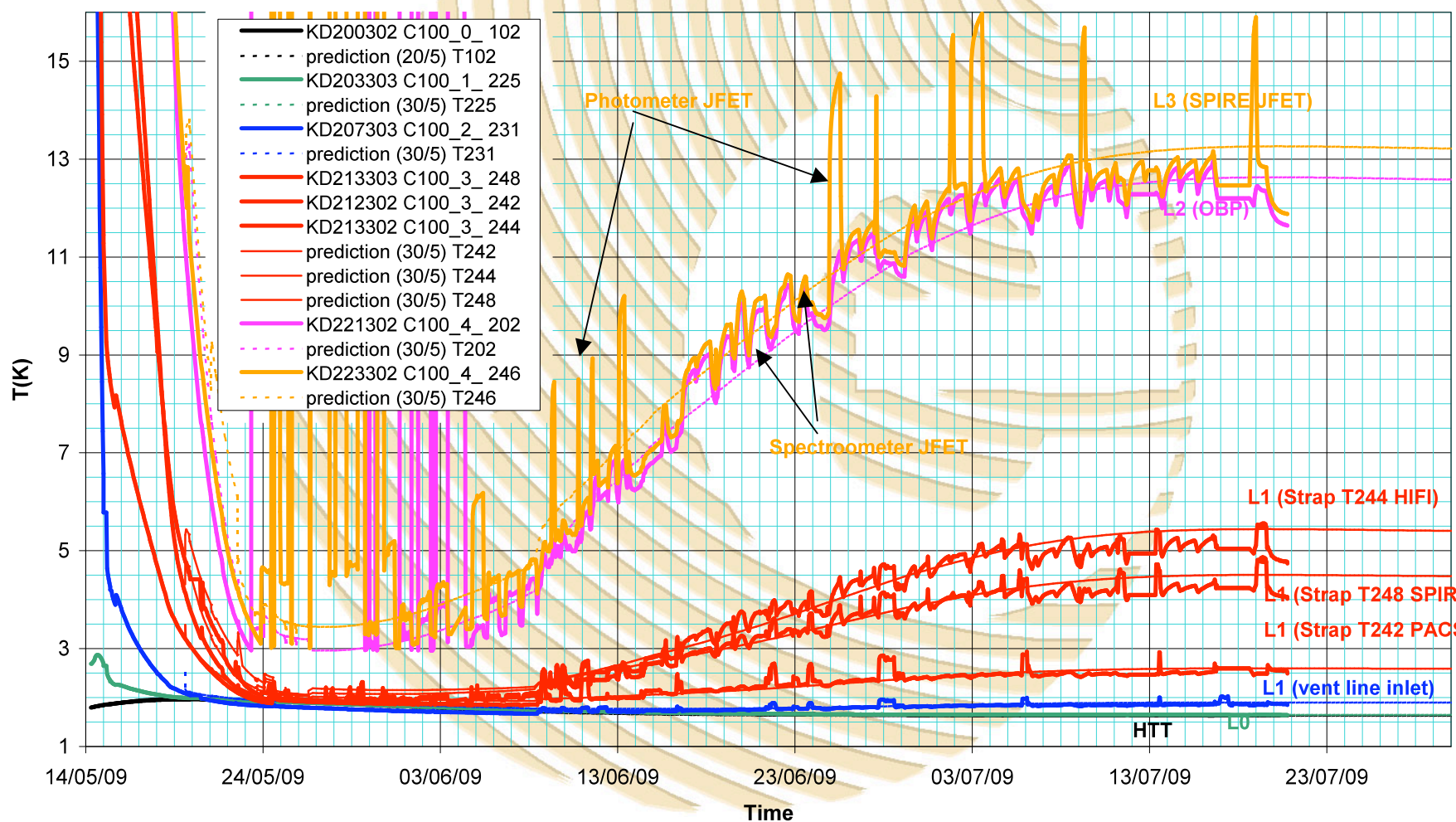


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Cooldown – levels 0, 1, 2, & 3



