MEGHA - TROPIQUES

Scarab, Calibration Results

14/02/2014-Paris

SCARAB

- Radiometric noise
- Gain
- A’ factor

SCARAB noise

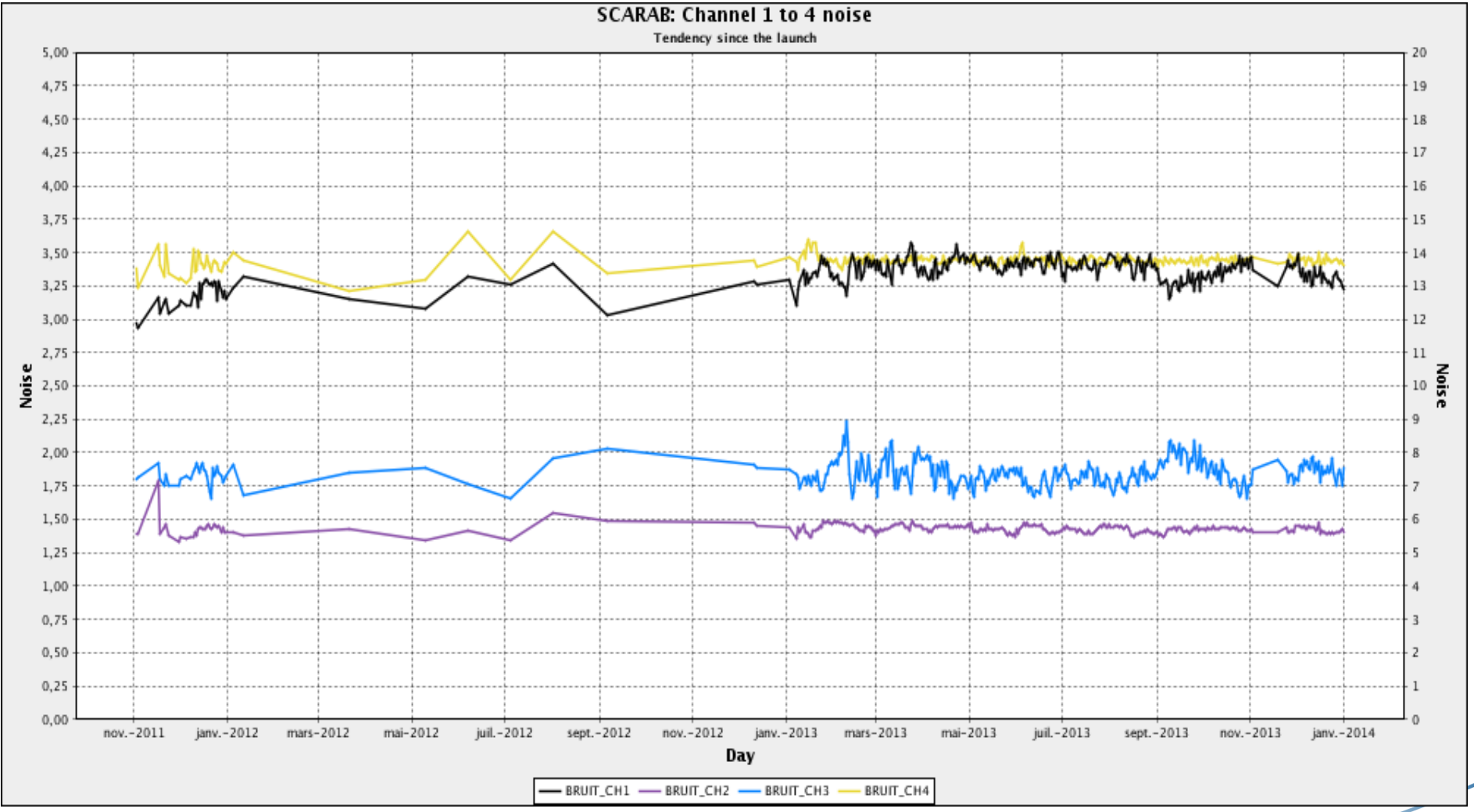
Radiometric noise

Requirements :

Channels	*Noise*	*Noise (LSB)*
Channel 1 – Visible channel	*< 1 W.m⁻².sr⁻¹*	*30 LSB*
Channel 2 – Solar channel	*< 0.5 W.m⁻².sr⁻¹*	*15 LSB*
Channel 3 – Total channel	*< 0.5 W.m⁻².sr⁻¹*	*15 LSB*
Channel 4 – IR Window	*< 0.5 W.m⁻².sr⁻¹*	*100 LSB*

