

# MHFT Thermal model

L. Grandsire – A. Ilioni – M. Piat –  
J.P. Thermeau

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# Status of activities

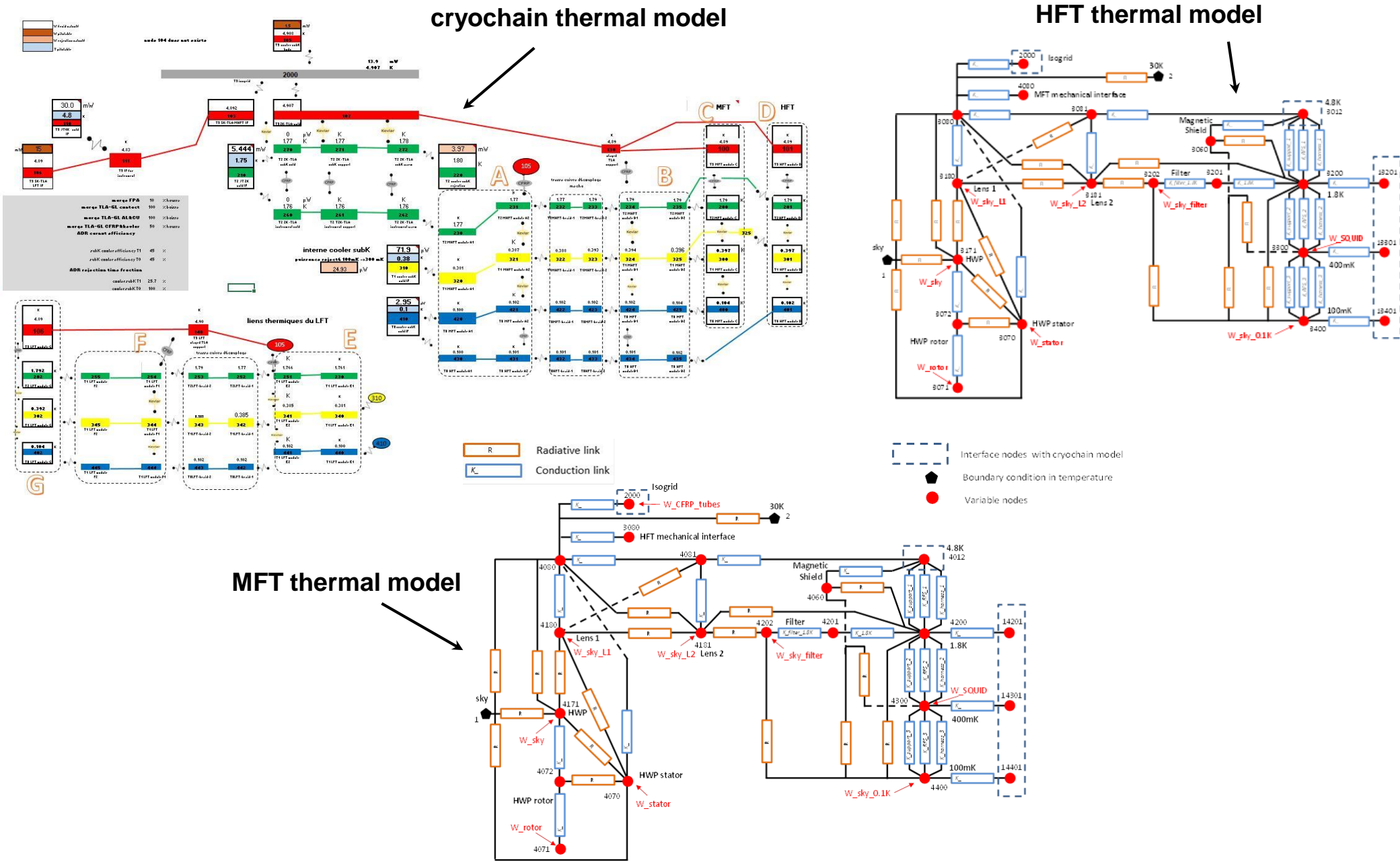
Activities	Done	On going	To be done
Cryochain thermal model	X		
MHFT thermal model	X		
Steady state study	X		
Steady state sensitivity to the main parameter model			X
Transient studies with realistic thermal fluctuation	X		
100 mK PI thermal control modeling			X

**Key Point CNES JAXA : hier**

**Revue de fin de phase A : en fin d'année**



# Thermal model





# Steady state study

## MHFT thermal balance

stages	MFT raw dissipation	HFT raw dissipation	Total dissipations (μW)
T3 - 4.8K	6530	2480	13920
T2 - 1.75K	101	57,9	158.9
T1- 0.38K	13,9	9,12	23.02
T0 - 0.1K	0,428	0,228	0.656