Herschel Post Launch transient - Level 0, 1, 2, 3



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

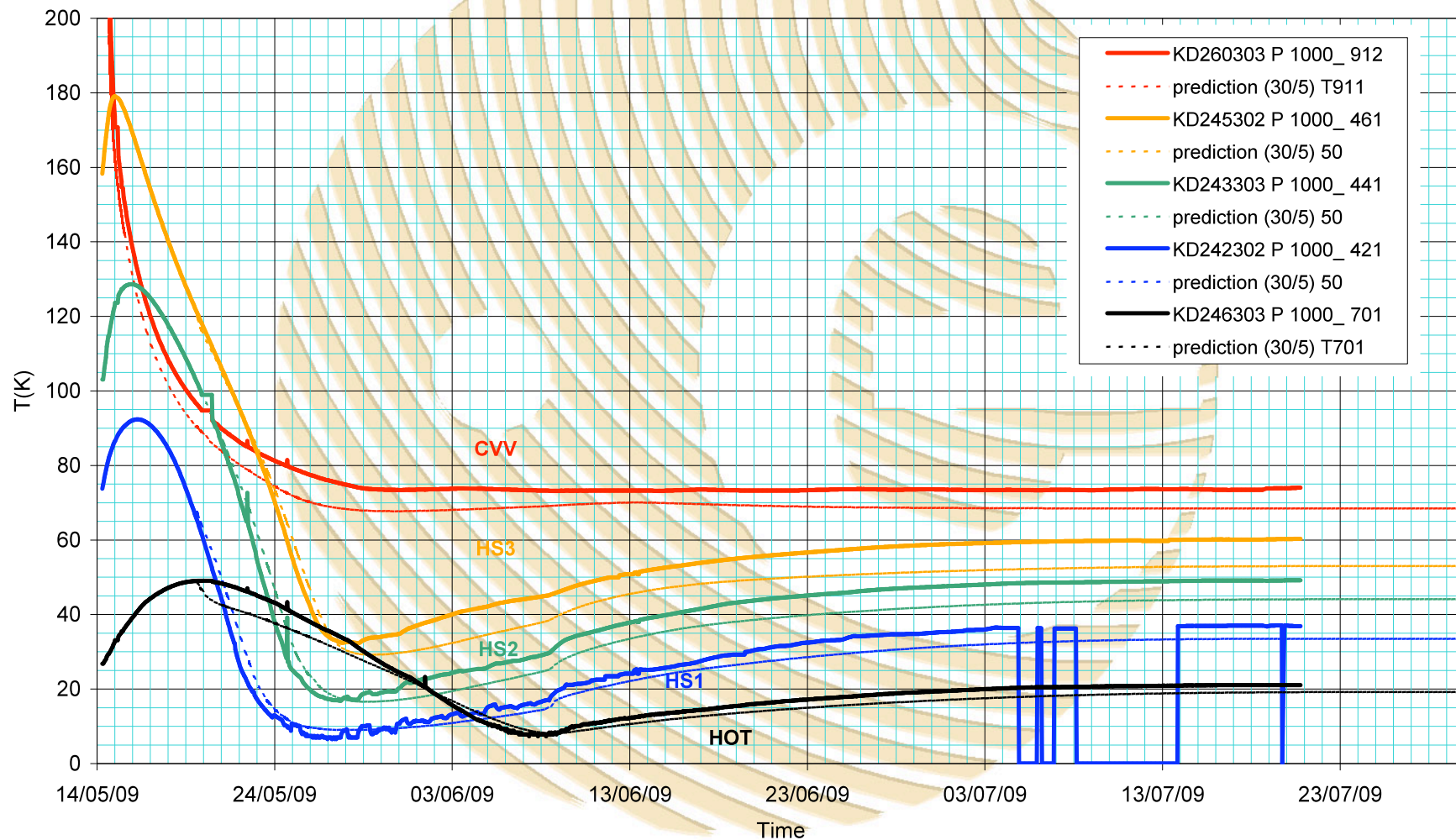


SDP DP workshop 14/12/2009
Göran L. Pilbratt VG # 9
<http://herschel.esac.esa.int/>