SCARAB noise

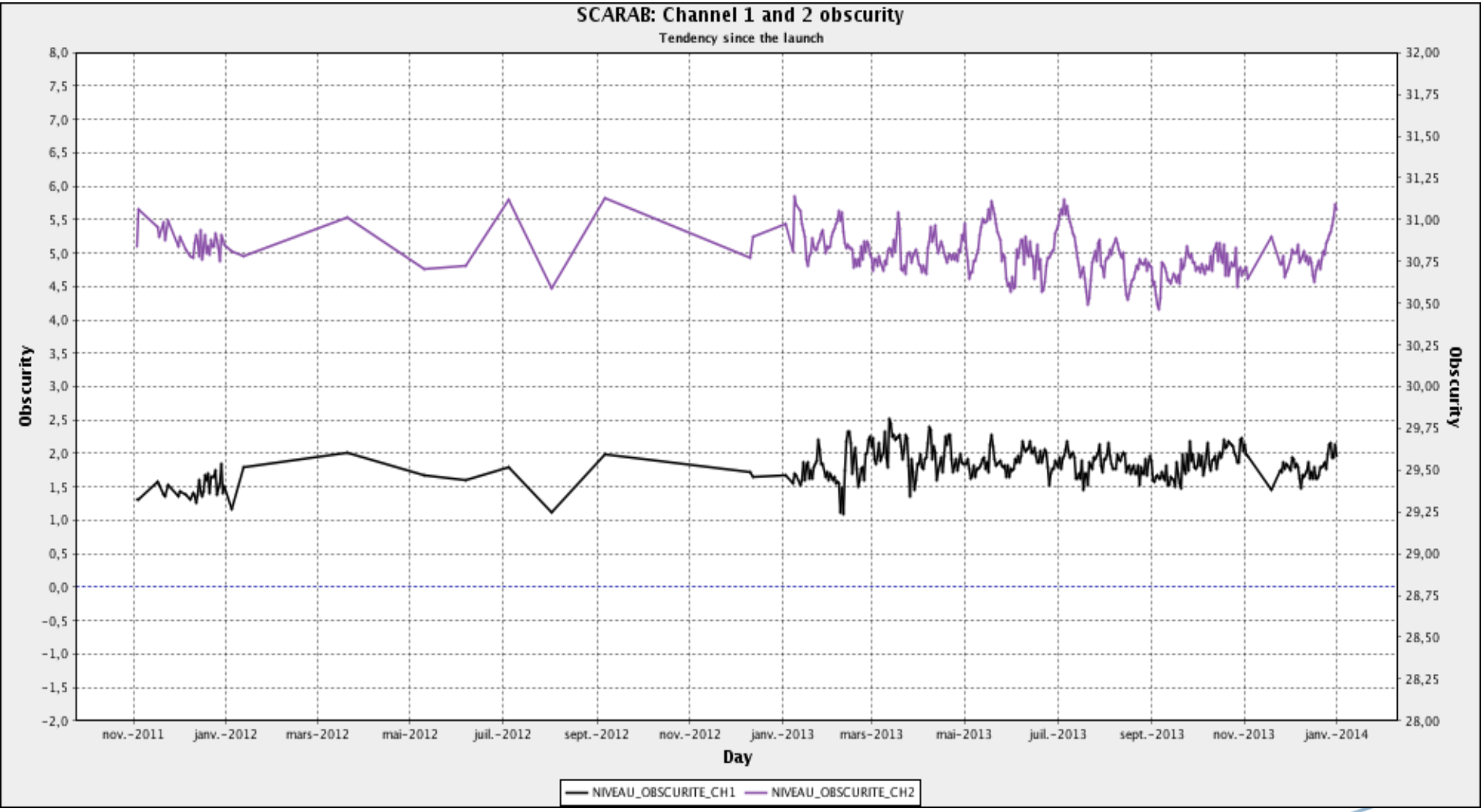
Mean Noise in LSB per orbit



=> Noise stability is very good

SCARAB noise

Obscurity level for channel 1&2

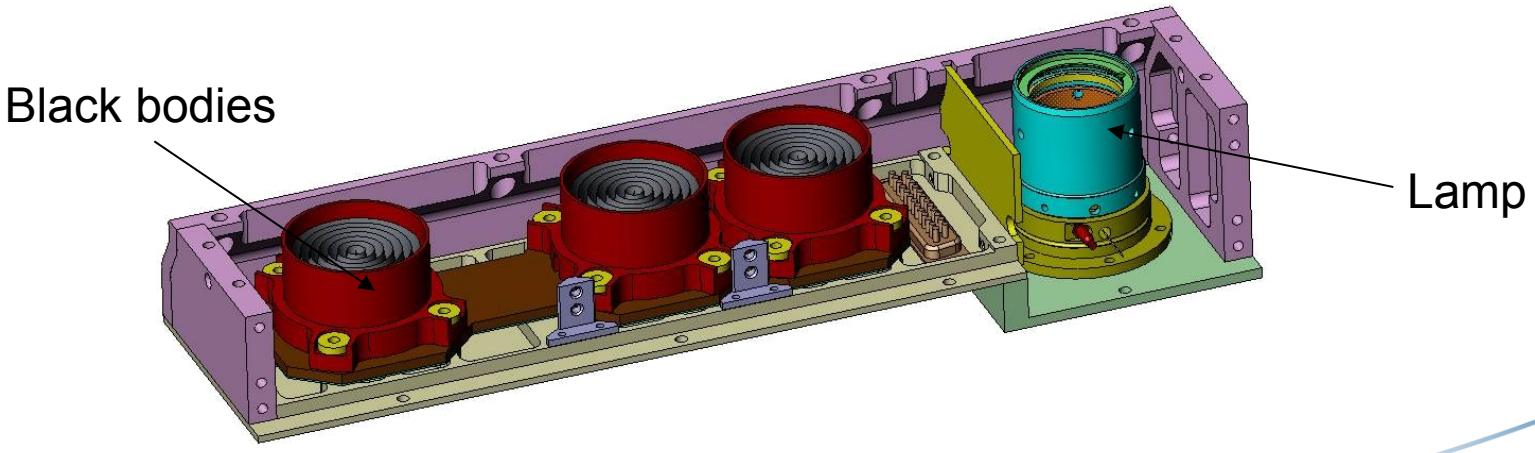


SCARAB gain

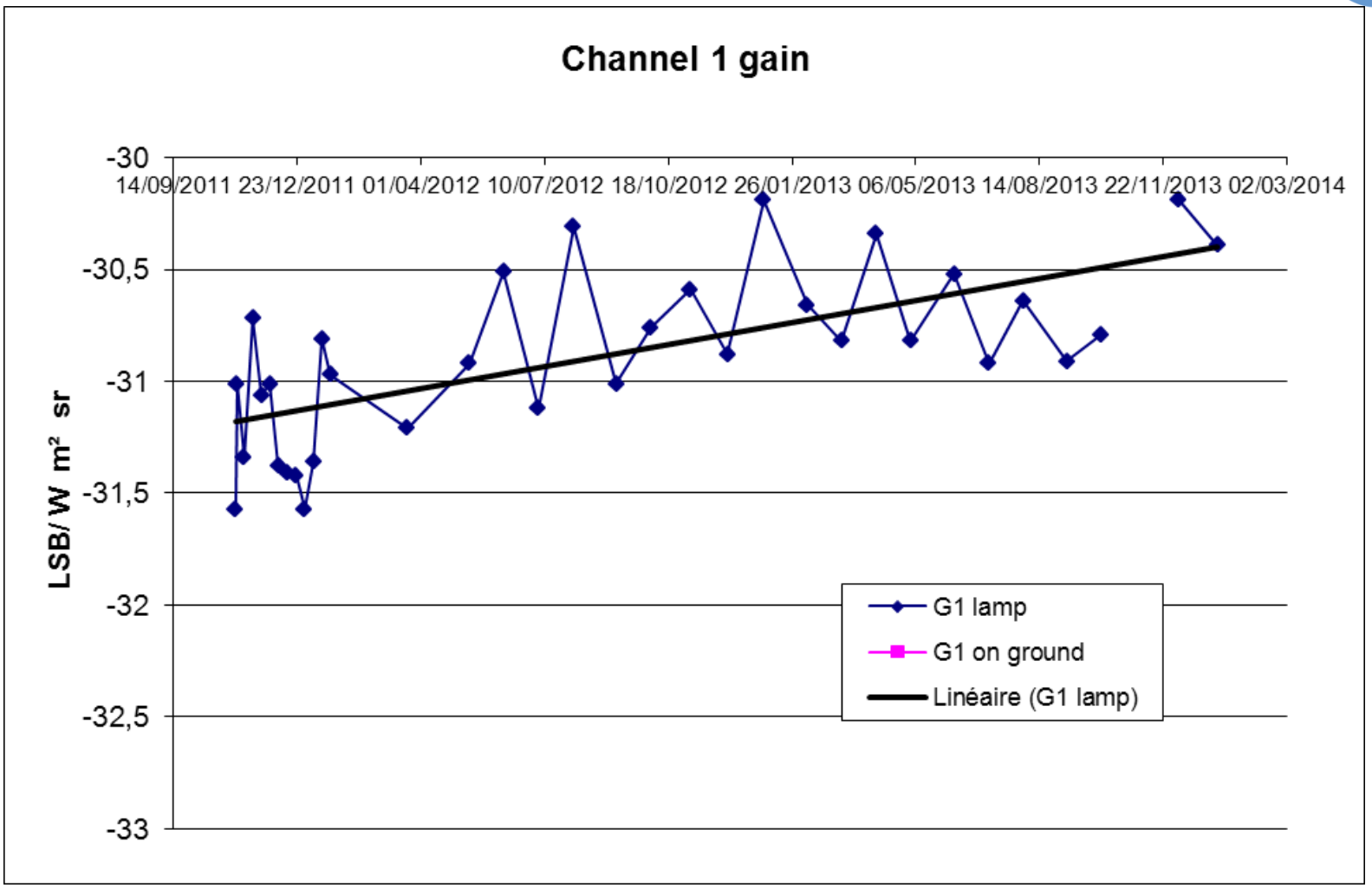
Gain

Measured with the CALibration Module (CALM)

- **1 lamp for channel 1**
- **3 black bodies for channel 2-3-4**
- **No solar filter on channel 2 (filter wheel)**
- **CALM mode once per month**



SCARAB gain



1% per year of drift ?