## MFT matrix of head loads

	Nbeuds	sky	30K	5K	2K	0.4K	0.1K	Isogrid	HFT	HWPstator	HWProtor	HWP	5K	L1	5K	L2	MS	Filter	FPA 2K	FPA 0.4K	FPA 0.1K		Nbeuds				
		1	2	4012	14201	14301	14401	2000	3080	4070	4071	4072	4171	4080	4180	4081	4181	4060	4202	4201	4200	4300	4400				
sky	1									-4.67E-06			-1.83E-05	-2.64E-06	1.40E-07		7.00E-08	6.63E-08				6.33E-09	-2.53E-05	1	sky		
30K	2						4.00E-03							4.68E-04										4.47E-03	2	30K	
5K	4012															-1.25E-04		6.04E-07			1.10E-04			-1.43E-05	4012	5K	
2K	14201																				-1.01E-04			-1.01E-04	14201	2K	
0.4K	14301																						-1.39E-05	-1.39E-05	14301	0.4K	
0.1K	14401																						-4.28E-07	-4.28E-07	14401	0.1K	
Isogrid	2000		-4.00E-03											-2.46E-03										-6.46E-03	2000	Isogrid	
HFT	3080													-5.90E-05										-5.90E-05	3080	HFT	
HWPstator	4070	4.67E-06																							2.00E-03	4070	HWPstator
HWP rotor	4071																								2.00E-04	4071	HWP rotor
	4072																								-2.71E-13	4072	HWP rotor
HWP	4171	1.83E-05																							-5.02E-18	4171	HWP
5K	4080	2.64E-06	-4.66E-04					2.46E-03	5.90E-05	-2.14E-03															2.24E-14	4080	5K
L1	4180	-1.40E-07								3.40E-08															-7.53E-09	4180	L1
5K	4081																								-8.03E-15	4081	5K
L2	4181	-7.00E-08																							-7.53E-09	4181	L2
MS	4060																								1.63E-07	4060	MS
Filter	4202	-6.63E-08																							2.29E-07	4202	Filter
	4201																								-2.29E-07	4201	Filter
FPA2K	4200																								3.73E-07	4200	FPA2K
FPA0.4K	4300																								1.01E-05	4300	FPA0.4K
FPA0.1K	4400	-6.33E-09																							4.97E-09	4400	FPA0.1K
sum of loads		2.53E-05	-4.47E-03	1.43E-05	1.01E-04	1.39E-05	4.28E-07	6.46E-03	5.90E-05	-2.00E-03	-2.00E-04	2.71E-13	5.02E-18	-2.24E-14	7.53E-09	8.03E-15	-7.53E-09	7.13E-18	-5.90E-19	3.99E-15	-1.13E-14	-1.19E-16	2.32E-17				



# Thermal budget

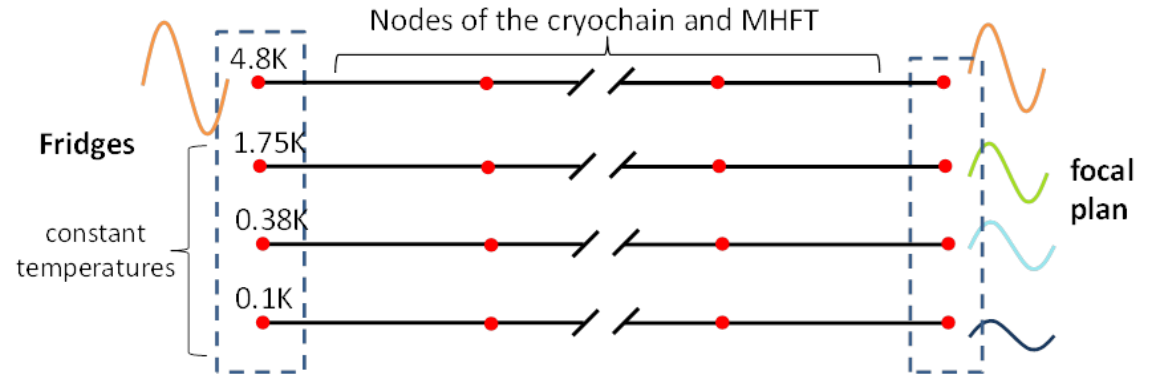
## MHFT thermal balance

Stages	MFT raw dissipation ( $\mu\text{W}$ )	HFT raw dissipation ( $\mu\text{W}$ )	PLM MHFT ( $\mu\text{W}$ )	Total dissipations ( $\mu\text{W}$ )	Budget / Dissipation	Total Power budget ( $\mu\text{W}$ )
T3	6530	2480	4910	13920	1	13910
T2	101	57,9		158.9	2.9	462
T1	13,9	9,12		23.02	1.3	29,8
T0	0,428	0,228		0.656	2.4	1,6