Cooldown – CVV & shields



Herschel Post Launch transient - CVV - Shields



HERSCHEL SPACE OBSERVATORY

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

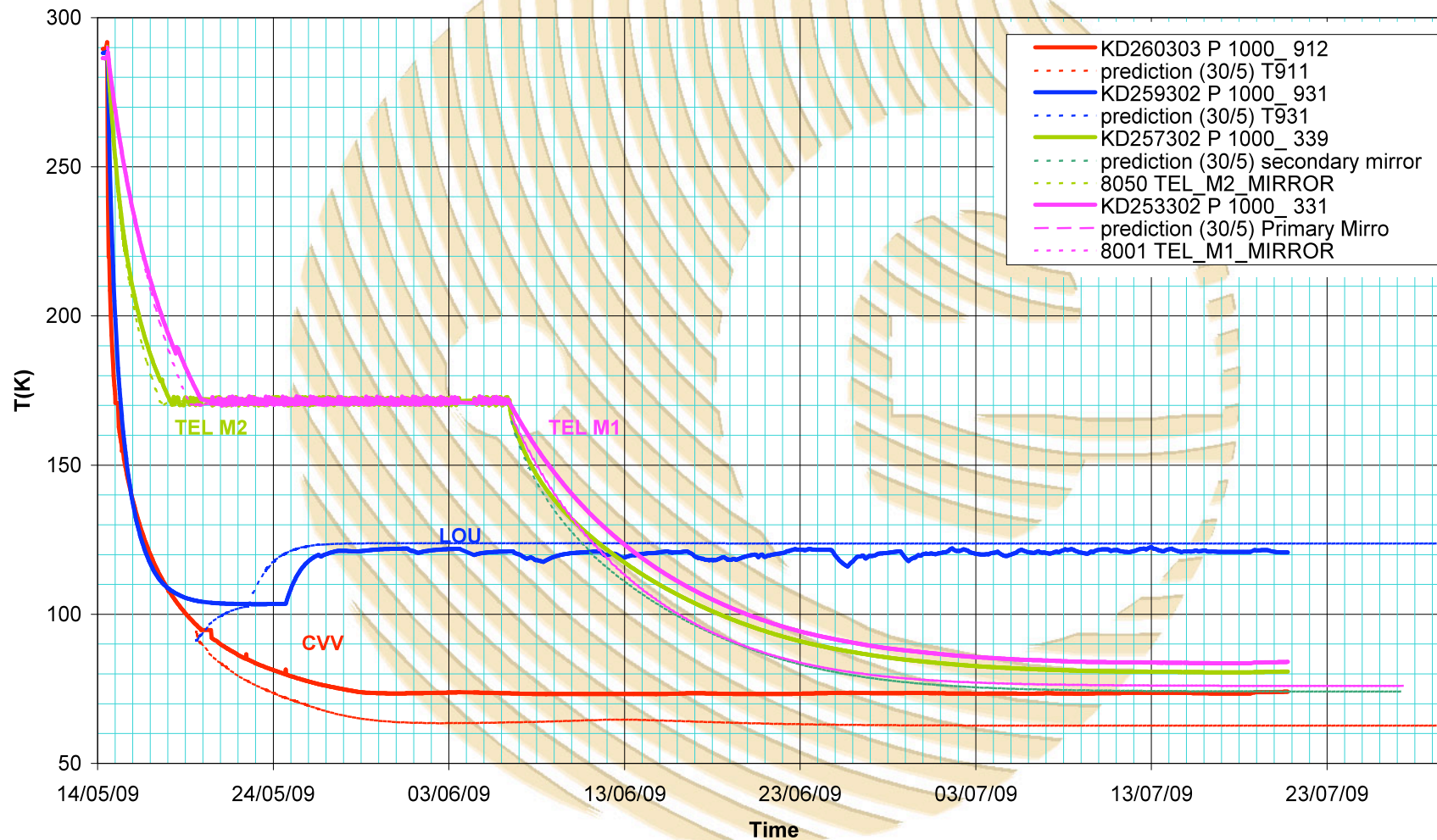


SDP DP workshop 14/12/2009
Göran L. Pilbratt VG # 10
<http://herschel.esac.esa.int/>

Cooldown – telescope, LOU, & CVV



Herschel Post Launch transient - CVV - LOU-Telescope



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

Herschel lifetime - 1



- **Herschel lifetime ingredients and modelling**
 - Amount of usable He at launch (filling level, launch attempt)
 - Transient phase He use particularly uncertain
 - Stationary conditions
 - CVV average stationary outside temperatures
 - Stationary average dissipation⇒ Model average He mass-flow
 - Calculate lifetime⇒ Pre-launch estimates of mission lifetime around 4 years
- **During stationary conditions**
 - Remaining lifetime = current He mass / average mass-flow
 - Mission lifetime = remaining lifetime + current time into mission
 - Remaining amount of He can be measured (DLCM)
 - Repeated DLCMs also give mass-flow⇒ Measure (rather than model) lifetime

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Herschel lifetime - 2



- **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 $\Rightarrow 1228 \pm 50$ days (1168-1288 days)
 - Compute total mission lifetime $\Rightarrow 3.65$ -3.98 years
 - Estimated amount of He was 275 kg (consistent)