SCARAB gain

Gain canal 1, autre méthode

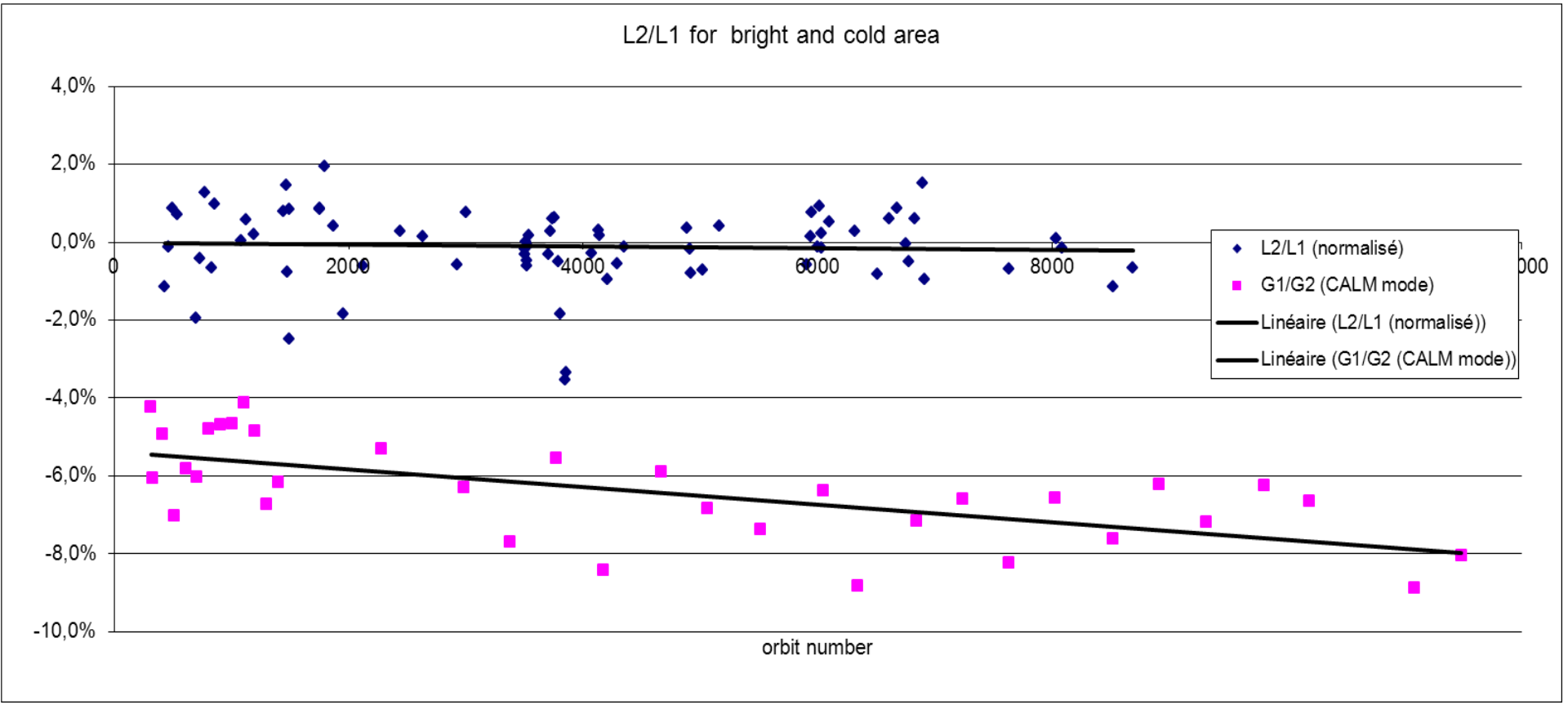
Comparaison des comptes numériques canal1 / canal 2

Scène homogène, lumineuse et froide (nuage)

- **Canal 4 <5W/m²/sr**
- **Canal 2 >250W/m²/sr**
- **Zone homogène à 10% près sur la radiométrie du canal 2.**