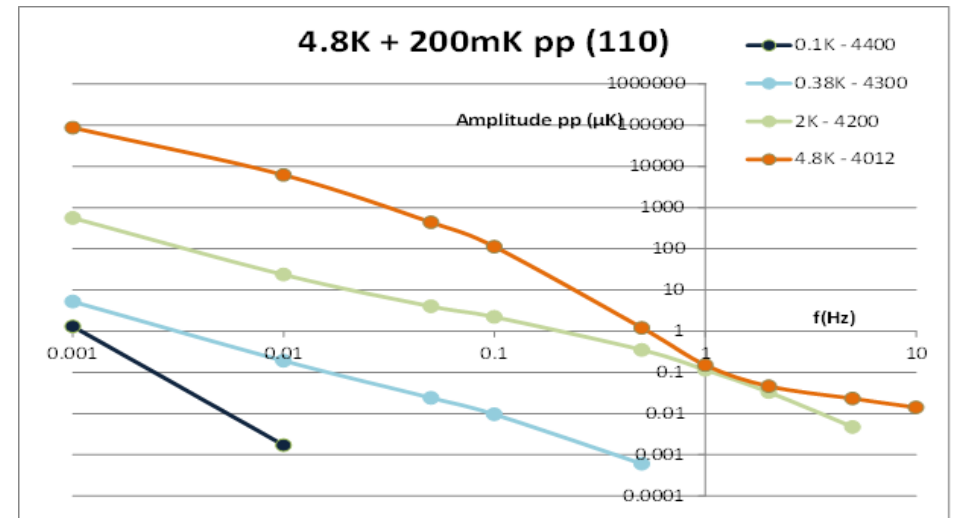
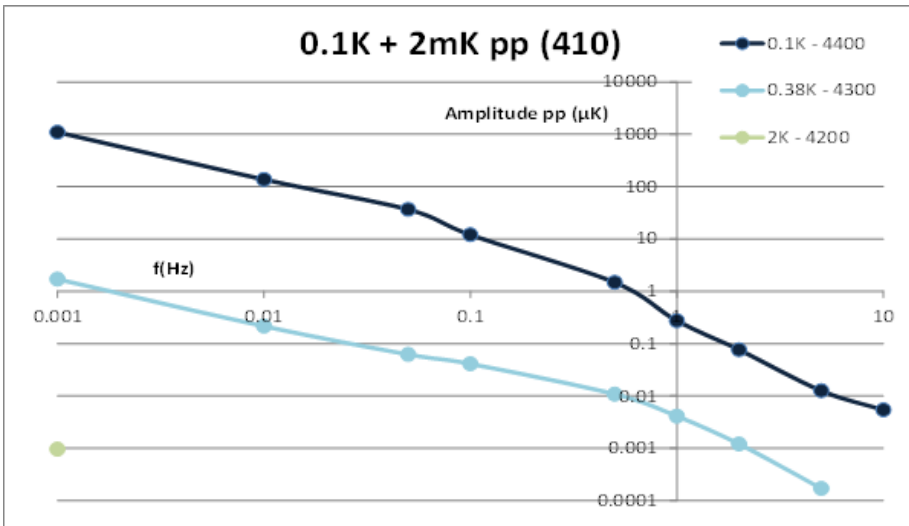


# Transient studies

- The study frequency range: from 1mHz to 10Hz.
- The temperature oscillation amplitude:
  - 200mK pp at 4.8K and 1.75K
  - 2mK pp at 0.38K and 0.1K



## MFT results





# Status of Doc for Phase-A2 Review

Expected documentation for Phase-A2 Review covered by this activity:

MHFT Technical budget	mass, thermal, electrical, data (science & HK)	Baptiste / Gilles / Thomas / Cydalise / Damien	
MHFT Thermal study report	MHFT nodal model 30K to 100mK (with simplified LFT model) Steady state sensitivity to the main parameter model Transient with "realistic" 30K, 5K and 1.8K thermal fluctuation; 100mK PI thermal contro modeling	Jean-Pierre / Thomas	

Delivered documentation for the KP:

## /Instrumental Design

PhaseA2-MHFT-Budget	Mass, Power, Thermal, Data budgets	KP version
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## /Architecture and Modeling

MHFT thermal study report	Thermal study report	KP version
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