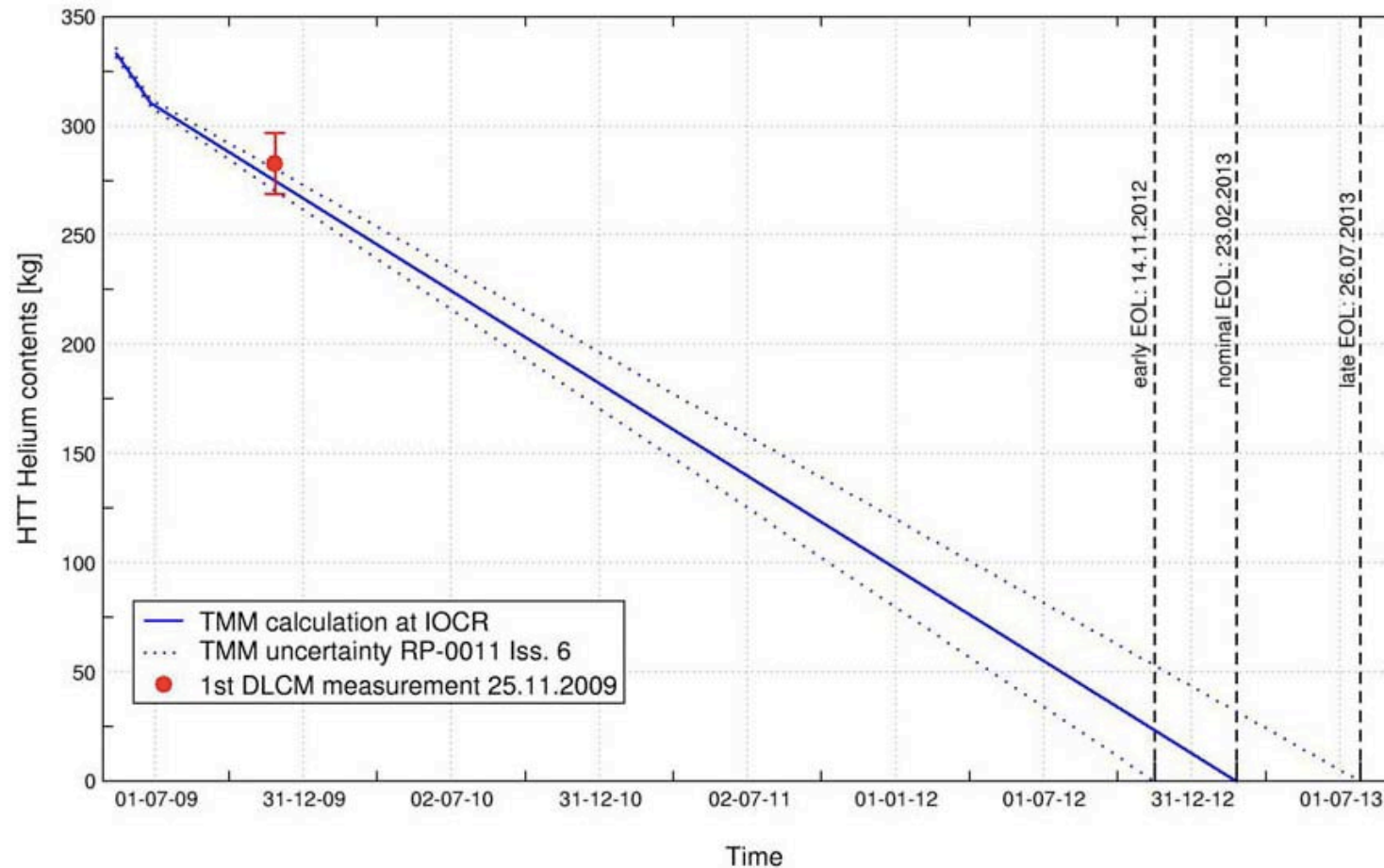
⇒ Mission lifetime given as 3.8 years (end ~March 2013)

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Herschel lifetime - 3



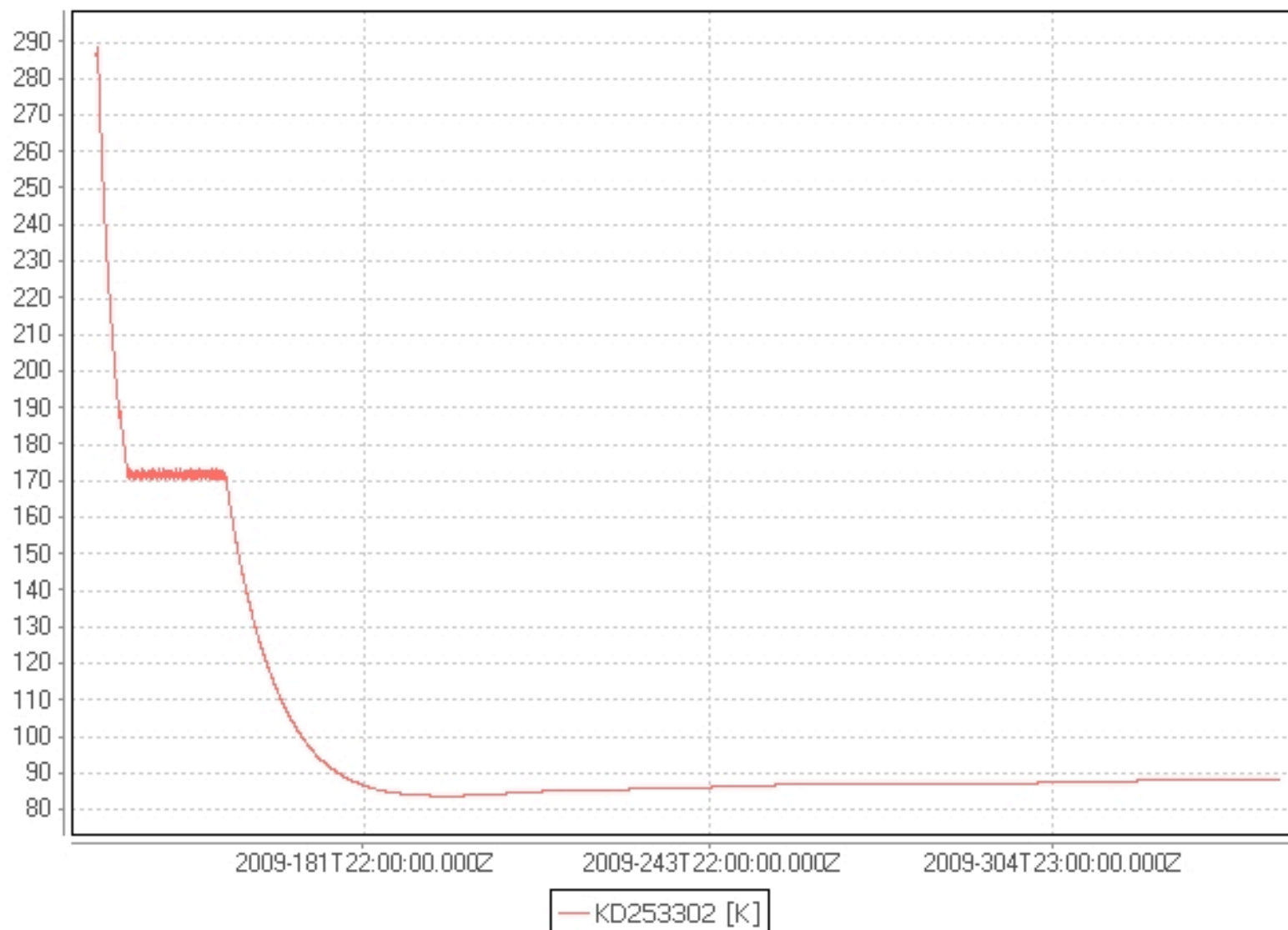
- There are (still) large uncertainties ...