Calcul du rapport C1/C2, normalisé

SCARAB gain

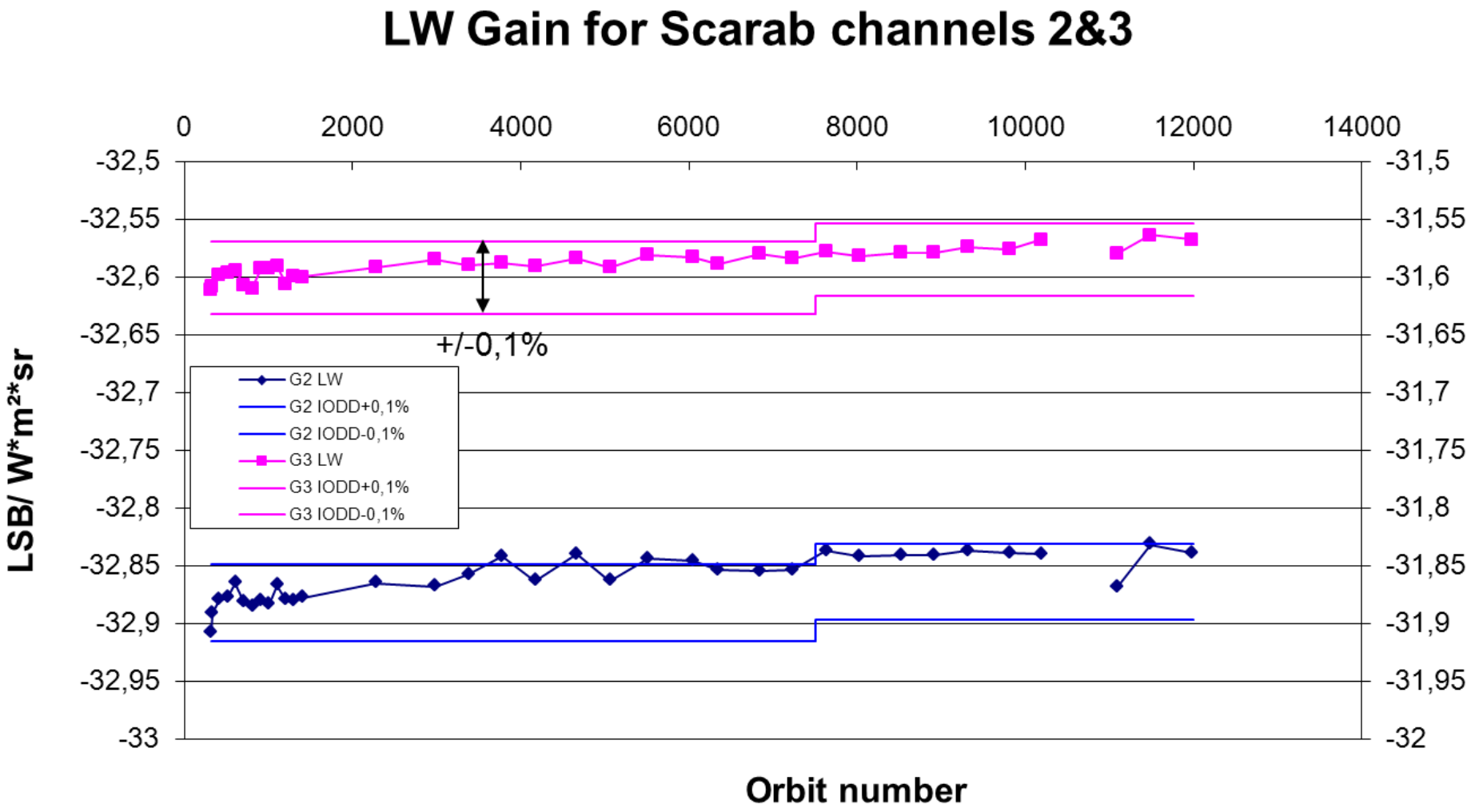


La stabilité du canal 1 est identique à celle du canal 2

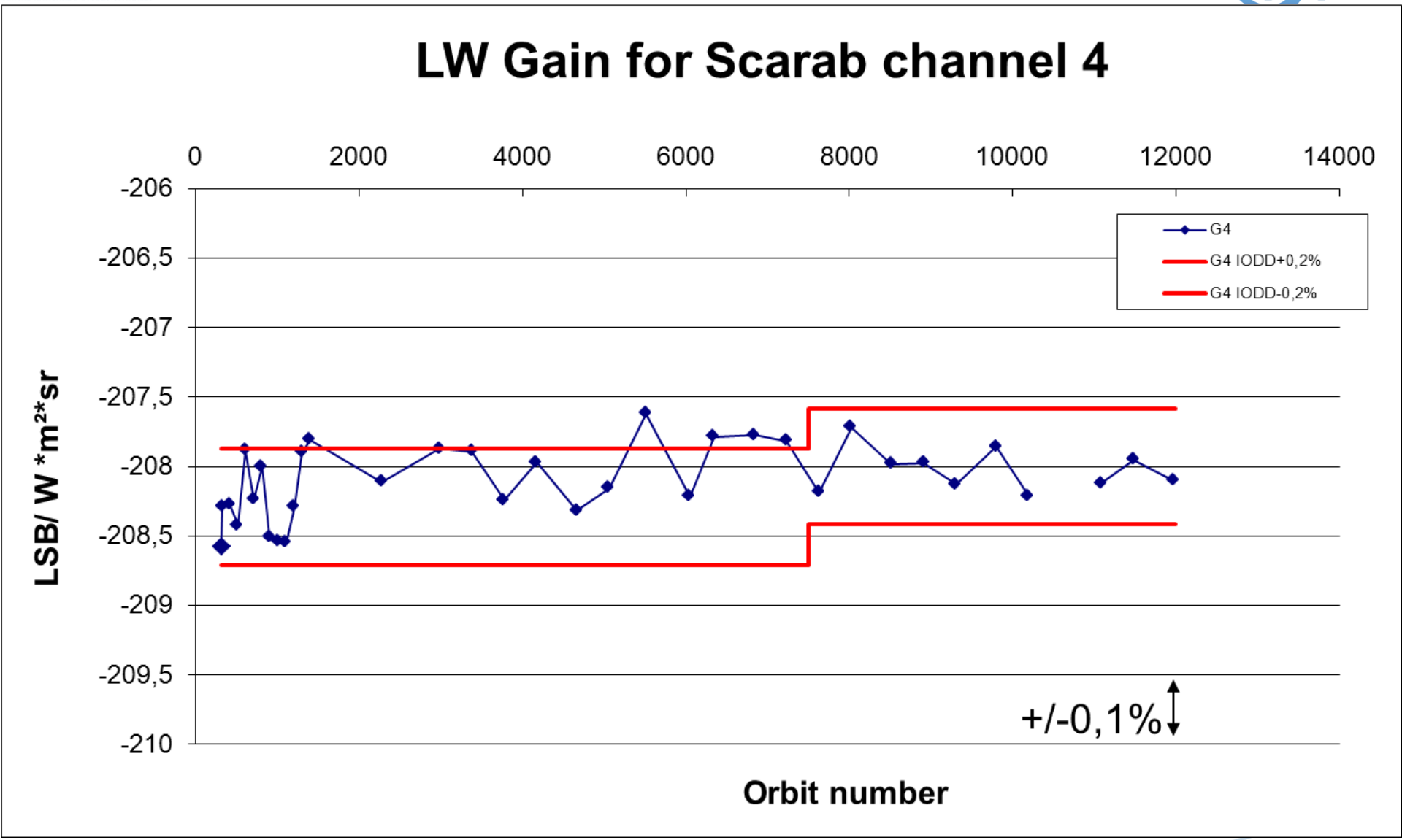
La lampe est instable (1% par an environ)