HERSCHEL SPACE OBSERVATORY

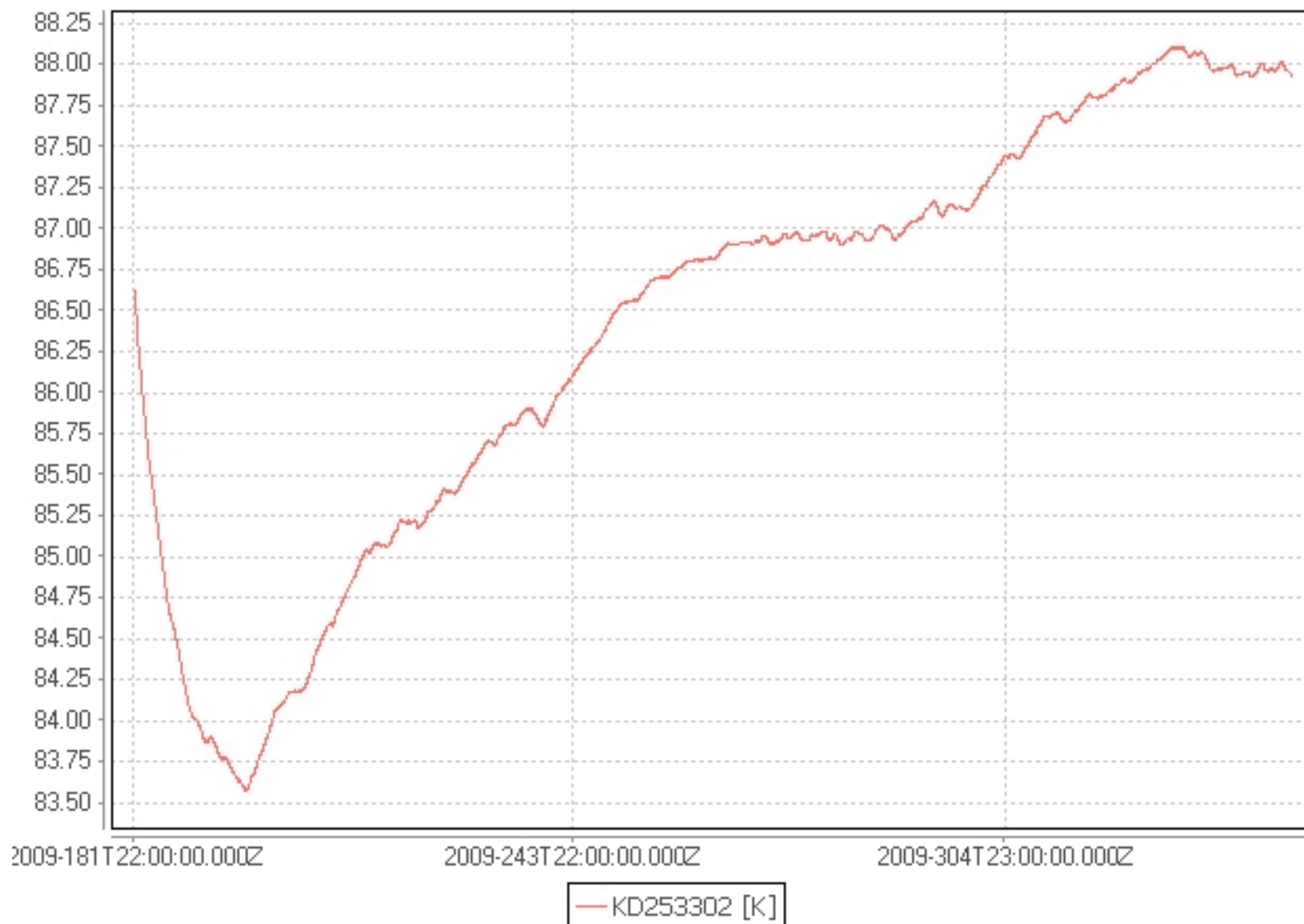
- ... but confidence of 3.5 year mission strengthened

Cooldown and to date – telescope



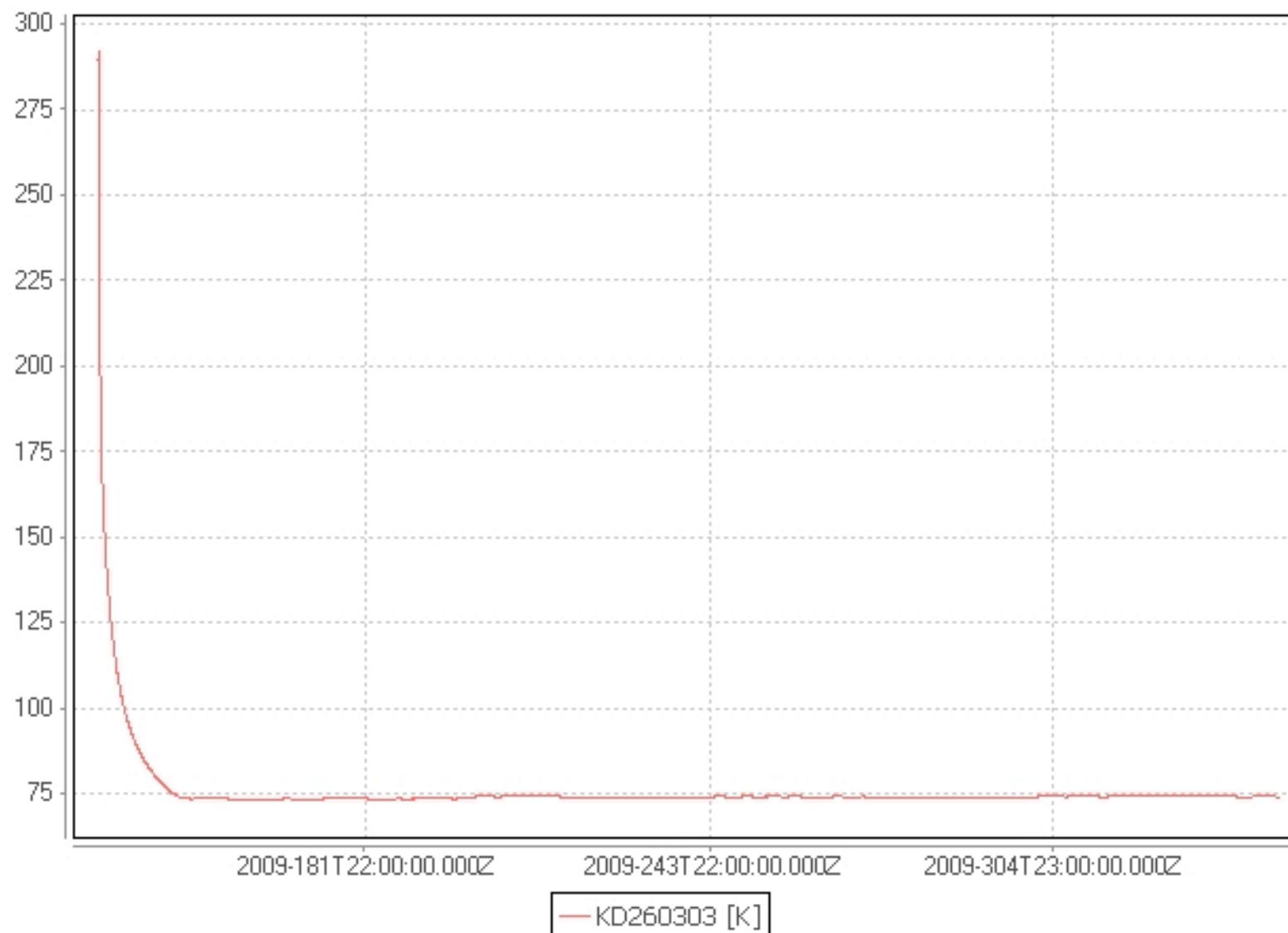
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1 July-12 December – telescope