=> Nouvelle méthode de suivi du canal 1 à implémenter

SCARAB gain


LW Gain for Scarab channels 2&3
0
2000
4000
6000
8000
10000
12000
14000
-32,5
-32,55
-32,6
-32,65
-32,7
-32,75
-32,8
-32,85
-32,9
-32,95
-33
-31,5
-31,55
-31,6
-31,65
-31,7
-31,75
-31,8
-31,85
-31,9
-31,95
-32
+/-0,1%
G2 LW
G2 IODD+0,1%
G2 IODD-0,1%
G3 LW
G3 IODD+0,1%
G3 IODD-0,1%
LSB/ W*m²*sr
Orbit number

SCARAB gain


LW Gain for Scarab channel 4
0
2000
4000
6000
8000
10000
12000
14000
-206
-206,5
-207
-207,5
-208
-208,5
-209
-209,5
-210
LSB/ W *m2*sr
G4
G4 IODD+0,2%
G4 IODD-0,2%
+/-0,1%
Orbit number

SCARAB gain

Gain

Gain stability is for channel 1 is similar to channel 2

Gain stability is around -0,1% for 2 years for channels 2&3.
=> Slight update to be done soon (+0,05%)

Gain stability is better than +/-0.2% for channel 4.

Gain will be probably slightly updated soon

SCARAB A' factor

Channel 2 : Solar channel 0.2-4µm Short wave radiance L_{sw}

Channel 3 : Total channel 0.2-200µm Total radiance L_{total}

Channel 5 : Infrared channel 4-200µm long wave radiance L_{lw}

Channel 5 is computed with :

$$L_{lw} = L_{total} - A' \times L_{sw}$$

When channels 2&3 observe a same pure SW source, A' can be evaluated by :

$$A' = L_{total} / L_{sw} = L_3 / L_2$$

A' represents the difference of sensibility in the SW domain, between channel 2 and channel 3.

SCARAB / A' factor

MS Mode :