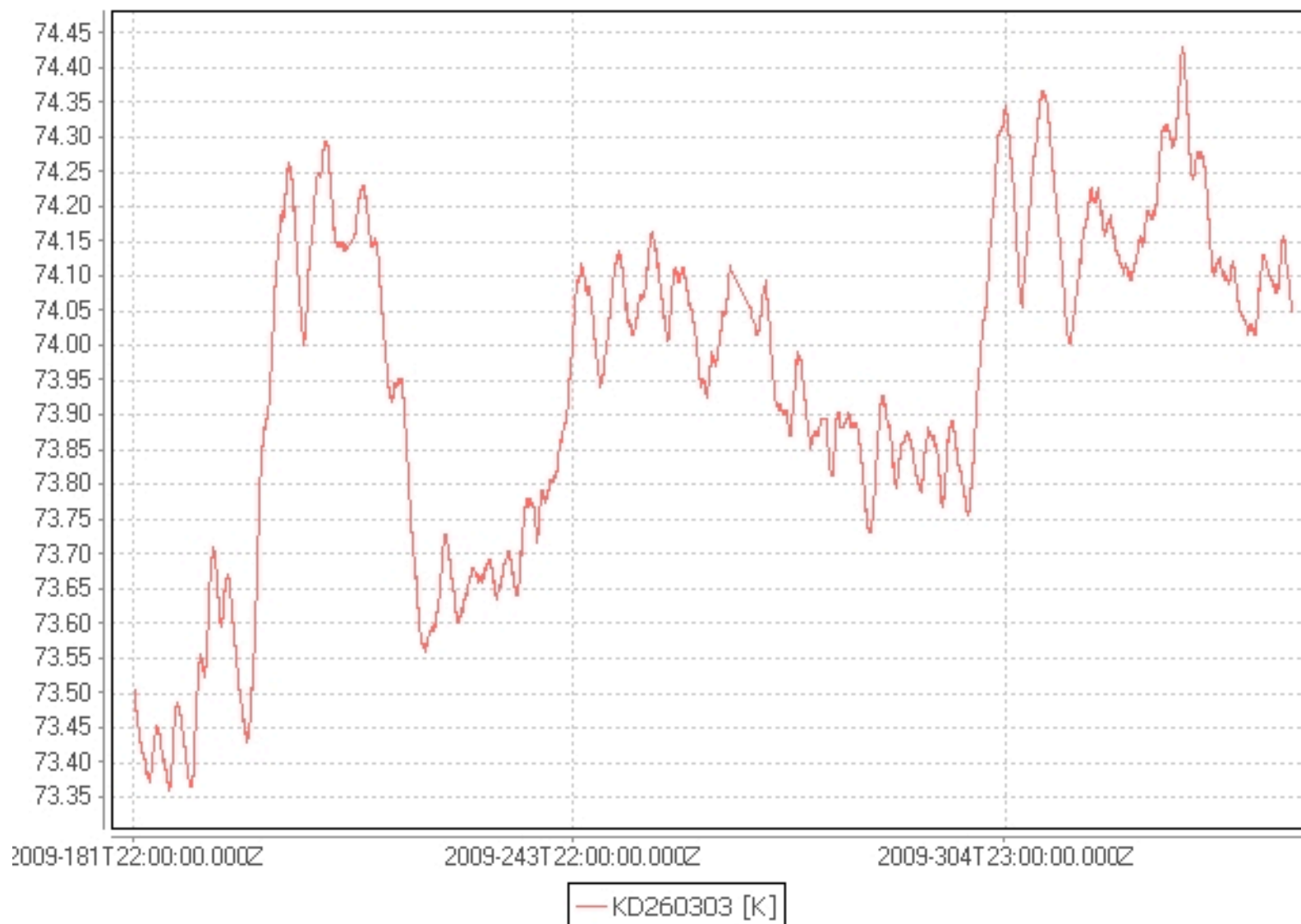
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Cooldown and to date – CVV



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1 July-12 December – CVV



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'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 \sim accurate
 - Attitude effects ~ 2 K
 - \Rightarrow Seasonal effect ~ 6 K – appears close to observed
- **CVV Δ ('hot'-'cold') ~ 2 K**
 - Absolute temp ~ 8 K higher than predicted – Δ \sim accurate
 - Attitude effects ~ 1 K
 - \Rightarrow Seasonal effect ~ 1 K - appears close to observed

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Herschel overall status - 1

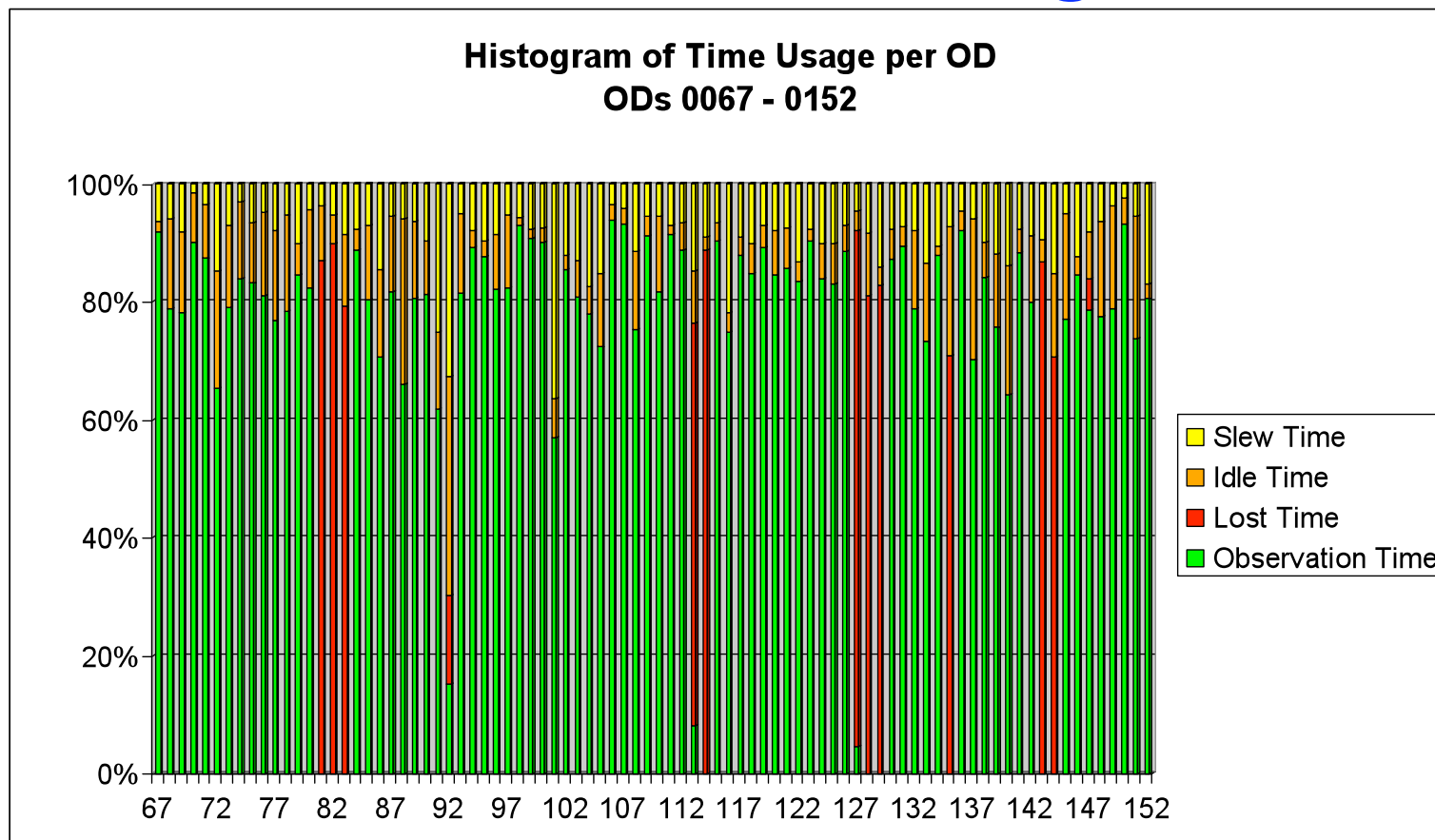


Herschel is presently in 'mixed phases'

- 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**

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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

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Herschel overall status - 2



Phase transitions

- **Commissioning Phase (CoP) to Performance Verification Phase (PVP)**
 - 'In bulk'
 - 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 for 17 KPs held

HERSCHEL SPACE OBSERVATORY

Herschel overall status - 3



- **Herschel observations right now**
 - SDP completion almost 60%
 - Of what's left
 - $\sim 1/2$ is HIFI
 - $\sim 1/2$ 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 $\sim 50\%$ of Herschel time in early 2010
 - HIFI Priority Science Programme (PSP) to be executed in February-April 2010

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Future AOs



- **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
 - **Timing for future AOs**
 - Existing KPs cover – ‘in one block’ – to summer 2011
 - Want many available AORs to ensure efficient scheduling
 - HIFI experience shows you need to be robust against instrument temporarily out of action
- ⇒ **want AO-1 AORs by late 2010, issue AO early 2010**

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Future Timeline



Exact dates to be communicated

- Mid-December 2009: SDP DP and IR workshops
- Early January 2010: Special (but short) AAS Herschel initial results session (2x90 min on 5 January)
- End February 2010: 'Grand HSA opening' (with public HIPE v2.0 release)
- End February 2010: GT AO issue
- End March 2010: A&A papers submission deadline
- End March 2010: GT AO proposal deadline
- End April 2010: OT AO issue
- Begin May 2010: 'First Results' workshop (ESLAB 2010)
- Mid-May 2010: A&A papers acceptance deadline (then preprints on astro/ ph publicly available) & user reduced data delivery
- End June 2010: OT AO submission deadline
- July 2010: A&A issue publication
- July 2010: HSC technical evaluation of OT proposals
- September 2010: HOTAC process OT proposals

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We have come a long way!