Channel 2 AND Channel 3 have an identical silica filter

=> Both observe the same pure SW source

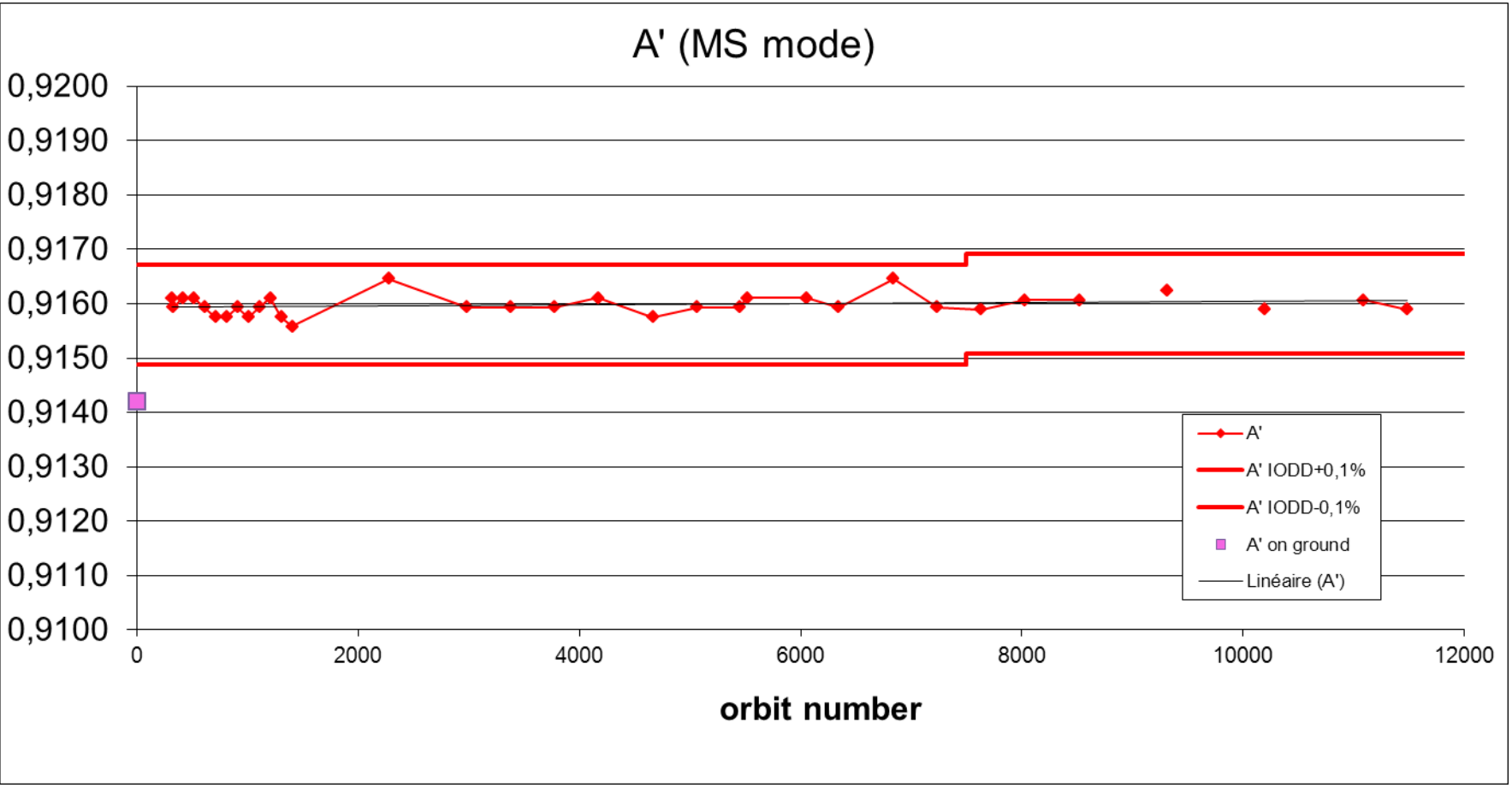
=> $A_{ms} = N_3 / N_2$

=> $A' = Ams * G_{2\_sw} / G_3 / T_{filter}$

T_{filter} must be known accurately with on-ground measurements !

SCARAB / A' factor

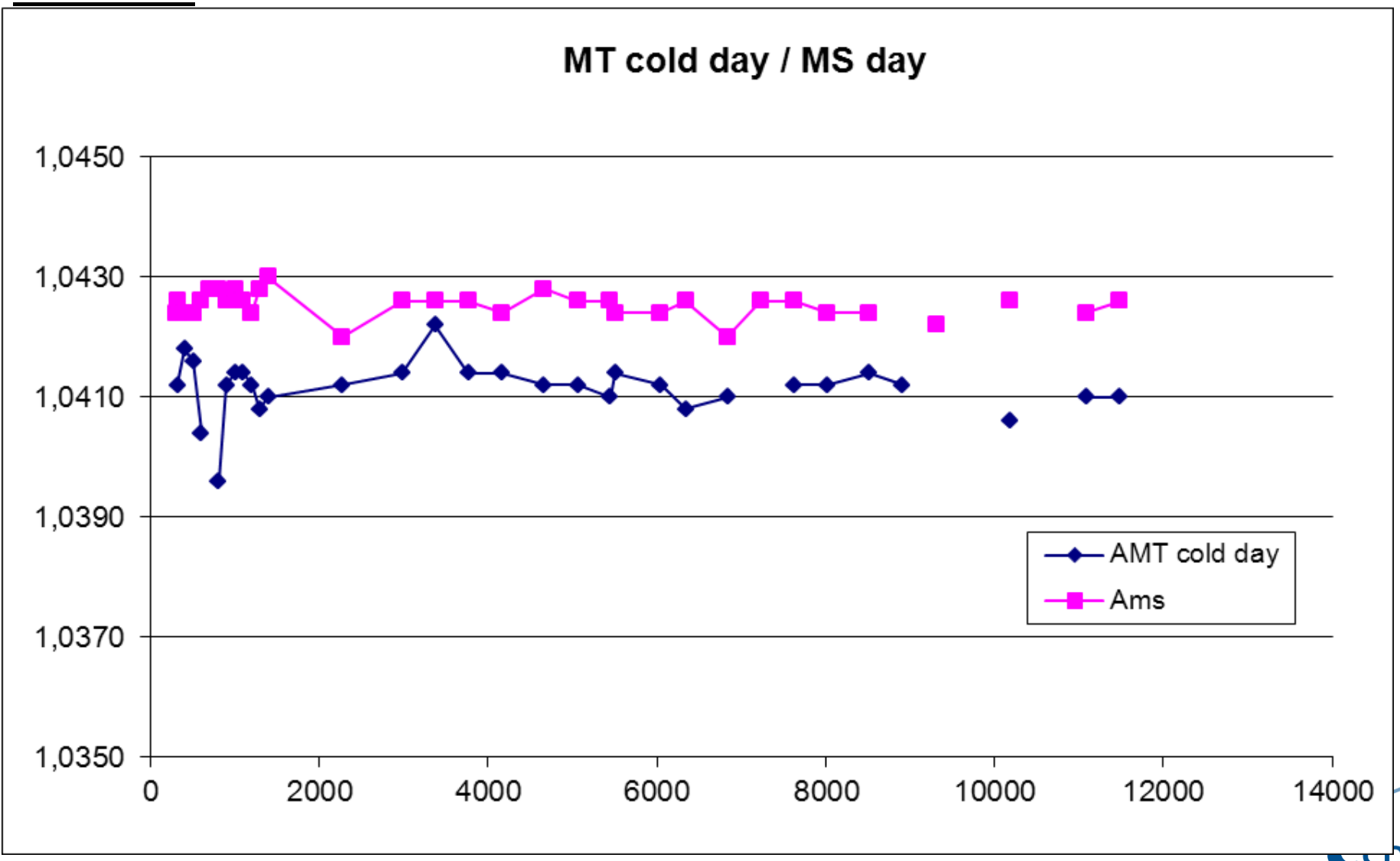
MS Mode :



The stability of the A'ms factor is about +/-0.05% for these two years !

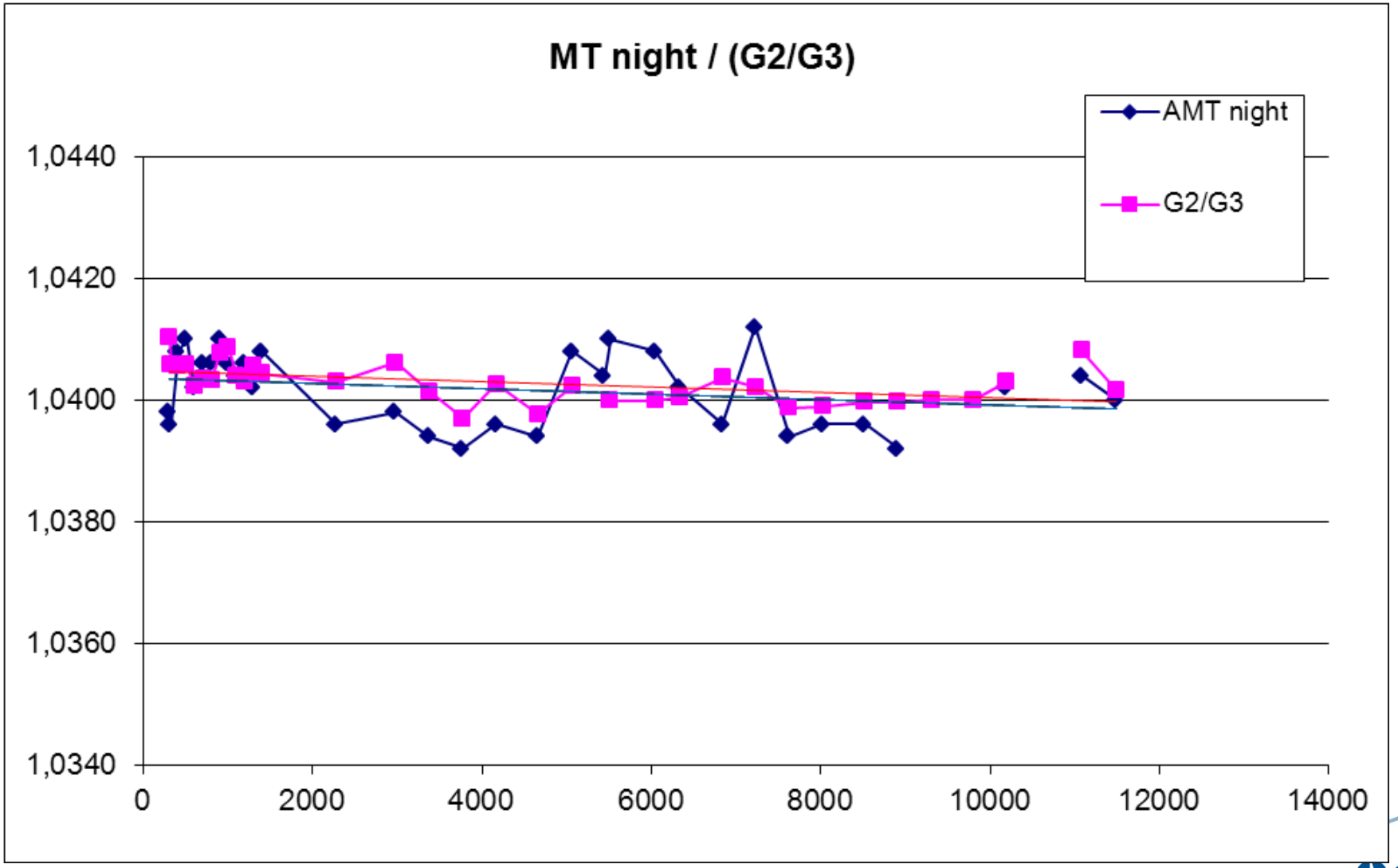
SCARAB / A' factor

MT Mode :



SCARAB / A' factor

MT Mode :



SCARAB / A' factor

A_{MT}(night) constant

G2/G3 constant

=> CALM stable, pas d'évolution relative gain onde longue

A_{MS} constant

A_{MT}(day) constant

=> pas d'évolution relative gain onde courte (sans filtre)

=> pas d'évolution relative gain onde courte (avec filtre)

=> pas d'évolution relative des filtres onde courte

=> Très bonne stabilité de l'instrument (filtre, canaux)

SCARAB / Absolute calibration budget (LW)

The absolute calibration budget can be established :

L1A2		Bright cold clouds	Hot / bright scene	Night scene
		250 SW + 50 LW	210 SW + 130 LW (20°)	0 SW + 80 LW
Instrumental noise	Random	0.21%	0.11%	0.14%
Calibration CALM	Bias	0.12%	0.12%	0.12%
A' factor (0.2%)	Random	1%	0.3%	0%
Registration and spectral effects	Random	1.5%	0.55%	0%
Location	Random	0.4%	0.40%	0.40%
Budget @1σ %		**1.9%**	**0.8%**	**0.45%**
Budget @1σ W/m²/sr		**0.95**	**1.0**	**0.35**
Requirement			**1%**	

SCARAB / Absolute calibration budget (SW)

Items	Value	Type	
Short wave calibration (sphere)	3% @2σ	Biais	1.5%
Error on spectral response		Biais	0.4%
Thermal gain correction	0.08%/° dT= 0.04° @1σ	Random	0.03%
Thermal leak correction	20% of the thermal leak@1σ	Random	0.04%
Location	0.06°@1σ	Random	0.4%
Budget at 1 sigma			1.6%

Absolute calibration of channel 2 was made in front of an integrating sphere at CNES facilities

SCARAB / Conclusion

Radiometric noise	**=> Very low, stable**
Gain value	**=> Very stable (0,05% per year)**
A' factor	**=> Very stable**